

THE CORRESPONDENCE OF JAN DANIËL HUICHELBOS VAN LIENDER WITH JAMES WATT

PROEFSCHRIFT

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Samenvatting (Summary in Dutch)

De correspondentie van Jan Daniël Huichelbos van Liender met James Watt

Dit proefschrift berust op een zo volledig mogelijke reconstructie en transcriptie van de correspondentie van J. D. Huichelbos van Liender (1732-1809, koopman te Rotterdam) en J. Watt (1736-1819, ingenieur te Birmingham). De ca. 350 transcripties van deze correspondentie – die duurde van ca. 1769 tot 1809 – beslaan het grootste deel van dit boek; daaraan zijn enige overzichten en referentie-tabellen toegevoegd, waaronder uitvoerige biografische notities over Van Liender. Uittreksels uit een aantal brieven aan Van Liender staan weliswaar buiten deze correspondentie, en zijn niet onbekend, maar hun verband met het hoofd-onderwerp rechtvaardigt opname. Voorts is een historische beschouwing op basis van de correspondentie toegevoegd.

Van Liender heeft in de tweede helft van zijn leven veel aandacht en inspanningen gewijd aan het introduceren van stoomkracht in Nederland voor bemaling en industriële toepassingen. Hij deed dat aanvankelijk in het kader van het Bataafsch Genootschap der Proefondervindelijke Wijsbegeerte, dat in 1769/1770 werd opgericht op initiatief van Steven Hoogendijk. Deze oprichtingsgeschiedenis en wat er toe leidde, worden in de eerste paragrafen van de beschouwing samengevat. Van Liender legde de eerste contacten met James Watt en de firma Boulton & Watt, en zorgde in 1786 voor patentbescherming van de Watt-machine in Holland. De activiteiten van het Genootschap resulteerden in de bouw van twee demonstratie-stoomgemalen (Rotterdam, 1776, 1787), het eerste een mislukking, het tweede een succes.

Vanaf 1787 zette Van Liender zijn activiteiten voort buiten het kader van het Genootschap (waarin hij overigens een belangrijke rol bleef vervullen), als agent, maar vooral als promotor van de stoommachines van Boulton & Watt.

De beschouwing besteedt ook aandacht aan twee “parallele” ontwikkelingen : de weinig succesvolle activiteiten van William Blakey, vooral in Amsterdam, en de zeer succesvolle bouw van een irrigatiegemaalje door Rinze Lieuwe Brouwer op het landgoed van bankier Jan Hope in Heemstede in 1781. Vooral het laatste werd totnu toe veelal als een geïsoleerde ontwikkeling beschouwd; enkele recent gevonden documenten, plus een herwaardering van enkele andere, maken duidelijk dat ook Hope streefde naar een demonstratie-gemaal om de werking van stoomkracht te tonen en de invoering ervan te bevorderen. Er waren meer banden met de Rotterdamse ontwikkelingen dan vermoed. De dood van Hope in 1784 maakte dat deze weg doodliep.

Het werk van Van Liender c.s. heeft niet tot een doorbraak geleid, en zelfs niet tot een waarneembare invloed op de ontwikkelingen na zijn dood in 1809. Nu en dan werden stoommachines gebouwd voor bemaling en industrie, maar windkracht en (in het Oosten van het land) waterkracht bleven overheersen. Het eerste belangrijke bemalingsproject met uitsluitend gebruik van stoomkracht, de drooglegging van de Haarlemmermeer, kwam er pas ca. 1850. Dat was meteen een gigantisch (overheids)project. De algemene doorbraak van stoomkracht kwam in de tweede helft van de 19e eeuw. Hoewel het Bataafsch Genootschap toen nog steeds bestond (het bestaat nóg), was de rol van Van Liender, driekwart eeuw eerder, in de vergetelheid geraakt. Deze studie moge als neveneffect hebben, dat zijn – zij het niet blijvende – betekenis beter erkend wordt.

Preface

The history of the introduction of the steam engine in the Low Countries has been told many times, and in various ways. The role of Steven Hoogendijk as initiator, as maecenas, and as founder of the “Bataafsch Genootschap” (Batavian Society) is usually highlighted, James Watt is prominently mentioned, and as intermediary between him and the Batavian Society we often find little more than “Jan Daniël Huichelbos van Liender (1732-1809), merchant in Rotterdam”. In the mid-1990s Louis Meijer drew my attention to a number of Van Liender’s letters he had found while researching the first industrial steam engine in Amsterdam. Not long after, I spoke to Remmelt Daalder who had arranged the 1987 exhibition “Het Keezending”, commemorating the bicentenary of the completion of the Blijdorp engine – then often thought to have been the first successful steam engine in the country. He introduced me to more letters, by both Van Liender and Watt. These letters contained many details that apparently were not generally known, and reading them suggested to me, that the correspondence between Van Liender and Watt – if it could be completed – might throw more (and maybe even new) light on the introduction of steam power in the Netherlands.

It is largely thanks to the comprehensive archiving policy of the Boulton & Watt Partnership and its successors, that it has now been possible to reconstruct both sides of that correspondence in virtually their entirety – encompassing 346 identified letters and related documents. Of these, 14 were faded beyond any readability, and 34 were (though identified from references etc.) not found in the archives consulted; of a few of those, duplicates survive.

Close reading of the letters also yielded particulars about Van Liender’s life and environment, improving somewhat on the scant knowledge about individuals like J.Hope and R.L.Brouwer and their Heemstede engine, and adding (albeit slightly) to the knowledge of the exploits of W.Blakey. It pointed the way to the extensive notarial records in the Rotterdam Municipal Archive, which yielded many more details. Van Liender thus became much more than just a Rotterdam merchant. Most of the correspondence consists of discussion of engineering details with excursions into other, sometimes personal and political areas. This is reflected in the opening essay.

The letters and related documents are the principal source material for that essay. For the first decades of the period discussed, the author also – like all his predecessors mentioned above – leans heavily on [*Bicker, 1800*]. That 132-page essay is a rare example of early engineering history, by someone who – as co-founder and long time First Secretary of the Batavian Society – played an active role in the three decades he describes. His story is factual, and treats both engineering and political aspects. He makes no secret of where his sympathies lie, but he obviously tries to avoid bias. He names many of his sources, and quotes extensively from them. In a footnote, he states that his essay is largely based on notes of Van Liender.

Whether the Batavian Society records of the day were very extensive, is difficult to say. Virtually all the original documents were destroyed in the 14 May 1940 Rotterdam blitz. Any notes of Van Liender, Bicker or others in those records are lost. The only Van Liender material which we definitely know to have been there, consists of a collection of 187 letters written to him by a great variety of correspondents in the period March 1770 to October 1780. These 187 letters also perished in 1940, but summaries – made in 1937 – survive as [*Brieven*]. Most of these letters are outside the scope of the present compilation, but I could not resist including four sub-compilations with summaries of letters to Van Liender from Rinze Lieuwe Brouwer, William Blakey, Jabez Carter Hornblower and Jean de Luc.

From 1780 onwards there is no evidence of Van Liender papers in the Society’s present records. Upon Van Liender’s death in 1809, all private papers would have passed into the hands of his sister Petronella, his sole heir. In her will, she bequeathed his printed books on art and science to the Batavian Society, but there is nothing about his private papers – among which would be the correspondence with Watt and many others. It seems likely that Petronella, or her heirs, had most of these destroyed.

February 2005; Jan A.Verbruggen

Acknowledgments

I am indebted to my promotor, **Prof. Dr. A. Rip**, for taking this work under his wings. My co-promotor **Ass. Prof. L.L. Roberts** had the initial idea of turning my study into a Ph.D. thesis, and she guided me along the way to re-shaping and perfecting it as such. As a not-always-too-compliant candidate, I owe her a large debt of gratitude.

The surviving originals of most letters are in the Archives of Soho in the Birmingham Central Library. Over the years several researchers have studied particular aspects of the diffusion of the steam engine to the Netherlands, and extracted groups of letters from these archives. These people were my principal initial sources for copies and for quite a few transcripts. They are:

Ing. J.L. Meijer, who made copies of many Van Liender letters for the period 1793-1807 and who introduced me to the correspondence.

Mr. R. Daalder, who made copies of both Van Liender and JW letters for the period 1775-1788 while preparing the 1987 bicentenary exhibition about the Blijdorp engine; he made transcripts of many. These are now kept at the depot of the Historical Museum Rotterdam, and access to them was graciously provided by **P. Grimm**.

Rev. Dr. R.L. Hills, who found many items of Van Liender and related correspondence and background information in the course of his extensive researches into the Watt archives, and who gave me the benefit of his vast knowledge of Watt and his time.

My principal debt lies with the archivists at the **Archives of Soho** — particularly **D. Bishop**, **R. McGregor** and **A. Quinby** — without whose help and patience this project would have gone a great deal less smoothly.

The comprehensive notarial records kept in the **Rotterdam Municipal Archives**, together with their genealogical archives, were the source of many details of Van Liender's life and activities.

Many thanks to **J. Kingma** for several suggestions and data found in unexpected places, to **Dr. J.A. Brongers** for reading the text in his usual critical way, and to the **Teyler's Museum Library**, the **Utrecht University Library**, the **Boerhaave Museum** and the **Utrecht Regional Archives** for particulars about Van Liender and others.

Above all, I admire and thank my wife **Loes Pettersson**, for her support and patience during the ten years this project has taken, and for putting up with a husband who would at all hours go "VanLiendering" at his computer.

About the author

Jan A. Verbruggen (1932) studied mechanical engineering at Delft. He worked in the steel industry as a stress analysis engineer, and also headed the company's pressure equipment inspection department. The latter position led to membership of the Dutch Pressure Equipment Committee, where he became effectively the chief editor of the Dutch Pressure Equipment Rules. In the course of these activities he became interested in the historical background of pressure vessel safety regulations, which later developed into an interest in the history of steam technology in general and of steam drainage in particular. In the late 1970s he became interested in the Cruquius pumping station, which resulted in an interest in the Cornish pumping engine (of which Cruquius is a rare example). In 1980 he took the initiative to restore the Cruquius engine to motion.

1. The role of Jan Daniel Huichelbos van Liender in the introduction of the steam engine in the Netherlands ¹⁾

Though the steam engine often features as the most prominent icon of the industrial revolution – popular accounts cite the appearance of James Watt’s innovations as having given birth to the Industrial Revolution just as storming the Bastille is portrayed as having inaugurated the French Revolution a few years later – the actual history of its ‘invention’, development and diffusion is a complex one. Much scholarly attention has been given to the machine’s internal, technical development, as well as to the history of its application in Great Britain beginning with Thomas Savery at the end of the seventeenth century. We have a much less detailed picture of developments outside Great Britain. Other than Svante Lindqvist’s exemplarily study of the (failed) introduction of steam engines in early eighteenth-century Sweden and Jacques Payen’s book-length history of the introduction of Watt’s design in France from the late eighteenth century, only a handful of articles and monographs have been written, barely scratching the surface of the steam engine’s early history in Europe [*e.g. Matschoss, 1908; Lindqvist, 1984; Payen, 1969*].

This seems less the case for the Netherlands, for which a small cluster of studies exist that trace the chronology of steam power’s introduction and use during the eighteenth century, but even here there remains much work to be done [*Bicker, 1800*], [*Giltay, 1869*], [*Huet, 1885; 1887*], [*Kuennen, 1919*], [*Muller, 1937*], [*Hazewinkel & van Nooten, 1948*], [*Havinga, 1969*], [*van Lieburg & Snelders, 1989*], [*van der Pols, 1973*], [*van der Pols, 1977*], [*van der Pols, 1984*], [*van der Pols & Verbruggen, 1996*], [*Roberts, 2004*].

In addition to the need to place what we know in the political and cultural contexts of the time, there is still important empirical research that needs to be done. That is the primary task of this study, which begins by asking which forces resulted in the introduction of steam power in the Netherlands. Within the broader context of long-term developments in fields ranging from land-drainage and water management to cultural patterns of sociability and university education, it turns out that the introduction of the steam engine in the Netherlands is a highly personal story. Another way to put this is to say that the primary force behind the introduction of steam engines in the Netherlands was not economic, the pull of technological progress or any other kind of necessity. The ‘cause’, if one could put it so, was quite contingent – the active presence of a few individuals who decided that steam power was important to the Netherlands’ future.

Ultimately, perhaps, no one was more responsible for steam power establishing its first firm roots in the Netherlands than Jan Daniël Huichelbos van Liender (1732-1809). And yet, we know surprisingly little about the man. Based on in-depth archival research, especially on the annotated presentation of Van Liender’s extensive and revealing correspondence with James Watt and his partner Matthew Boulton, this study aims to flesh out his biography while shedding light on how and why steam engines made their way into the Netherlands during the latter decades of the long eighteenth century.

One of the things that makes this story so interesting is that there was no generally felt need in the Netherlands at the time for a new power source. With no known coal reserves, steam engines were not required for pumping water out of mines. But even in the land-drainage and water management sectors where steam power was first adopted in the Netherlands, there were few who clamoured for the introduction of steam power. Water and, above all, wind – put to work by a long tradition of innovative technology – continued to be seen by many as the most reliable and cost effective power sources. Straight through the first decades of the nineteenth century, steam power was by no means seen as the obvious choice either for land drainage and water-management schemes or for industrial application.

And yet, there were a handful of individuals in the Netherlands who dedicated themselves to seeing steam engines adopted and adapted into the Dutch landscape. Apart from an isolated (and quite early) patent in 1716 for what seems to have been a Savery style engine for use in land drainage and construction of decorative fountains, the mechanical action of steam was introduced as a subject of natural philosophical study in Dutch universities from the 1720s, thanks largely to the efforts and interests of Willem ‘s Gravesande. But practical momentum came only in the late 1760s, when the wealthy Rotterdam merchant Steven Hoogendijk spearheaded the actual construction of a small number of steam-driven drainage projects alongside the establishment of a scientific society – the *Bataafsch Genootschap der Proefondervindelijke Wijsbegeerte*

¹⁾References are in square brackets and in italics, with the following sub-formats
[<author>, <year> p<page>] for literature in the Bibliography
[Akten <volume>/<fol.>] for notarial documents in the Rotterdam Municipal Archives (GAR)
[Brieven <number>] for summaries in the collection “Brieven”, see Bibliography
[<year>-<month>-<day>] for document transcripts in this book
Some of the above data may be incomplete or uncertain, contain question marks etc.

(Batavian Society) – that was dedicated to promoting the introduction of steam engines into the Netherlands. It was as director of the society that Van Liender came to be a central and quite active figure in pursuing this goal, emerging as Boulton & Watt’s official sales agent in the Netherlands (the only European agent they had). As stated, the bulk of this study is dedicated to the annotated presentation of Van Liender’s correspondence with Watt and Boulton. It is the task of this introductory essay to set that correspondence in historical perspective and integrate its findings in the historical narrative of steam power’s early adoption in the Netherlands.

To this end, first a few basics are described and explained: the steam pumping devices preceding Watt’s engine, the scientific attitude(s) of the day, Steven Hoogendijk and his Batavian Society. This lays the groundwork for the the story of the first engine in Holland – the Rotterdam fire engine – and its failure. While the Batavian Society is considering what to do next, two parallel stories develop: William Blakey’s exploits, mainly in Amsterdam, and Jan Hope’s estate irrigation in Heemstede, and an attempt is made to find links between these developments and the Batavian Society thread in Rotterdam. In the mid-1780s the latter continues successfully, with Van Liender as the leading actor. Van Liender continues to promote and install Watt engines in the Low Countries, these are described in chronological order. Most are drainage pumping engines, but two of them mark the first industrial applications of steam power, in 1799 and 1809. One of the major successes is the naval dockyard pumping engine at Hellevoetsluis, where Van Liender collaborated with hydraulic engineer Jan Blanken. After Van Liender’s death in 1809 there is little if any follow-up. Steam engines continue to be used on a small scale, but wind remains the principal power source for drainage. In the mid-19th century the Haarlemmermeer drainage is the first major drainage project using steam only.

1.1 Developments before 1769

The pre-1769 history of steam power has been described in detail (both engineering and socio-cultural aspects and explanations) in the literature, e.g. [Farey, 1827], [Huet, 1885], [Matschoss, 1908], [Hills, 1989], [Rolt & Allen, 1997], [Roberts, 1998] and will only be briefly summarized here. The three main types of pumping device will be briefly explained, to provide a common ground for comparisons and for the appreciation of the use of them and their varieties.

The principal interest in these engines, in their country of origin England, came from the operators of mines, either collieries or metalliferous hard rock ones (as distinct from surface “streaming” operations, where river beds are “panned” for ore). Some of them, particularly the Savery device, found industrial applications as “add-ons” to waterwheel-operated industries, for returning the tailrace water of a waterwheel to the mill pond in times of water shortage. They also found applications in water supply for towns, and in operating fountains etc. in country estates. Other, non-pumping rotative, industrial uses came later in the 18th century.

The pumping abilities of these devices also attracted attention abroad, where the problems of mines were often similar and water or wind power were insufficient or presented other problems. But where, for instance, water power was ample (such as in the Harz and Erzgebirge mining regions in Germany) the interest in steam power was much less or even non-existent.

In the Low Countries, academic interest arose (‘s Gravesande, Allamand and others [Roberts, 1998]), but this did not result in practical applications. However, as early as 1716 a patent for a fire engine was granted by the States of Holland; this is discussed in subsection 1.1.3.

The new power could be applied, at least in principle as some thought, to land drainage. Others doubted if pumps developed for high lift/low capacity (mines) could be successfully adapted for high capacity/low lift (land drainage). This issue was tried and settled with the first three engines built in this country: the Rotterdam and Blijdorp pumping engines described in the subsections 1.2 and 1.7, and the Heemstede engine (subsection 1.6). The first two were built by the Batavian Society of Experimental Philosophy, a programmatic name of which the background is very briefly discussed in subsection 1.1.4, while subsections 1.1.5 and 1.1.6 summarize the history of that Society.

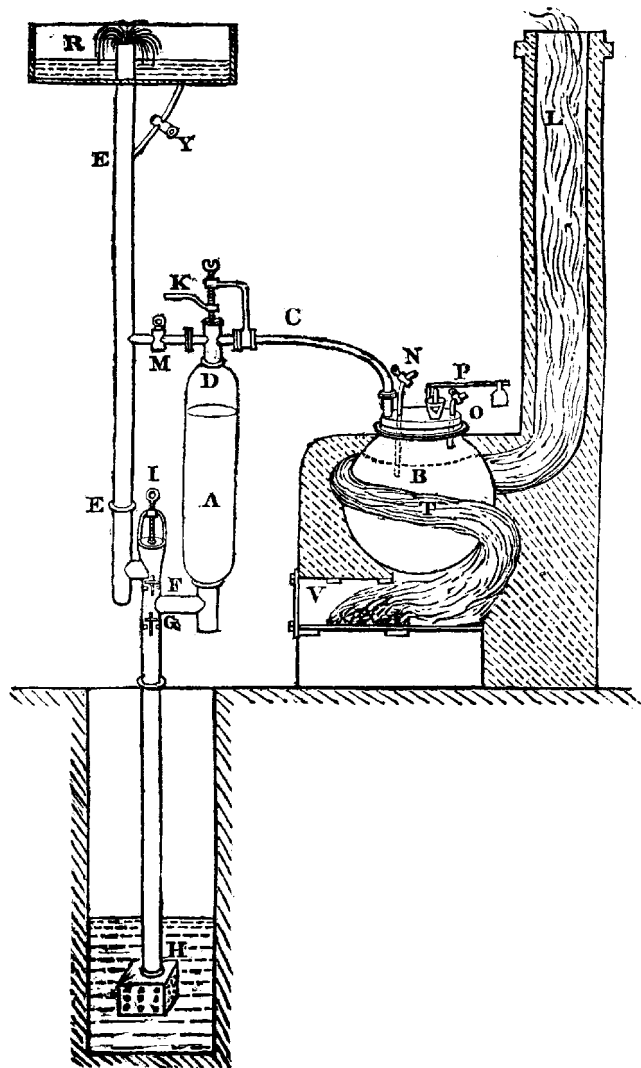
1.1.1 Thomas Savery’s Miners’ Friend

The first practical pumping device making use of steam was built and patented (1698) in England by **Thomas Savery** (c.1650 - 1715), who actively promoted his invention as the “Miners’ Friend”, i.e. for draining mines (see sketch on next page, which includes improvements, probably by Desaguliers). Its main component is a vessel **A**. Imagine this vessel completely filled with steam. This is then condensed, resulting in a vacuum. The vacuum draws up water from **H** via the suction pipe and the non-return valve **G**. Once the vessel has completely filled up with water, steam from the boiler **B** is admitted via cock **D** which forces the water out via check valve **F** and up the delivery pipe **E**, after which the cycle is repeated a few times per minute. Condensing was initially achieved by applying cold water to the vessel’s exterior, later this was improved on by injecting a cold spray via cock **M**. Control (mainly operating the cocks **D** and **M**) was usually manual, but several engineers devised mechanisms to make the engine self-acting.

Theoretical maximum suction height is c.10 meter, but leakage and other losses set a practical limit of seven to

eight meter. Theoretical delivery height is about 100 m per megapascal steam pressure. Again, attainable practical values are markedly lower. These two data indicate the capabilities of the device, but they also point out the two principal limitations. The vessel must be positioned at less than c.8 m above the low water level, i.e. for a mine it would have to be well underground, and be moved down as the mine was deepened. As for steam supply, either the boiler would have to be underground too, or a long steam pipe would have to be routed from the surface to the pumping vessel. Any but very shallow mines would necessitate high steam pressure, beyond the boiler and pipe making technology of the day. For low lift these problems did not occur, and thus the simple Savery device – often with two vessels operating alternately – was successfully used for town water supply, for country houses and gardens (e.g. fountains and other ornamental waterworks), and for improving the workability of waterwheel-driven industries by pumping tailrace water back up to the mill pond. Such uses continued until well into the 19th century, and as late as 1871 in the USA a fully automatic steam pumping device on Savery’s principles was patented as “pulsometer”.

The overall efficiency of the Savery device (chemical energy in fuel, to net pumping work) was very low, of the order of 0.3 %. Much of the steam was wasted by condensing on the cold wall of the vessel and on the water surface. An attempt to reduce the latter was sometimes made by putting a float (e.g. a wooden disk, or a hollow body) on the water surface, or by attempting to maintain a layer of air between water and steam (see the Blakey engine discussed in subs.1.5).



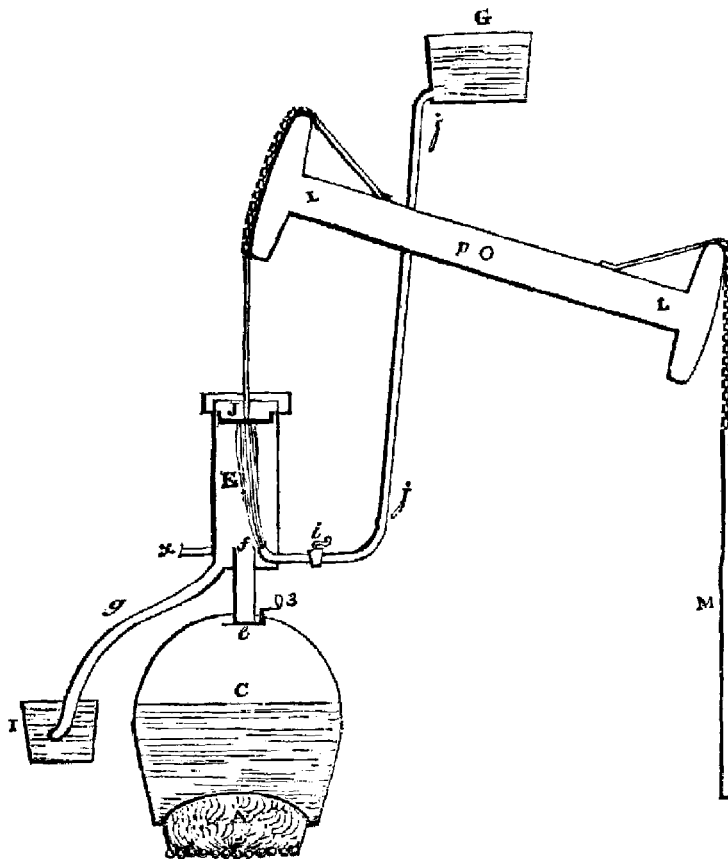
[Farey, 1827 p112]

1.1.2 Thomas Newcomen and his atmospheric pumping engine

For a more practical solution to their drainage problems the miners had to wait for **Thomas Newcomen** (1663 - 1729). His fire engine stood at surface, close to the mine shaft (see sketch on next page). A long rod **M** hung on one end of a horizontal rocking beam **L**, operating a lift or bucket pump down the shaft. The other end of this beam was moved up and down see-saw fashion by piston **J** in open-topped steam cylinder **E**. The up-stroke of this piston was driven by the weight of the descending pump rod, and would allow the space below the piston to fill with low pressure (virtually atmospheric) steam from the boiler **C** via valve **e**. At the end of the stroke this valve was closed and a spray of cold water from cistern **G** was admitted via cock **i**. The resulting vacuum (or, as it could also be put, the atmospheric pressure) pulled/pushed down the piston and via the beam motion pulled up the pump rod and bucket, thus raising the water. The engine would make 10-12 strokes per minute, sometimes even more.

Newcomen’s engine quite radically differed from Savery’s pump. However, the wording of Savery’s patent was very wide-ranging, and its applicability (or otherwise) to the Newcomen engine would probably have to be decided in court, in long drawn-out and costly proceedings. This may have been one of Newcomen’s reasons for joining the Savery patent. He would avoid these delays and expenses, in exchange for part of his profits which would go to the other Savery patent holders. The patent expired in 1733.

The overall efficiency of the atmospheric engine (as the Newcomen engine became known later) was c.0.7-0.8 %, i.e. more than double that of a Savery pump. Some improvements, mainly made by J.Th. Desaguliers, pushed this value up to about 1 %. Collieries, with their cheap supply of coal, used them a great deal.



[Farey, 1827 p129]

1.1.3 Jacob van Briemen's 1716 fire engine patent

In September 1716 a Jacob van Briemen obtained a patent from the States of Holland for a machine which could raise water by the force of fire [van Briemen, 1716]. The patent text lacks technical description. Van Briemen asserts that his engine takes up much less space than other water raising devices used here and elsewhere. Four to six feet square will suffice. His engine is also easily portable, and can draw water from wells, ditches, rain collectors and such. It could raise water to 60 ft (say 20 m) and more, making it suitable for fountains, cascades and other ornamental water works. He uses what he calls a "proportioned fire". He states to have been working on this machine for 17 years, i.e. since about 1699.

The patent is discussed in [Roberts, 2003], without speculating on what kind of machinery van Briemen developed. The small footprint and portability, the modest lift, plus the start of Van Briemen's work on it just after the granting of the Savery patent in England, allow the speculation that his engine was related to the Savery device. No further mention of Van Briemen or his engine has been found.

1.1.4 The emerging of "experimental philosophy"; Jean Theophile Desaguliers

The seventeenth and eighteenth century Enlightenment saw the completion of a shift in the attitude of many philosophers (a then common name for what later became universally known as scientists). Philosophy had always tried to explain the world around us (reality, nature, hence the often-used term natural philosophy), using various tools: observation, interpretation, reflection, experiment, test. Authority and tradition – and hence religious beliefs – had long played an important part in this scholastic approach, and the results of reflection were only infrequently put to the test. This began to change around the fifteenth century when testing theories, and deriving general laws from tests, gradually became more common. [Timoshenko, 1953 pp7ff] discusses the early beginnings of materials testing and the analytical design of structural elements, particularly the contributions by Galileo (1564-1642), Mariotte (1620-1684), and Robert Hooke (1635-1703). Francis Bacon formulated the foundations of empiricism or experimental philosophy in a general way. In the 18th century a new element emerged: the dissemination of knowledge to a wider public through lectures, demonstrations (developed from suitable experiments), and publications. Experimental philosophy was being popularized. One of the great popularizers was **Jean Théophile Desaguliers** (1683-1743), an Englishman of French descent, who lectured widely in Britain, and also in the Low Countries. His major work was *A Course of Experimental Philosophy* which appeared in two volumes in 1734 and 1744. It was soon translated into Dutch (in three volumes, 1736-1751) and it was widely read. Desaguliers described many practical matters and items, including detailed and well-illustrated descriptions of the Savery and Newcomen pumping devices.

1.1.5 Steven Hoogendijk –Initiator and Maecenas

Steven Hoogendijk (1698 – 1788) was born into a Rotterdam family of clock- and watchmakers, a trade in which he followed. About Steven's youth we know very little. He had a sister Maria and a brother Thomas. Neither of the three ever married. An apprenticeship in the trade (not necessarily his last) was terminated in 1715. In 1723, at the age of 25, the Rotterdam Corporation (the governing body of an important city, Dutch "Vroedschap") appointed him Supervisor of the Town Clock and other clocks, a position he held until well into old age, and which earned him the nickname of Steven Klok [Hazewinkel & van Nooten, 1948]. He kept the

town's reference clock at his home on the Haringvliet.

In 1745 he was in addition appointed supervisor of a scoopwheel windmill which assisted in flushing the town's canals, which also served as sewers. He was thus confronted with the short-term unreliability of wind power, and with the problems of highly variable lift to the Schieland drainage province's reservoir, the level of which was outside Rotterdam's control. The latter problem he tackled by designing and building an arrangement of two scoopwheels of different dimensions and position, which could be connected or disconnected as needed. The entire arrangement was less than satisfactory, however, and on warm wind-less days the stench of the canals would be considerable and objectionable.

This, and the reading of the Dutch translation of Desaguliers' book, gave him the idea that the fire engine might provide a solution. This idea may have been strengthened by his encounter with the English engineer John Smeaton, during his brief visit to the Low Countries in 1755 [Smeaton, 1755]. He tried to convince the Corporation, which in 1757 agreed to send a fact-finding mission to England – to look at the uses of steam pumping power. The mission consisted of hydraulic works supervisor Waltman and interpreter Schadee. There were no land drainage installations to inspect, so as the nearest form of using fire engines, they were to look particularly at the pumping of London's water supply. The trip resulted in a negative report, largely due to the lack of mechanical knowledge of Waltman [vdPols & Verbruggen, 1996 p151-157]. Hoogendijk's first "institutional" approach had thus failed, and for an individual action he lacked influence, so for the next twelve years, he appears to have let the matter rest.

Steven's sister and brother died in 1756 and 1768 respectively. The entire considerable wealth of the family was now in Steven's hands. He soon made a new will [Akten 2307/683], dividing his estate among a number of rather remote relatives. Before long, however, he had another idea which he started to discuss with friends in March 1769 [Hazewinkel & van Nooten, 1948], notably with physician Lambertus Bicker who according to [van Lieburg & Snelders, 1989 p14] became the key man-of-ideas for the developments that followed. Other allies in the preparatory period were Martinus Schouten, Solomon de Monchy, and Leonard Patijn, all three eminent physicians, and ornithologist Cornelis Nozeman.

On 3 June 1769 Hoogendijk made a new will [Akten 2308/568; under date 1769-06-03 a full transcript and translation have been included in this book, see also Havinga, 1969-08-02] which stipulated bequests to the amount of c.f 38,000, the remainder of the estate to go to "the Foundation which the Testator might have founded during his lifetime and, failing this, which he is founding upon his death". This society, as yet unnamed, but which was to have the motto *Certos feret Esperientia Fructus* (Experience will certainly bear fruit), is to manage the remainder of his estate, and it is to be financed by the income on it.

1.1.6 The beginnings of the Bataafsche Genootschap der Proefondervindelijke Wijsbegeerte (Batavian Society of Experimental Philosophy)

Hoogendijk's 1769 will describes several aspects of the new society but the wording "the Foundation" quoted above does not support the widely held view that this will did indeed *establish* the society with immediate effect – as stated explicitly in [Havinga, 1969], and implied by others. A will, taking force only at the death of the testator, cannot do that – nor can it provide any financial guarantees to anybody before that time. The 1769 will was, nevertheless, an important step towards establishing what was to become the Batavian Society of Experimental Philosophy. It set a number of "boundary conditions" for the structure and aims of such an organization if it were to qualify, in time, as Hoogendijk's principal heir. These conditions included the basics of a governing structure, and the main aim: to regularly set essay competitions, concerned with practical problems – of which the will gives a few examples. The fire engine, which must have played a prominent role in Hoogendijk's considerations, is not explicitly mentioned as an aim of the envisaged Foundation, but his third sample Question implicitly suggests to look for ideas in that direction.

If there is one, two, three or more feet of water on the land, whether means would exist to extract the water from there within a specified time as desired, without depending on weather, wind or high tide, and costing less than the watermills? [1769-06-03].

The governing structure would consist of seven administrators (named in the will), to have the sole control of finances, and of seven directors (to be named in a separate document, only to be opened after Hoogendijk's death), to be solely responsible for scientific matters. The latter was soon seen to be a mistake, as it would leave the fledgling Society without scientific direction until Hoogendijk's death. In fact, a number of Hoogendijk's friends did start work as directors-to-be rightaway, and on 29 September 1777 (seven years after the Society had received its Charter) the situation was formally put right, while at the same time the number of administrators and directors was reduced from an ambitious seven to a more realistic four [Havinga, 1969-08-02].

The 1769 will specifies, that only the income from the inherited capital may be used for activities, the capital itself may never be used or diminished for any reason.

The provisionally designated administrators and directors soon started work on a Constitution (Dutch: "Grondwet", equivalent to what today would be the Articles of Association) based on the outline in the 1769

will. This resulted in an agreement between Hoogendijk and the provisional directors. Not long after (the precise date has not been ascertained) the States of Holland were petitioned to grant the new Society its Charter. This did not go smoothly. The Dutch Society of Sciences in Haarlem, chartered since 1761, defended their monopoly and filed objections [*undated document, but evidently 1770, in the Batavian Society records in the GAR*]. These objections were not accepted, and on 7 July 1770 the States of Holland and Westvriesland granted their Charter (Dutch “Octrooi”), including permission to use the name “Bataafsche” (Batavian), but limiting the activities to Questions, and prohibiting lectures. The date of this Charter thus marks the formal beginning of the Batavian Society. The Society’s first General Meeting was held on 18 May 1772. The lectures ban was soon ignored.

One consequence of Hoogendijk’s longevity was, that for its first twenty years the Society had no capital and no regular income. If finance was needed, this could be (and often was) provided by Hoogendijk on a case-by-case basis. Furthermore, it appears that – within the limitations of the will – if Hoogendijk should have died before the erecting of the two steam engines to be discussed later, the Society could not have financed either of those engine projects – the capital could not be drawn on, the income would not have allowed an investment of this magnitude, saving up several years’ income (even if practical) was not allowed, outside finance would perhaps have had to be sought. However, Hoogendijk could of course – as long as he lived, and if he saw the need – provide capital. This he did for those two engine projects. In fact, instead of donating the capital to the Society, he made the investment himself. As a consequence the resulting property remained in his name (as the estate inventory shows, see below).

Hoogendijk made a new will, his final one, on 29 December 1785. Monetary bequests now totalled c.f 120,000, and there were additional substantial bequests in kind: his house with furniture and decoration to go to his housekeeper, another house to one of the Directors of the Batavian Society. The remainder of the estate, including books, paintings, prints, maps, scientific instruments, the town reference clock, tools, would go to the Batavian Society. Executors are S.de Monchy, P.Hartog, and J.D.Huichelbos van Liender.

As an aside it may be noted, that Van Liender plays a somewhat subordinate role in this 1785 will. Each executor gets f 10,000, but Hartog gets, in addition, a well-situated merchant’s house worth about f 10,000, and De Monchy (Hoogendijk’s physician) gets an extra f 6000 plus 1000 ducats (nearly another f 6000). Van Liender is bunched with the other Directors who get f 1500 each.

Upon Hoogendijk’s death in 1788, it turned out that the existing structures of the two engines he had financed (as will be discussed later), had indeed been put in his own name, i.e. they had not become the property of the Batavian Society during his lifetime [*Akten 3307/937ff, transcript in Havinga, 1969-08-02*]. The surviving documents do not allow a precise calculation of the amount eventually inherited by the Batavian Society in 1788; Havinga concludes that the Society came into the possession of Hoogendijk’s tomb, two steam pumping stations, plus an estimated f 120,000 in securities.

The above biographical details of Hoogendijk are largely based on [*Hazewinkel & van Nooten, 1948*], supplemented by data from [*Bicker, 1800*], [*Giltay, 1869*], [*Kuenen, 1919*].

The Batavian Society’s scope was and is much wider than the introduction of the steam engine. The involvement of several eminent physicians probably saw to it, that the Questions Programmes of the Society included many health and medicine related questions. Today, the Society no longer sets prize questions, but its programme of lectures on a wide variety of practical scientific subjects is still going strong. From 1959 the Society regularly supports practical scientific work in the Rotterdam area. In 1989 the biannual Steven Hoogendijk Award was established for “scientific achievement in the domain of experimental philosophy, which is of particular importance for the municipality of Rotterdam”. Four years later, the award was modified to alternate between Rotterdam (for biomedical work) and Delft (for engineering) [*van Lieburg & Snelders, 1989 p193-194*].

1.2 The Rotterdam fire engine

1.2.1 The principal actors: Jan Daniel Huichelbos van Liender and James Watt

Jan Daniel Huichelbos van Liender has already been mentioned briefly a few times, but at this point he deserves a proper introduction. Steven Hoogendijk knew the merchant Pieter van Liender (1697-1776) quite well, well enough to appoint him executor of his 1768 and 1769 wills. When and how they first met, is not known, nor whether they had common interests, beliefs or such like. Pieter van Liender had come from Utrecht in the mid-1720s.

Through Pieter, Hoogendijk would have met his son Jan Daniel (Huichelbos was his mother’s maiden name, which the young man had assumed as part of his surname). It seems likely that the latter – in his thirties – displayed the inquisitiveness and the wide range of scientific and engineering interests, which are so evident from his later activities and correspondence – characteristics which must have impressed the ageing Hoogendijk, whose plans and ideas on the other hand are likely to have attracted young Van Liender. Thus a

form of collaboration could develop, with Hoogendijk in the background, and Van Liender as his quite independent and ever more competent right hand and stalwart ally, to do most of the more practical work. Van Liender did for a time operate outside (but usually on behalf of) the Batavian Society. He became a consulting member in 1775, and a director in 1786.

On the other side of the Channel, young **James Watt** had built a career as an instrument maker, and in the late 1760s, as a surveyor and (atmospheric) engine consultant, but his fame at that time is unlikely to have extended to Holland. However, one of Van Liender's business relations and (as it seems) good friend John Enslie may have provided a link. Enslie was an English merchant who was partner in the Rotterdam firm of Molewater & Enslie. He resided in both countries and had a good command of Dutch. He was quite well acquainted with James Watt, going back to the latter's instrument-making days. Van Liender appears to have first contacted Watt through him, in early 1769. The actual letter has not been found, but a letter from James Watt to his friend and sponsor Roebuck [1769-02-10] appears to refer to it.

It appears to be Watt's understanding that the Dutch plans are for a full lake drainage, including making the surrounding dike. Maybe the nature of the Rotterdam project was still undecided. At any rate, Watt is clearly not over-enthusiastic about the value of such a project for his own purposes, and in early 1769 he is not likely to let on to Van Liender what those purposes and ideas were.

Later in 1769 Watt got his separate condenser patent, but he did not immediately go public with his invention – several wrinkles needed ironing out before he could offer a marketable product. From [1775-05-11] it appears, that Van Liender only learned about Watt's invention in that year, well after the non-return point for the Rotterdam project. Thus, the earliest Batavian Society plans would be based on the engine knowledge of the day, i.e. on the atmospheric engine.

1.2.2 Planning and building the engine

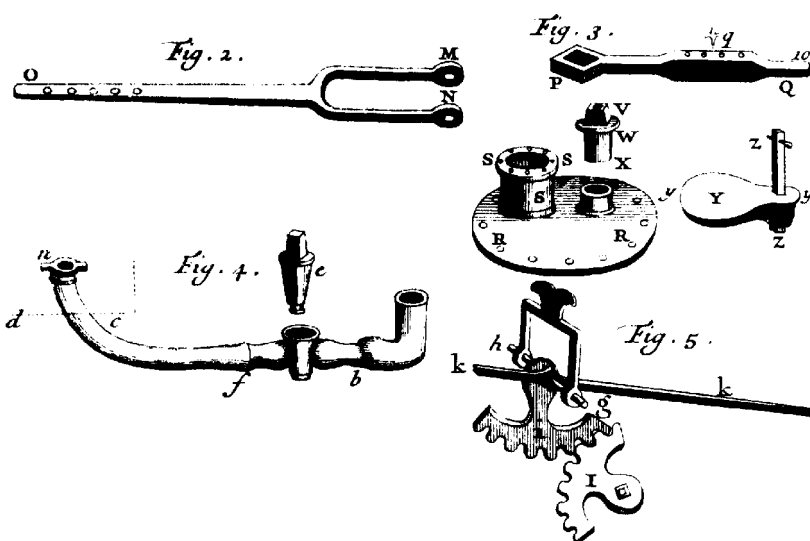
The first outwardly visible activity of the Batavian Society in connection with the introduction of fire engines, occurred on 30 December 1771, when the Directors of the Society petitioned the Rotterdam Corporation for permission to erect a fire engine for control and flushing of the town canals, in a disused gunpowder magazine near the East Gate (Dutch "Oostpoort") [Havinga, 1969]. The Corporation was also asked to commit themselves to financing the engine and – if it answered expectations – to buy it. To further prepare the ground, in 1772 a pamphlet advocating the use of fire engines for land drainage was published anonymously [Bicker, 1772]; Bicker later revealed himself to have been the author, inspired by Hoogendijk. The pamphlet sparked off a debate ([Steenstra, 1772], [Brouwer, 1774], described in some detail in [van der Pols & Verbruggen, 1996]).

A year later, on 28 December 1772, the Corporation rejected the Batavian Society's request – formally because other measures would make this drainage device superfluous. The "commitment to finance & buy" clause may have influenced the decision, and maybe the spirit of the negative 1757 Waltman report (see 1.1.5) still lingered.

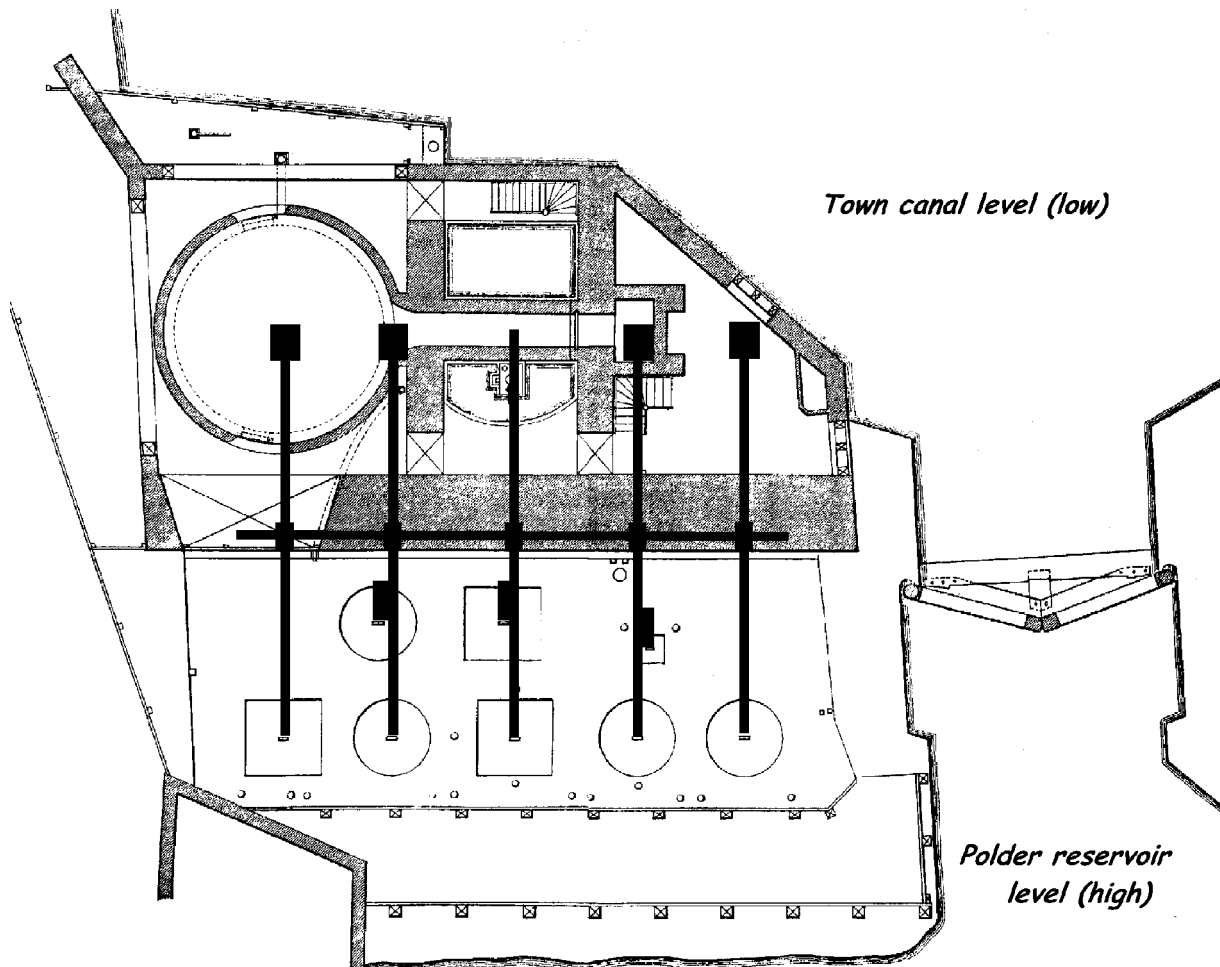
At this point, Hoogendijk apparently decided that the time had come for him to leave actions to someone else, and restrict himself to back seat inspiration and financial support. Van Liender would in future handle all steam engine matters for the Society (recall that he did not become a member until 1775). Hoogendijk committed himself to furnishing up to c.

f 30,000 for making and erecting the engine.

Early in 1774 a new petition to the Corporation, without the offending clause, was submitted by Van Liender *cum suis* – i.e. on behalf of the directors. Permission was granted on 6 June 1774, and included exemption from fuel tax. The Society was also permitted to have some heavy iron forgings made by the Rotterdam Admiralty's forge at bare cost. Van Liender apparently took an active part in (what we now would call) the management and supervision of the project. [1775-08-10] suggests that he was on the site much of the time, also acting as interpreter between erector Hornblower and the workmen.



[Desaguliers, 1751 plate opposite p93 (partial)]



Hoogendijk's plan drawing as reproduced in [Huet, 1885], with beam arrangement superimposed

Where did the planners obtain their data for designing such a novel contraption as the Newcomen engine was in Holland? Overall pictures of such engines were not hard to come by, many engravers had published commercial prints for collectors. Several such prints are reproduced in [Rolt & Allen, 1997]. Some seem fairly reliable, others are obviously “copycat” efforts. They all lack detail. Desaguliers' description and drawings supply such detail in abundance. The few sample drawings reproduced on the previous page, show clearly that – with some dimensional information added – a competent blacksmith, plumber or other craftsman would be able to produce the parts. Desaguliers adds several sub-assembly sketches to show how those parts should be fitted together. Desaguliers was probably the only available source for such detailed data, and as Hoogendijk had a copy, it may be assumed that this was the principal source of engineering data. Remaining details would be hammered out in discussions between mainly Hoogendijk, Bicker and Van Liender. As far as is known, no notes etc. of such discussions survive. There is at least one link with the earlier experimenters: in 1772 the Leiden physics professor Allamand demonstrated a model of a fire engine to a meeting of the Batavian Society [Kuenen, 1919; Muller, 1937].

An atmospheric engine is not a very sophisticated piece of engineering, so an approach using basic engineering skills, and insights, plus common sense, might well work. Photocopies of a few general arrangement drawings survive, and it is generally assumed that those drawings were made by Hoogendijk himself. They are reproduced in e.g. [Havinga, 1969; Muller, 1937] and show a massive brick structure, with heavy timber framing, a complex and massive timber beam structure, a varied assortment of eight round and square wooden pumps, a large cast iron main cylinder, and a boiler. All these, and the many smaller parts, would have to be made, put together, adjusted, and operated. A competent engineer might tackle this and acquire the necessary experience en route, the hard way, which seems doable (Brouwer must have worked this way for much of the Heemstede engine project discussed in 1.5), but the help of an engineer with fire engine experience would probably save time and money. Such a man would have to be found in England. The selection process is not known, we may speculate that maybe Enslie was consulted, and possibly, through him, Watt. Eventually the Batavian Society engaged the services of Jabez Carter Hornblower, member of the Hornblower family of

engineers (see Glossary).

One important design parameter for pumping engines (Newcomen, to some extent Savery, later Watt) was the quantity known at the time as **engine load** or **piston load**. The column of water being raised in the pump(s) would exert, usually via rods and a beam, a force on the steam piston. Divided by the piston area this is equivalent to a pressure, which should be expressed in pounds per square inch or psi – but the usual designation was “pounds per inch” or just “pounds”. The engine load is counteracted during the pumping or working stroke of the engine by the vacuum which is developed by the condensing steam. The engine will move only when that vacuum exceeds the engine load by a sufficient margin for friction, acceleration and flow resistance. Theoretically, the vacuum cannot exceed absolute vacuum or about 14 psi, but air in the steam, and leakage, will set a practical limit of maybe 10 or 11. Newcomen engines often worked at a load of 7 or 8 pounds, which leaves a good margin for acceleration, i.e. the engine works quite briskly. If need be, some overloading will do no harm – the engine will still work, but more sluggishly. Overloading beyond say 11 pounds means sailing quite close to the wind, and the engine may stall. Underloading will result in excessive acceleration, and the engine hitting the limit stops. There is thus a very limited range of loads that can be accommodated by a given engine.

When designing a new engine, the total pump force to be exerted by the steam piston is known from the pumping requirements (the volume of water to be raised per stroke, and the lift). Dividing this by the desired engine load directly yields the required steam piston area, and thus the piston and cylinder diameter.

For many operations the limited load range discussed above, is sufficient, but in some cases the requirements go further. The Rotterdam engine was such a case, as Hoogendijk and his friends were well aware (if only through Hoogendijk’s experiences with the windmill). The Schieland boezem level and that of the town canals could fluctuate substantially, so that the required lift could vary between virtually zero and about 1.8 m. The work of the pump during a pump stroke can be imagined as lifting a column of water with the diameter of the pump and the height of the lift or level difference. The required engine load in psi will then equal the lift in inches, times the specific gravity of the water in lbs per cubic inch (0.036), times the area ratio pump/engine, times the beam arm ratio pump side/engine side. One or more of these quantities must be adjustable to keep the engine load in the desired range. We will later – in subsection 1.2.3 – encounter a complex proposal to adjust the beam arm ratio, but the pump area seems a more convenient target. All the other quantities are, for all practical purposes, fixed for a given engine.

If the pump area (and thus the quantity pumped per stroke) is modified inversely proportional to the change in lift, their product, and the engine load, remain the same.

For the brickwork and timber structures, capable and flexible contractors could be found locally. The steam cylinder (with piston) and the boiler would have to be ordered abroad – eventually these, plus a number of covers, pipes etc. were made at short notice by John Wilkinson’s New Willey Foundry in Broseley, England and shipped via Chester in January 1775. Hornblower arrived in June 1775 [*Bicker, 1800 p17*]. The engine made its first strokes on 9 March 1776 [*Havinga, 1969 p41*].

Meanwhile, Van Liender had written to Watt (via Enslie) for information on Watt’s new invention, which he had read about in a newspaper [*1775-05-11a+b*], and he included data on the Rotterdam atmospheric engine about to be erected. Watt replied [*1775-07-10*], again via Enslie, with a concise but clear description of his invention and patent, not neglecting to add that he will export only to countries which will grant him patent protection equivalent to the British patent. Van Liender thanked him [*1775-08-10*]; from that letter it is also clear that his engineering knowledge still has gaps: he applauds the idea of a steam jacket, and writes that the idea had already occurred to himself a long time ago – but on a Savery or Newcomen engine (the only types he can have known about) such a steam jacket would have been totally useless: the main vessel or cylinder must be alternately hot and cold; Watt’s invention created the separation between a permanently hot vessel (the cylinder) and a permanently cold one (the condenser), which made steam-jacketing the one (and cold water immersion of the other) feasible and desirable.

Within a week after the Rotterdam engine made its first strokes, he proudly reports this to Watt [*1776-03-15*]. It is evident that all of this early exchange of letters occurred after the work on the Rotterdam fire engine had progressed beyond the point of no return, a late switch to the Watt design was unthinkable.

1.2.3 Working the engine – Disappointment and attempts at improvement

Virtually from day one, the pumping engine was beset with trouble [*Bicker, 1800 p20-28*]. Bicker reports this in rather general terms, stressing the structural weakness of the pumps and the difficulties in convincing Hoogendijk that his design was inadequate. In addition to this weakness, another design problem emerged. In order to reduce friction Hoogendijk had purposely designed the pump pistons to be a very loose fit in the pumps, leaving a substantial circumferential gap – the leakage through which considerably reduced the volumetric efficiency. Whether the beam assembly gave much trouble, is not clear from Bicker’s text, but it is

perhaps telling, that [Wright, 1800] – which can tentatively be dated early 1779 – writes of only three beams, and on the well-known c.1780 watercolour the two outer beams are no longer present (which would reduce the number of pumps from eight to six). It appears likely that the elaborate linking/stiffening structure with its many joints would have been difficult to keep rigid.

Hornblower had been distrustful of the pumps from the start, and the cure he recommended was simple: use a single pump, preferably a cast iron one – but he was also prepared to design and have made a wooden pump of adequate strength. This was turned down, as using just a single pump would defeat the original purpose of adapting stroke volume to lift – essential for this pumping station.

Several attempts at trials or demonstrations failed through these and related pump problems, but Bicker stresses that the engine portion of the pumping station worked without fail.

It became clear to the Batavian Society that a solution to the problems – if at all possible – would need more expertise than locally available, and might entail rather drastic measures. It was decided to set an essay competition based on the following Question (translated from [Bicker, 1800 p25ff]).

The need for the low-lying polders in the Netherlands to be relieved timely and reliably from the flood waters of breached dikes or heavy rains, has often caused the desire for a device which, by working more continuously than the Wind-Watermills, would better answer that requirement. – Some Gentlemen, giving thought to this problem, have formed the opinion that this goal could have been achieved by means of the well-known Steam or Fire Engine, provided that this could be linked to Machinery which, driven by such Engine, would be capable of raising a sufficient quantity of water, in a given time, to the required height. Subsequently, spurred on by their laudable love for their Fatherland, they have with much effort and at their own considerable cost, erected such an Engine in this town for trial purposes. – The pumpwork attached to this Engine did not meet expectations, being of inadequate strength to withstand the forces exerted on it, and losing too much water during the raising process, rendering it incapable of producing the large effect of which the Engine on account of its known power should be capable of. These Gentlemen have requested the Batavian Society to set the following Question for the improvement of that part of the Machinery, replies to be sent before the first of March 1779.

Which is the best means which, attached to a Steam or Fire Engine, is capable to work for several months without serious interruption, which will raise to a variable height of up to 5 feet a quantity of water which increases as the lift decreases, and which is commensurate with the known power of the Engine?

This Question, with some additional details about the engine, was published in the United Provinces as well as in England. A gold medal would be awarded to the best entry. Van Liender must have sent a copy to Watt (but no covering letter has been found). Watt being away at the time, Boulton wrote a reply [1778-08-29], giving the cold shoulder to the idea of Watt entering into such a competition to improve an atmospheric engine pumping station. The partnership does not go in for honours, their expertise is the stock-in-trade of their business. They will gladly undertake to provide a complete pumping station of the required capacity (provided the patent issue is satisfactorily settled), and the method for raising the water should then be left entirely to them.

The Question elicited eleven replies, of which three came from England. Three of these were accepted, but it was not until 1800 that they were printed, the others are lost. In addition, two more proposals were received “hors concours”; these were also printed. The “hors concours” possibly indicates, that these entries were in fact commercial propositions.

John Wright (gold medal) advocated a solution in two parts. (1) Replace the rigid parallel-multi-beam structure by three beams at an angle, linked only at their indoor ends to the common drive; each beam to operate a single pump. (2) Provide each pump with a bypass pipe & valve to adjust the driving force to the required lift [Wright, 1800].

The first proposal is straightforward, although the proposed method for linking the three indoor ends to the single steam piston rod via a horizontally curved coupling piece, would appear to require some more attention. The second proposal envisages a pipe with a valve, connecting the upper water level to the pump cylinder space below the piston. The foot and piston valves – which must also be present – are not mentioned. When the upper level rises, the valve must be opened, admitting some of this high-level water under the pump piston. This will then provide the extra upward force needed to raise the water above the piston to the increased upper level. Thus it would appear that the power delivered to the pump by the engine, is kept constant, and the extra power required for the extra lift, is to be provided by the upper water level itself. This, if operable, would prevent or hamper the normal opening and closing of the foot and piston valves. It would also have Munchhausenesque characteristics, and reek of a perpetual motion device. That fact was apparently not recognized by the judges, although the (probable) impossibility of perpetual motion was a subject of debate at the time (see e.g. [Smeaton, 1755] about the Genetté device in Leiden).

William Chapman (honourable mention) proposed a device to adapt the pump stroke (and thus the stroke volume) to the lift, without affecting the steam piston stroke. The pump would be operated by an auxiliary

beam, which was to be connected to the main beam with a link rod. The point of connection would be movable along the beam by a trolley. For high lift, the trolley would be moved towards the beam gudgeon, i.e. to a point with lower stroke. Moving the trolley was to be effected by a servo mechanism: a small bidirectional waterwheel, the feed of which was to be regulated by a float in the upper level, would operate a screwed rod which moved the trolley. Chapman apparently thought, that all variation would be in the upper level, and tidal. Adapting to the actual conditions does not seem impossible. However, the mechanism appears to be rather complex and vulnerable [*Chapman, 1800*].

Rinze Lieuwe Brouwer (honourable mention) – who had inspected the engine – stuck to a five-fold beam structure for the pumps, with one detachable pump per beam. His stiffener arrangement for this structure is quite different from Hoogendijk's, but at least as complex, and it is not obvious that it will be more effective and durable. The engine's beam is separate, and drives the pump beam assembly via a chain. Brouwer paid a lot of attention to the design of his (wooden) pumps, particularly to safe and troublefree operating conditions with little leakage, and to ease of maintenance and cleaning. He devoted much of his entry to detailed calculations of engine power and suitable pump dimensions [*Brouwer, 1800*].

John Grieve (hors concours) envisaged a large bucket or tub with one end hinged on a raft in the upper level, and the other linked to the beam of the steam engine – which would be on a large (19x19 m²) raft in the lower level. The shape of the bucket – which had filling clacks at the bottom – would be such, that the volume of water in it would be proportional to the level difference, and that the full stroke of the engine raised the lower end enough to tip the entire contents into the high level side. The engine-on-a-raft appears to be a weak point [*Grieve, 1800*].

William Punshon (hors concours) advocated what looks like a variation on the Savery engine, with steam drive and pump functions combined in a single cylinder and piston. The closed-top cylinder takes steam above the piston, whereupon the piston descends through its own weight, forcing out the water below – then the steam is condensed by a jet of water, and the vacuum pulls the piston back up, drawing water into the pump. Punshon did not address the main problem of varying lift [*Punshon, 1800*].

None of the proposals were implemented. Hoogendijk apparently despaired of getting the pumps to work properly, and he started thinking of rotative water-raising devices. In his view, a large diameter drum (roughly twice the required lift), with an internal spiral channel, was promising. His friends tried to talk him out of this, as being an as yet wholly untried device, and they even prepared for comparative trials against various existing devices – vertical scoopwheel, inclined Eckhardt wheel [*Sipman, 1977*], and pumps – but eventually nothing of substance was achieved, and in 1785 this first fire engine project was given up. At that time the idea of initiating a new project had already taken root.

Would a Watt engine – had it been available at the time – have done a better job here, than the atmospheric engine? No, because the problems did not stem from the engine, and the variable lift problem would remain the same.

Meanwhile, two other fire engine projects, one successful, had been started elsewhere in Holland. These, and a pamphlet with an engine proposal, will be discussed before continuing the Van Liender/Watt thread.

1.3 The Falck pamphlet

Champion or attack a cause (anonymously if desired). Propose or promote an invention. Find an audience. Write a pamphlet. Around the 18th century the latter was quite popular. We have already encountered an example in subs.1.2.2. Learned papers and books reached a rather limited audience. Newspapers did not include such material, and they were few and catered for a limited readership. Other periodicals might do, if the material submitted was within their range of interest. A pamphlet might be commercially interesting for a publisher, or the author might publish at his own expense.

One particular pamphlet [*Falck, 1776*] will be discussed here for two principal reasons. (1) Both Van Liender and Watt had copies; (2) The author's views, while erroneous, appear to provide a glimpse of a possible view of steam which has rarely if ever been discussed before.

N.D. Falck (? – 1798) was a ship's doctor with a mechanical turn of mind. He looked at Watt's patent description and admired the ingenuity, but he considered Watt's engine to be needlessly complex and probably prone to much repair, and he doubted its efficacy. He thought there was a better (simpler, more reliable) way of improving atmospheric engine efficiency. In an atmospheric engine (see subs.1.1.2) steam is admitted to the cylinder during the steam half of the stroke, during the pump half of the stroke the steam valve is closed, i.e. the boiler absorbs energy from the fire, but does not deliver steam to the engine. In Falck's view this energy, which is not "vented" from the boiler, is completely wasted. In his own words:

Hence it must evidently appear, that if the steam could get a continual vent without being lost, but always reduced to service, the power of the engine would be greatly increased, without increasing the quantity of fuel; besides, that comparatively no accidents need be feared with respect to the mechanism of the engine [Falck, 1776 p31].

Falck's "solution" was indeed quite simple: connect a second identical atmospheric engine to the boiler, linked

in such a way that the two engines take steam alternately. Thus we get, he thought, twice the power for the same amount of fuel.

With hindsight the fallacy is glaring. Put in straightforward engineering terms: each engine uses a certain quantity of steam per stroke. To generate that quantity, a certain amount of fuel (depending on the boiler efficiency) must be fired. Two engines use twice as much steam, hence twice the amount of fuel (assuming the same boiler efficiency). Total efficiency remains the same.

Van Liender acquired a copy of the pamphlet, probably during his visit to England in late spring 1776. He started a correspondence with Falck, summaries of some of Falck's letter survive [*Brieven 54, 55, 58, 61, 77, 78, 91, 101*]. In July he orders 500 copies of Falck's plate, indicating his intention to publish a translation, and the print run he envisages. Van Liender annotates Falck's text with some general comments, defending Watt, and stressing the possible usefulness of fire engines for land drainage. In November Falck puts a number of questions to Van Liender about the Watt engine, indicating he has never seen one, and that the patent text must have been the main source of his criticism of Watt. Nevertheless, in December he states that the entire Watt scheme is doomed to failure. After a long silence, Falck states in February 1778 that his failing health has forced him to abandon his engineering projects. In July he reports having seen a Watt engine at work, and being very enthusiastic about it. A few weeks later he reports that a model of his own engine is now completed, he hopes that it will confirm his theories. Nowhere in this correspondence is there evidence of a discussion of principles.

Neither is there in letter [*1776-07-10*] by which Boulton sends Watt (in Glasgow at the time) a copy of the pamphlet. He does draw Watt's attention to a serious miscalculation in Falck's description of the York Buildings London water supply engine, resulting in the impossible engine loading of 17 pounds per inch (see the notes with the [*1776-07-10*] transcript, and subs.1.2.2 for a general discussion of engine loading)

How can Falck's views be interpreted in the light of his own time, and are they – in that light – as obviously erroneous as we would find them now? From his text quoted above, it appears that he saw steam not so much as a substance, but as a carrier of the energy (or “impellent force” as it was sometimes called) of the fire directly and immediately to the engine. This energy could not be stored, if it was not used rightaway it was lost. In a previous sentence he states, however

.... since steam is nothing but rarefied particles of water uniformly intermingled with rarefied elastic air expanded by fire

which would tend more towards a view of steam as a substance.

The view of an immediate non-storeable energy carrier may seem strange to us in everyday life, but in modern physics it is quite commonplace: the photon, viewed as a particle, is generally seen as a package of energy which cannot be stored. Once it is generated it travels in a straight line at the speed of light, the width of an atom or the breadth of the universe, until it meets something, maybe a useful target, which absorbs the energy. If a photon source is shielded, its radiation is absorbed by the shield and thus irretrievably “lost”.

This is, of course, not to say that Falck was “ahead of his time”. But it helps to argue, that in his time the picture of energy, combustion, heat, possible relationships between these quantities (if they were indeed quantities) was very much in statu nascendi. Watt and his friends would help to order and organize this picture, but that story is outside the scope of this book.

1.4 William Blakey and his Amsterdam engine

In 1774 Van Liender read in a foreign magazine about an engineer claiming to successfully build fire engines for pumping, and he lost no time in establishing correspondence contact with the gentleman, then in Paris. **William Blakey** (c.1712 - after 1792) was or had been active in several fields [*Bootsgezel, 1936*]: steelmaking, steel springs (on which he wrote a treatise), other aspects of clockmaking, elastic bandages, fire engines for pumping. In 1766 he obtained an English patent for the latter [*Hills, 1989; 2002*]. He had visited Holland in 1772 (of which visit no further data or evidence has been found) and 1776, and in the latter year took out a patent for a Fire Pump in the Province Holland [*Doorman, 1940 nr.H 260*]. *Bootsgezel* includes most of the illustrations of the Blakey engine available at the time (1936), and much of his paper is devoted to detailed descriptions of the way these engines work. Blakey certainly possessed engineering skills and he seems to have had several original ideas. He also had a habit of loudly blowing his own trumpet, making extravagant claims, and unexpectedly decamping.

Blakey's pump was a variation on the Savery device, with three principal “new” aspects and one claim, described and discussed below.

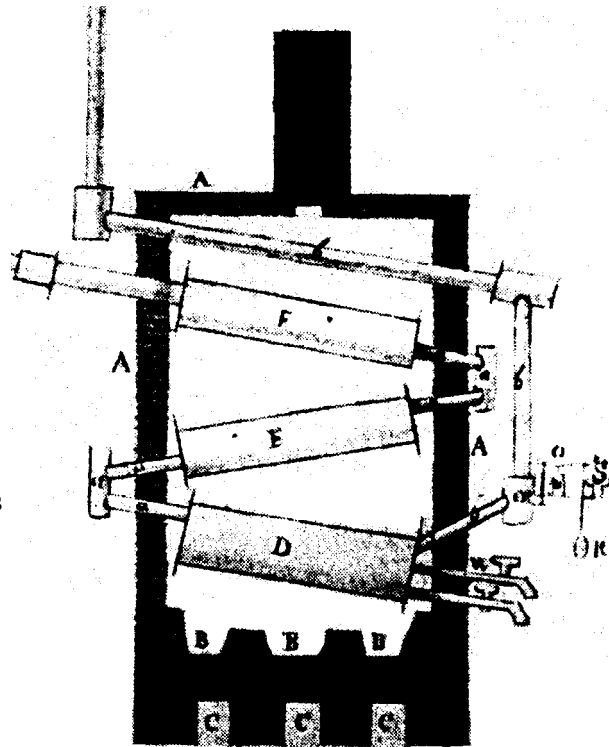
(1) To safely generate the high pressure steam which a Savery pump needs for achieving substantial lift, Blakey built a water-tube boiler (see sketch on next page). This was a major improvement in boiler design, and might have been more successful if boilermaking had been up to the task of reliably manufacturing and assembling even small-diameter high pressure components. For the low-lift applications envisaged in Holland,

pressure would be moderate, and a safe design seems possible. As a further refinement, he put in what we now would call an “economiser” *b*: the cold boiler feed water pipe is passed through the furnace *A* near the chimney, where it can still absorb some heat from the cooling down gases before they pass to the chimney, thus improving boiler efficiency.

(2) In the main pumping vessel a layer of air is interposed between the steam and the water, in an attempt to insulate the two and to prevent premature condensation. However, it was difficult to make adjoining layers of steam and air behave in a disciplined manner and moreover, as noted in [Farey, 1827 p121], during the pumping stroke the air layer would have to be compressed, causing loss of power.

(3) The engine was made self-acting with a complex mechanism of rods and levers, with several weights, two cataracts and a float; the reader interested in the details, is referred to [Bootsgezel, 1936]. To which extent this had been tested in practice, is not clear; the contraption looks vulnerable.

(4) On various occasions Blakey boasts high fuel efficiency (see e.g. below), without backing up these extravagant claims – he asserts, for instance, that replacing the boiler for the Rotterdam engine by one of his own design, one half of the fuel may be saved, if not three quarters. Such a large effect from boiler design alone, if realistic, would be quite amazing, to put it mildly. He also advocates to drain the Haarlemmermeer with his pumps and save one third of the fuel (but does not indicate compared to what). In reality a Savery engine is only about half as efficient as a Newcomen one, and there is little that can be done to improve this within the confines of the Savery principle.



[Bootsgezel, 1936]

Bootsgezel concludes from a short eulogizing 1777 poem he found in the Batavian Society archives, that “Blakey seems to have been in great favour in Rotterdam”. Bicker tells a different story.

He witnessed a 1776 demonstration by Blakey in the Crooswijk polder near Rotterdam, which he found totally unsatisfactory. Blakey then went to Amsterdam, where he managed to land a f6000 contract from the Corporation for a pump to help flushing and cleansing the town canals. According to Bicker the result was totally useless. Bootsgezel writes about an accident in December 1778 with a water tank (during a visit from the Mayor! – Murphy’s Law avant la lettre), about which he has not been able to find out more particulars. In concluding, Bicker remembers him as “an incompetent and vapid adventurer” (Dutch: een onkundige en winderige fortuinzoeker). The summaries of R.L.Brouwer’s letters to Van Liender tell an equally negative story in 1779, when Blakey’s Amsterdam engine was already being dismantled. The engineering, Brouwer writes, is slipshod and inadequate and there is literally nothing good about it. Blakey apparently blamed the sun’s rays for his problems in Amsterdam, Brouwer comments sarcastically that hopefully those rays will be more favourable for him in Russia – Blakey’s next destination.

The correspondence includes a letter from Devrier, Blakey’s partner in Liege [Brieven 64], which is entirely negative about Blakey. Blakey, on the other hand, in several letters complains bitterly about the way he is being treated by various officials and others in France.

In the Watt correspondence Blakey is only mentioned once, in a PS to [1779-05-14] of Van Liender to Boulton, simply stating that Blakey’s Amsterdam engine is begun to be demolished.

Blakey appears to have been dependent on his day-to-day earnings, advertising and selling his services wherever he could, and abandoning grounds where the grazing was less promising. If he was capable of refined and innovative engineering and workmanship (the water tube boiler is a great idea, and Hills thinks he may have been moving towards the concept of condensing in a separate vessel), he would mostly have neither the resources nor the time to apply such skills. He did not, like Watt did, develop a solid base from which to operate and exploit his capabilities with authority, or to extend his scope by experimenting.

1.5 Estate irrigation in Heemstede

As an interlude between the fateful Rotterdam engine and the Batavian Society's next attempt at Blijdorp, Bicker discusses the engine built by R.L. Brouwer for irrigating the Groenendaal estate of Amsterdam banker Jan Hope at Heemstede near Haarlem. Hope did have a windmill for this purpose but, as Bicker puts it, this was totally inadequate at times when it was most needed. Brouwer's engine is of the Newcomen type and – writes Bicker – even though made by a Dutchman (*sic*), it answers fully, and deserves high praise. It stands in a remote part of the country, and thus cannot contribute as much as one might wish to dispel the prejudices against these engines. Bicker treats it as an interesting but isolated event.

[*Huet, 1885 p33-35*] quotes Bicker in full; he points out that the success of the engine is to a considerable extent due to the simple single-pump arrangement, made possible by the constant lift conditions. For later writers, the Heemstede engine receded into the background as being outside the mainstream of developments. In [*van der Pols & Verbruggen, 1996*] an attempt has been made to give the engine more prominence, without however providing new facts or insights. In [*Roberts, 2004*] the Heemstede engine is discussed as an example of the use of technology in the Dutch “Arcadia” or garden, rather than as part of an engineering development.

The study of Brouwer's letters in [*Brieven*] (reproduced in subsect. 11.2 of this book) indicated that the Heemstede story was less straightforward than Bicker's text would suggest. More recently a few relevant letters came to light in the Archives of Soho in Birmingham, and it turned out that Jan Hope was a member (Director) of the Dutch Society of Sciences and – since 1772, i.e. virtually since its inception – a member of the Batavian Society. He would thus have had at least general information about the Rotterdam developments.

In May 1779 Matthew Boulton visited Holland, probably mainly in search of finance for one or more of his enterprises, but no doubt steam engine matters would be on his mind as well – he had, shortly before, inquired from a former British ambassador to the United Provinces about patent procedures in Holland [*1777?*]. In Rotterdam he met Van Liender [*1779-05-14*], and he would obviously have been shown the Rotterdam engine and have been told about its problems. He also met Jan Hope, probably in Amsterdam, and most likely in his capacity as a banker. Whether this helped Boulton with his financial problems is not known, but during the meeting the subject of steam engines evidently cropped up. Boulton would have suggested, that Hope put his steam queries on paper. This Hope does with [*1779-07-02*], with supplementary notes [*1779-08-05*] and [*1779-08-06*].

In this letter, Hope unequivocally states, that his windmill is quite adequate and that his ideas about erecting a fire engine stem from more general considerations, viz. introducing the fire engine in Holland, and that he is prepared to finance such an engine. Here we find an unexpected parallel with the developments in Rotterdam, several years before the Batavian Society started planning their (second) engine. Hope, too, is thinking of a demonstration engine. As a member of the Batavian Society he would have known, at least in general terms, about that Society's exploits in the Rotterdam area, and it seems very likely that he had been toying with the idea of doing something similar, for some time before meeting Boulton.

The latter put Hope's letter in the hands of Watt, who lost no time in replying. In [*1779-08-15*] he proposed a 15 inch diameter by 5 feet stroke engine with a 31 inch pump. He also stressed that patent protection in Holland is essential, and that the firm has a lot of business on hand, i.e. B&W are willing to do this, but there is currently no pressing need for business on their part.

Just when Hope first met Brouwer, is not known, but by mid-1779 Brouwer is evidently his engineering consultant. He would have supplied the queries and data for Hope's letters, and maybe drafted them. And he was in quite regular correspondence contact with Van Liender since at least early 1779, probably even earlier – in connection with his contribution to the debate about the 1772 Bicker pamphlet mentioned earlier. In the first of the surviving summaries [*Brieven 13 of 23 February 1779*] he asks for an extension of the 1 March deadline for the 1778 essay competition, because of health problems. The Heemstede engine project first crops up in [*Brieven 147 of 23 July 1779*], without being mentioned by name. In [*Brieven 154 of 15 November 1779*] Brouwer refers to “his” correspondence with B&W, but the details he provides show that this is the Hope/B&W correspondence discussed above.

How did Brouwer acquire his engineering skills? His entry for the Batavian Society 1778 competition appears to be the work of an accomplished and practical engineer. His Franeker University education and subsequent time as a merchant in Amsterdam do not seem sufficient explanation, and details about his activities are lacking. Van Liender claims that he gave Brouwer some advice on the engine [*1783-12-19*].

The patent issue as stated by Watt, may have been a bit off-putting to Hope, who maybe had a more pessimistic (realistic?) view than Van Liender, about what procuring a patent for a foreigner might involve. It appears that in the early fall of 1779 he and Brouwer considered two alternative routes.

- One would be, to gather data about the Watt engine, and try to procure the necessary parts without B&W knowing. Brouwer asks Van Liender for a B&W drawing [*Brieven 147*] and for information on English manufacturers of cylinders and other parts [*Brieven 154*], without letting B&W know. This, if carried through, would have been a form of espionage and piracy – not unusual at the time.

One problem with using the Watt design is, that Brouwer is generally distrustful of B&W and their products; in his opinion their letters are devious [*Brieven 154*] and they “represent a lot of quackery” [*Brieven 155*]. This may be partly understood from Brouwer’s familiarity with atmospheric engines, but in addition, the Watt development happened at a time when many engineers or would-be ones peddled their steam engine wares, boasting extravagant claims – the dominant and lasting role of Watt in the field is perceived more clearly with the wisdom of hindsight.

- Another route would be to avoid the Watt design altogether, and go back to the earlier Savery or Newcomen devices. With hindsight, a Savery pump would have been a simple and effective solution for the Groenendaal case. However, Brouwer probably preferred the Newcomen engine, maybe his experiences with Blakey would have coloured his opinion, but there may have been another factor as well : Hope wanted a demonstration engine, and a Newcomen one would be more conspicuous, more generally applicable, and thus more suitable for that purpose.

However, all such considerations are speculative – in January 1780 Hope decided on a Newcomen engine, all parts to be made locally, and Brouwer to be the designer/erector/engineer [*Brieven 169*]. In March the pattern for the cylinder (brass, to be cast in Amsterdam) is ready, and other parts are in hand. In May he reports that erection has begun; Brouwer now stays at Heemstede (with Hope’s equerry) when needed [*Brieven 176 of 1 May 1780*].

No later letters of Brouwer survive, and no further details of the making and erecting of the Heemstede engine are available. It was completed and set to work in 1781, Bicker’s essay and letter [*1783-12-19*] of Van Liender to De Luc merely state in general terms that the engine is exemplary, deserves high praise, and works without problems. In this letter to De Luc, Van Liender complains however, that Brouwer remains firmly convinced of the superiority of the Newcomen engine, and that as a consequence his patron Hope is not likely to help finance a B&W demonstration engine. In [*1785-01-30*] Van Liender writes to De Luc again. Jan Hope had died in April 1784, and as the Groenendaal engine had been a private project, there was no hope – if ever there had been – of finance from that quarter for a Batavian Society project. The (minor) role of the engine in further discussions will be mentioned with the run-up to the Blijdorp engine. Brouwer, who had been elected Consultative Member of the Batavian Society in 1779, also all but disappears from the scene.

The engine probably continued to work well, and it was a sight worth a visit [*Kannegieter, 1973*]. Garden fashions change, however. Maybe subsequent owners neglected maintenance and proper operation (after all, there was still the windmill), and at some unknown time – probably after 1800 – the engine fell into disuse. Around 1842 the grounds were extensively re-shaped, and apparently the brick engine house, and what remained of its contents, was removed and the site landscaped. Contractors being what they are, it seems likely that part of the foundation masonry is still present, by now under a road surface. The windmill, with its peculiar twin platforms, still stands on its brick base. As with any surviving old timber structure, much of the timber has been replaced over the centuries (e.g. in the past few decades the two platforms and the sails have been renewed), so it is hard to tell how much of the original structure is still present.

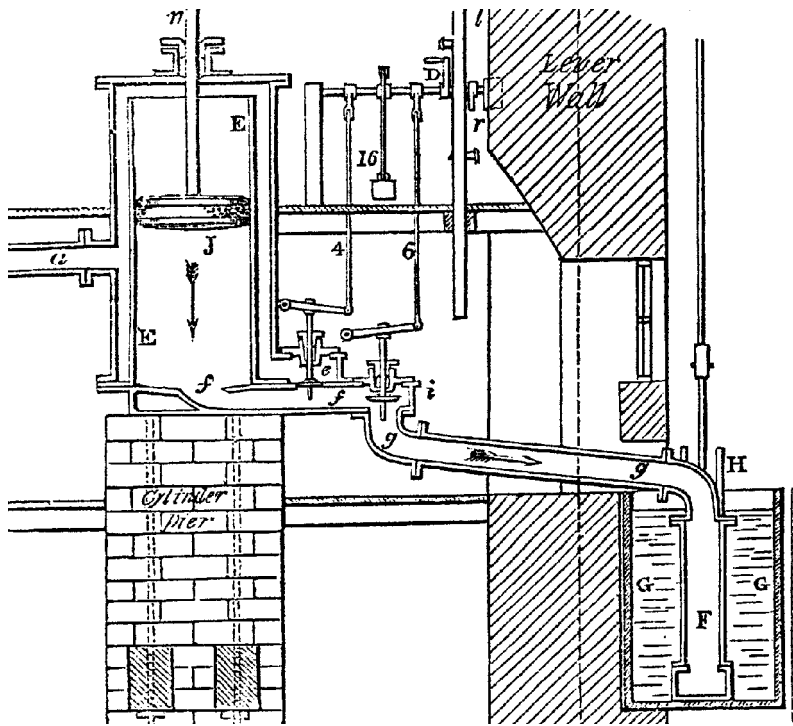
In concluding, the erecting of the Heemstede engine was not an isolated event, as Bicker’s account suggests and as subsequent authors have depicted it; there were several quite close connections with mainstream developments in Birmingham and in Rotterdam. Its size was small, and its location was a bit out of the way, but an important reason for its passing into virtual oblivion must be the death in 1784 of its patron Jan Hope, and the lack of continuity. This fate helps to stress the importance of an institutional approach as pursued by Hoogendijk and his friends.

From the documentary evidence available today, Brouwer quite suddenly appears on the stage in early 1774, as a fully-fledged (amateur) engineer, to disappear just as suddenly less than ten years later, soon after his Heemstede triumph. In principle this would suggest further research, but apart from some biographical statistics which may lurk in the vast Mennonite church records, there appear to be few if any leads.

1.6 The Watt engine and the B&W partnership; patent policy

1.6.1 The Watt engine

The main cause of the low efficiency of the Savery and Newcomen engines, as James Watt clearly saw, was the great loss of heat, occurring because the main vessel or cylinder had to be heated up and cooled down for every stroke. His solution (see sketch on next page, which omits the beam and pump) was to let the condensing of the steam, needed to create a vacuum, take place in a separate cold vessel F – the condenser, connected to the main



[Farey, 1827 p322]

cylinder E by the eduction pipe g with the exhaust valve i – so that the main cylinder could be kept hot. There were additional measures with the same purpose, such as encasing the main cylinder with a steam jacket and closing the cylinder top. The beam and pump arrangement was the same as for a Newcomen engine. Steam pressure was slightly higher than atmospheric, and the vacuum was better. As a consequence the work per stroke of a Watt engine was, as Watt claimed, about 70% higher than that of an equally-sized Newcomen one. The crucial advantage of the Watt arrangement was its much greater efficiency – about 2.5 %, over three times that of a Newcomen engine. Watt obtained a patent on his invention in 1769. This would normally run for fourteen years. It took Watt a further six years, however, to develop the engine into a

marketable product. This would leave him only eight years of exclusivity. Watt petitioned for an extension of the term of the patent, and on 22 May 1775 he was granted a surprising extra 25 years, or a total of 31 years.

1.6.2 The Boulton & Watt partnership and its business model

One of Watt’s early supporters had been John Roebuck. He financed the early experiments, and in return he had a two-thirds share in the 1769 patent. He went bankrupt in 1773, whereupon his share was acquired by Birmingham entrepreneur Matthew Boulton [Hills, 2002; 2005].

When in 1775 the patent had been extended to 1800, the Boulton & Watt partnership was established just a few days later, on June 1st, to exploit it.

It is sometimes thought, that B&W started to manufacture and sell engines, and there is some evidence of that being what Boulton originally intended [Hills, 2002 p419; Uglow, 2002 p133]. However, he and Watt eventually decided on a different approach, possibly based on Watt’s experience as a consulting engineer for Newcomen engines. They would license the use of the patented design, in a single engine, for an annual fee or premium, based on the – assumed – fuel savings relative to an equivalent “common” or atmospheric engine. They would provide design drawings and other data to the licensee, who was then at liberty to procure the engine anywhere he desired. Boulton clearly and succinctly summed up this business model in a letter to Matthew Wasbrough of 26 August 1778:

... As to the price of and Engine whose cylinder is 12 inches, I cannot pretend to say because we only sell the licence for erecting our Engines, and the purchacer of such licence erects his Engine at his own expence. However in general I can acquaint you that the price of our Engine in (Ed.Note: is?) not more but rather less than that of an Old Engine of equal power. It is quite inconsistent with our plan to give a licence for erecting engines when and where you please. We make an agreement for each engine distinctly, and the profit we reserve to ourselves is one third of the savings made by the use of our Engine instead of one of the old construction. The sum therefore to be paid during the working of any Engine is not to be determined by the diameter of the Cylinder, but by the quantity of coals saved & by the price of coals at the place where the Engine is erected. [AoS ref.MS 31473/81/44]

The standard agreement includes some important restrictions, such as the prohibition to move the engine more than ten miles from its original location without B&W’s prior consent [Hills, 1970 p217].

Suitable engine manufacturers were few and far between, particularly in the early years. Several skills (casting & boring cylinders, blacksmithing, heavy timber carpentry, fitting work, building, etc.) needed to be coordinated. Some users would tackle this themselves, or hire an engineer; the 1776 Rotterdam and 1781 Heemstede atmospheric engines are examples. Many would turn to B&W for guidance, and B&W would then procure the major parts from contractors (e.g. a cylinder from Wilkinson), maybe make smaller parts, bolts, nuts etc. in the Boulton workshops, and provide an erector, all for an extra fee; this would superficially look as if B&W were selling the engine. General licences to make and sell Watt engines were sought by some

engineers – such as Smeaton and Wasbrough – but were consistently refused, as was the making of models of the engine, which might be used to deduce data for making piracies.

This business model would work best in regions with many engines, i.e. the mining regions, particularly Cornwall. Elsewhere the periodic fee, involving the monthly reading of a stroke counter by a B&W agent, would have practical drawbacks. Here B&W would usually settle for an annual fixed fee, often based on horse power (particularly for rotatives), or even a one-time fee.

The B&W patent policy was one of actively patenting any likely aspect of the steam engine, combined with a wide-ranging interpretation of their patents, and aggressive enforcement. The basic patent was the 1769 separate condenser one, extended in 1775 to remain in force until 1800. Other patents were cemented onto this foundation via “technical specifications” — for an example see [1786-05] — forming an edifice which made virtually any foray of others in the field of steam engines a “piracy” – unless the engineer restricted himself to Newcomen or Savery type engines. Enforcement generally took the form of threats (with legal action), negotiations and settlements out of court. B&W were not keen on going to court, an important reason being (besides the cost) that weak spots in the patent(s) might show up, see e.g. [1793-08-01]. It was not until January 1799, shortly before the patent would expire, that a court ruling upheld the 1769 patent, so that B&W then could start collecting the arrears.

Outside Britain and its Colonies, the patent would not be valid. B&W stated on various occasions that they would only do business with countries where they would be granted a patent or privilege similar to the British patent. This was not as straightforward as it might seem. The issuing of privileges was often restricted to inhabitants of the country. How this restriction was worked around in Holland, is described in subsection 1.7.1. From [Tann & Breckin, 1978] it appears that before 1800 (expiry of the patent), engines were sold to several countries (France, Belgium, Germany, Italy, Spain, Russia), but that paper does not discuss patent issues as such. Quite a few foreign orders before 1800 were countermanded, possibly at least some of those may have foundered due to patent problems. In the Van Liender/Watt correspondence, only France and Germany crop up. In France an *Arret de Conseil* (apparently a patent-like document) appears to have been issued, which was later (after one engine had been erected) revoked [1785-09-04]. The French industry – notably Perier – continued making Watt-type engines [1785-10-04]. In Germany, the Prussian government appears to have refused a patent, after which mining engineers (notably Oberbergrat C.F. Bückler) attempted to gather data in England, and built their own Watt-type engines; for an echo of this, see [1800-08-19; 1800-09-09].

In 1800 the separate condenser patent expired (and the B&W Partnership was dissolved), so now anyone could build and use Watt engines without license payments, and the firm would only survive as a manufacturer in competition with others. In order to prepare for this, B&W established the Soho foundry in January 1796, and thus entered the engine manufacturing business – from late 1800 as Boulton, Watt & Co., managed by the next generation. The two seniors granted their sons the right to collect the premiums on the engines sold from 1796 onwards to the expiry of the patent. As the premium thus became embedded in the selling price, it disappeared from direct view.

Research may show whether this “leasing of a patented engineering solution” was rare or common in B&W’s time. It certainly was not popular with an important group of customers – the mine adventurers in Cornwall, who actively sought to circumvent the need for regular payments. In our time this model is quite common, e.g. in the world of computer programs (and so is the concomitant piracy!). See also [Dickinson, 1935 pp105,166] and [1776-07-10].

1.7 The Batavian Society starts a second demonstration project

By 1783 it was becoming clear, at least to Hoogendijk’s friends, that the Rotterdam fire engine project was doomed to failure. If a demonstration of the steam engine’s capabilities was to become a reality, a fresh start would have to be made.

Van Liender was by now convinced that the Watt development was the most promising. He probably did not yet feel confident enough to approach Watt directly – only a few letters had as yet been exchanged, mostly through Enslie. He again used an intermediary, this time the atmospheric physicist Jean de Luc, French/Swiss, attached to the Court of St. James as reader to the Queen. De Luc knew Van Liender fairly well (see summaries of some of his letters, they shared an interest in fire engines), and he was a close friend of Watt. He apparently forwarded Van Liender’s letters to Watt, as they are in the AoS.

Thus Van Liender wrote to De Luc [1783-12-19] about his desire to erect a Watt engine in Holland. Finance is a major problem (recall, that the Batavian Society had no means of its own). A wealthy man like Jan Hope might easily put up the money for such a project, but due to the influence of his engineering advisor Brouwer, he would be likely to do that only if it were a Newcomen engine. It must be admitted that Brouwer’s little

engine for Hope is a jewel, but any attempts to convince him of the superiority of the Watt development, have failed – see e.g. Brouwer’s comments on B&W in the summaries of his letters to Van Liender. The latter now proposes that B&W erect a demonstration polder pumping engine in Holland at their own cost (which he estimates at £ 2000). A Patent would follow quite naturally.

No reply to this letter, either from De Luc or from B&W, has been found.

Ongoing discussions apparently eventually convinced Hoogendijk of the need for a second attempt. Hope died in April 1784, so that route to finance was now definitely closed. Hoogendijk decided to once again provide the money – this time one of the relevant documents survives: a codicil dated 29 September 1784 [*Havinga, 1969-08-02*] wherein he allowed the Society (always after his death!) to use up to £25,000 of the inherited capital to finance a steam engine, provided this would over the following years be made up out of the income. In addition he must have made provisions to supply the needful for the project during his lifetime. It is quite clear from the available documents, that Hoogendijk maintained tight financial control over his Society, so it seems likely that he did not supply a lump sum for the Society to use, but that he would pay the bills as they arrived – no documentary evidence of this has been found, however.

Shortly after, Van Liender tells the good news to De Luc [*1785-01-30*], and via him to B&W. He now proposes that the Batavian Society pay the regular manufacturer’s price, and that they will procure for Watt a Patent in Holland, but that the Society would have no financial obligations beyond that – i.e. that B&W waive their premium. Should this proposal not lead to an agreement, then the fallback option would be that the Society erect a Newcomen engine, which they are perfectly capable of – witness the lovely and perfect engine near Haarlem. Van Liender mentions that an existing polder is envisaged (which would avoid the variable lift problem), at present served by two cascaded windmills, but he does not mention its name.

Watt lost little time in responding. In [*1785-03-29*] – which refers to the letter to De Luc, and marks the start of the regular direct correspondence – he emphasizes the crucial importance of securing a Patent, before briefly discussing a few engineering aspects such as principal dimensions. Therefore the Holland patent issue will now be dealt with first.

1.7.1 The Holland patent

The Republic of the Seven United Provinces could grant patents, but the individual Provinces could, too. Would a Republic-wide patent be possible or advisable for Watt? This route was not pursued, but a patent at the Provincial level was sought instead. In [*1785-03-29*] Watt asked if drainage needs were likely to arise outside the Province of Holland? Van Liender replied [*1785-06-03*] that Holland was judged to be the only province where pumping engines would be needed. It was decided to apply for a patent in that Province only. Industrial (rotative) engines were not envisaged at that time, and the considerable drainage needs in the province of Utrecht appear to have been overlooked.

Watt made it abundantly clear, e.g. in [*1785-09-04*], that he would not start actual work on the engine, until after the Patent had been granted – from later letters it is plain that he did not strictly adhere to this adagium. In the early stages of the project, Van Liender envisaged a simple and speedy patent procedure, see e.g. [*1785-06-03*]. It soon transpired, however, that Holland would only issue patents to residents, defined as individuals residing in the province for a specified time [*1785-10-04*], the period appears to have been about three months. This would have been quite impractical for Watt or Boulton. Van Liender proposed several workarounds, including the idea of having the Patent issued to a mutually trusted person in Holland, such as Enslie. A few weeks later [*1785-11-29*] he hit upon the idea that continuity would be better guaranteed if the Patent could be granted to the Batavian Society (or rather to its Directors), which would then enter into an agreement to transfer all proceeds to B&W. This B&W agreed to.

As a general rule, a request for a patent should be accompanied with a full technical description or a working model. James Watt would have to provide that, but if it had to be waited for, the Patent and the progress of the demonstration engine would be delayed. The States agreed to issue the Patent on 12 Jan 1786 [*Privilege 1786-01-12a and b*], with the injunction that Watt would provide the technical description later. This came in May (Watt’s patent specification [*1786-05*]), and Van Liender quickly had a translation made – or, more likely, made it himself – before depositing the documents with the States of Holland. As far as could be ascertained, only Watt’s final draft of the text survives (in the AoS); this has been transcribed.

In November 1786 the financial agreement between the Batavian Society and B&W was concluded [*Contract of Cession 1786-11-08*]. This convoluted and repetitive legalese document was the result of proposals and comments by Dutch and English solicitors, and shows that B&W attempted not to take any chances.

Looking ahead in the story: did the patent bring the fruits envisaged? Hardly. Only three engines were made before the Holland patent expired in 1801, almost simultaneously with the English one. For the first one (Blijdorp) the basic conditions were set forth in Watt’s letter [*1785-03-27*]: the expenses of the engine were to be borne by the Dutch; Watt waived the license fee for this demonstration engine.

The Mijdrecht pumping engine was erected in the province of Utrecht, and thus strictly speaking outside the

jurisdiction of the patent. Both Van Liender and Watt were probably aware of this, but the issue is not brought up in any of the letters found. Maybe by this time mutual trust had developed to the point where they could tacitly let sleeping dogs (the States of Utrecht) lie. There is no mention of the patent, or of premiums. The rotative Boon engine (for corn and malt grinding) was built 1797-1799, i.e. in the unitary *Batavian Republic*. Formally, it is unclear what the status of the 1786 patent became after the autonomy of the Provinces had been abolished. However, in this case B&W, after the establishing of the Soho foundry, acted as manufacturer for the entire engine, the premium would have become an integral part of the selling price, and thus invisible.

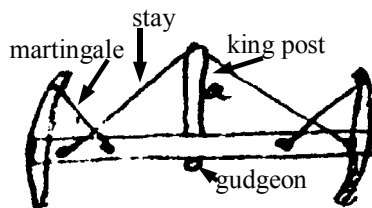
1.7.2 The building of the Blijdorp engine

When the patent issue had been settled in January 1786, Watt began to design what would become known as the Blijdorp engine. His engine designs had by this time become more or less “standardized”. Several drawings survive in the AoS and some in the GAR. A general section has been reproduced in [*Van der Pols & Verbruggen, 1996 p49*], and a drawing of the valve gear in [*Dickinson & Jenkins, 1927 plate LVII*]. From the first one it is clear that Watt planned a cast iron pump, no doubt because he had used such pumps for quite some time. Data on an engine at Soho show, that that engine had a cast iron pump in 1777 [*Dickinson & Jenkins, 1927, Pl.XXII*]. This, with a properly sealing piston, would solve the structural pump problems as experienced with the Rotterdam engine. The selection of an existing polder, provided virtually constant lift, so that the multiple beam & pump structure would be obviated.

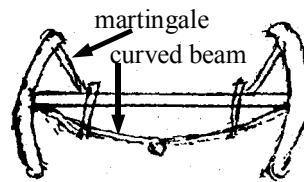
Bicker describes the building and erection of the engine. Some aspects – such as the pump well – are dealt with in minute detail. His ten-page story leaves the impression that everything went smoothly. The c.44 letters exchanged over the same period tell about delays, unclarity and misunderstandings, but it is clear that these were not major stumbling blocks, rather wrinkles.

Right at the start, Van Liender enlisted the help of Dirk Smits, the surveyor (i.e. engineer) of the Hoogheemraadschap Schieland (in which hydraulic province the Blijdorp polder is located), experienced in hydraulic and civil engineering, and a member of the Batavian Society. He designed the foundations and the building, pump well and water channels (launders), from Watt’s design data, and supervised their execution by contractors. Van Liender and Watt corresponded about several details such as types of arches, and the merits of lintels (no spur forces) instead of arches (always some spur), and also about the feasibility to re-use the steam cylinder from the Rotterdam engine as pump or steam jacket (Watt advises against).

Work on site started early October 1785 by soil drilling (to get data for the pile foundation), site fencing and the building of a substantial site office shed, with office, a smithy, a stable, storage space etc. After the Holland Patent had been granted on 1786-01-12 (supplemented by a decision to grant – for the Blijdorp engine only – freedom of taxes on building materials and fuel), building work proper started with the contracting for the house and pump well foundation (177 piles, associated timberwork). This was completed mid-June 1786. Shortly after, the brickwork was contracted, and also the remaining piling and timberwork for the pump feed and discharge channels etc. Work on the beam should also start now. Watt prefers a beam with a king post, but Van Liender suggests recycling the curved Rotterdam beam; Watt agrees, but ironwork (martingales, chains, gudgeon) should be adapted or replaced.



[1786-03-27]



[1786-05-31]

Mid-August 1786 Van Liender and his sister leave on their annual six-week holiday trip – this time to Germany. Upon his return he finds that, shortly after his departure, work had been stopped. There was an apparent lack of instructions, and there was also an old stipulation in [*1785-10-11*] that upon raising the boiler seating to a certain level, work should be stopped until receipt of further instructions. Van Liender writes for such instructions to Watt [*1786-09-22*] who quickly responds [*1786-09-28*], but wishes that the gentlemen on site might have contacted him rightaway. This illustrates Van Liender’s king pin position: others would not attempt to resolve such problems in his absence. In [*1786-10-13*] Van Liender concludes that the stoppage had been unnecessary.

By early December 1786 the brickwork was completed, a few weeks later the roof was closed so that indoor work could continue during the winter. Also the floodgates had been installed in the channels or launders. The “metal materials” (castings, boiler in parts, etc.) suffered delays, as manufacturer Wilkinson had to re-do a

flawed cylinder casting [1787-01-11]; most of these materials arrived late January 1787. The B&W engine erector, Malcolm Logan, should have come over in February, but he is ill and no alternative is available, eventually he arrived late April [1787-04-13; 1787-04-19; 1787-04-27]. In the meantime, under the direction of Van Liender and Smits, the working barrel (pump cylinder) had been fitted in place mid-March (Bicker describes this in great detail), and the copper boiler pieces riveted together. Further delay followed as Logan condemned the old Rotterdam chains (they were cast, whereas tougher forged chains had by then come to be the standard). Late May the boiler was set on its seating, and the beam raised upon the “lever wall”. With [1787-07-03] Watt writes to Logan about a vexing problem with a pumping engine in London, which might well occur with the Blijdorp engine too: “valve slapping” in large pump valves (both the piston and the “clack” or top delivery valves assembly may be affected). The cause appears to be that, when the motion reverses at the end of each half-stroke, the still open valves “slam” shut as a result of the reverse water flow. This causes wear, damage and noise. Watt is of opinion, that a pause at the reversal point is the preferred remedy (he does not specifically say why, but it is known that this helps – as it allows the valves to close by their weight before a reverse water flow can occur). Making the steam engine valves open and close “gently” also helps, and a third option is to admit some air under the valves, with a pump or bellows, and special piping. It is not clear if any of these extra provisions were applied, but the later wear problems suggests they were not. Also in July, the engine is almost complete; Van Liender and Bicker take Hoogendijk to see it. Finishing touches take another eight weeks or so, and with [1787-09-07] Van Liender writes that experiments will be started within a few days – in fact, the engine makes its first strokes the next day. A week later it already works well enough to take Hoogendijk to the site again, to witness the first demonstration. Logan stays long enough for final adjustments, to iron out teething troubles and to instruct a local engineman (probably W. Krijgsman); in October the engine runs steadily at 17-18 strokes/min [1787-10-09]. Bicker writes that Logan then demonstrated the power and flexibility of the engine by shutting down the injection water for the condenser and letting the engine run for a couple of minutes “on the air pump”. Early November 1787 Logan returned to England, no doubt leaving copies of the B&W printed directions for erecting and working the engine [reproduced in Dickinson & Jenkins, 1927 p375ff] with Van Liender, Krijgsman and maybe others. With [1788-02-12] Van Liender writes about two serious accidents: due to a control gear fault (through wear of a leather strap) a valve spindle was lifted out of its guide, then jammed as it came down – repair was troublesome but successful. In December 1787 the pump rod fractured, causing a hard indoor stroke. This, too, appears to have been successfully repaired. A recurring problem is, however, the rapid wear of the clack and pump piston leathers (which also form the hinges). Some valves have now been experimentally fitted with iron hinges, as those of the Heemstede engine are – whether this is effective, time will tell (it was not, see [1791-10-18]). This is – although Van Liender is not specific – probably the “valve slapping” problem discussed above; Watt responds with recommending the same remedies he communicated to Logan [1788-04-05].

The principal dimensions of the engine are in the correspondence, but not in a systematic way, and with some uncertainty. The steam cylinder diameter was probably 34”, stroke 6’ equal beam, pump diameter 55”; proposed by Watt [1785-10-11] and agreed by Van Liender [1785-11-29] – notwithstanding slightly different values in other letters.

Altogether, this project had proceeded fairly smoothly, but with enough small problems, delays, and misunderstandings to provide valuable engineering and project management experience to Smits and Van Liender, particularly the latter. For the next project they would need all their resources.

At the same time when the Blijdorp project drew to a close in 1787, political developments in Holland began to make life difficult for Patriots (see General Chronology section), and many fled the country. Van Liender also started to make plans in that direction, but took his time in order to avoid having to sell out his interests at ruinously low prices. He asked Watt about the cost of living in England [1787-10-09, 1787-11-15], planning to leave in May 1788. This he did [1788-05-29], but he had to return in July to act as Executor of Hoogendijk’s estate. A year later he moved to England again, and stayed in Birmingham for about nine months; Watt introduced him to the Lunar Society [Uglow, 2003]; there is no correspondence from this period. About June 1790 Van Liender moves to Paris and Versailles – the next project is prepared from there.

1.7.3 The Blijdorp engine trial & demo programme

The Blijdorp engine was, like the Rotterdam one, conceived as a demonstration of the capabilities of the steam pumping engine, to promote its use in the United Provinces and particularly Holland. Bicker reports on the demonstrations actually performed.

The engine stood on the Blijdorp polder, which was normally served by a single windmill. The adjacent Kool polder’s windmill was destroyed by fire in August 1787, and as an emergency measure a communication

channel with a sluice had been made between the two polders, so that the Blijdorp windmill could drain Kool as well.

In what follows, the polder officials generally adopt a conservative attitude. Polder boards generally did: they were responsible for the safe and secure living conditions of the polder population, and experimenting would usually involve an element of risk, which they would not readily take. This “natural” conservatism would quite easily become associated with political conservatism, i.e. in the period we are discussing: Orangism.

15 September 1787. The first demonstration of the engine was reserved for founder, initiator and maecenas Steven Hoogendijk, almost ninety now and not in the best of health. He witnessed the culmination of his initiative “to his utmost joy”, as Bicker reports.

October 1787. On the 17th, as a trial, the engine drained the Blijdorp polder to 7 inches below standard summer level, in just a few hours. The Kool polder channel was then opened, raising the level to well above summer level, and again in a few hours the engine reduced this to $5\frac{3}{4}$ inches below summer level. The Batavian Society then offered to provide maintenance drainage for both polders without cost, but subject to the condition that during this period the windmill would not be used. This offer was summarily rejected, whereupon the engine was stopped. The windmill then turned out to be inadequate. However, the polder officials would only relax their refusal by accepting a 12 or 18 hour comparative trial – which failed, as the windmill could not be made to work for 12 hours at a stretch. The engine then worked for 18 hours and, while it rained for 14 of these, lowered the level by $4\frac{1}{2}$ inches.

Bicker, van Liender and engineer Dirk Smits then conducted what may be seen as final acceptance trials before granting B&W erector Malcolm Logan permission to return to England.

November 1787. Continuing rains had flooded both the Blijdorp and Kool polders to $9\frac{1}{2}$ inches above summer level, and there was no wind. On 10 November the Blijdorp polder authorities requested the Batavian Society to help them out, and eventually agreed to the condition to stop the windmill as long as the engine could work. After 63 hours, with heavy rains continuing, the level had fallen by $3\frac{1}{2}$ inches. After a further period of working, Bicker states that the engine had altogether discharged $12\frac{1}{2}$ inches in 78 hours (*Author’s Note: the $3\frac{1}{2}$ ” in 63h figure is easy to check, but the further period would appear to add up to $44\frac{1}{2}$ hours, in which time the level had fallen $9\frac{1}{2}$ inches, bringing the total to 13” in $107\frac{1}{2}$ h*). By early January 1788 the levels in both polders had been brought to acceptable values, and some polder officials inserted a statement in the papers recognizing the crucial role of the engine. This did not, however, herald a general change in attitude on the polder board’s side.

1788. In view of the polder board’s uncooperative attitude, the Batavian Society now decided that the engine was to be worked for trial and demonstrative purposes only. Bicker gave a number of lectures on the subject. Still, many in the polders remained opposed to the engine. In August, it was found that at the windmill a sluiceway had been used to surreptitiously let in water, in order to reduce the apparent effect of the engine. This gate was then fitted with a lock. Several trials were performed during the year.

April 1789. At the request of the Batavian Society the States of Holland appointed a committee of experts to examine the engine and its performance. Their report was favourable, showing – as a conservative estimate – the engine to be equivalent to at least three windmills.

16 May 1789. The engine was demonstrated to the Inspector of the Rivers, the Burgomaster of Leiden, the Secretary and the Surveyor of Rhyndland, and other officials – all concerned with the possible reclaiming of the Nieuwkoop lake (halfway between Utrecht and Leiden, adjacent to, but unconnected with the Nieuwkoop & Zevenhoven drainage, mentioned in subs. 1.10 in connection with the use of cast iron in windmills). A trial was run to demonstrate the capacity of the engine.

22 July 1789. Demonstration at the request of a Mr. De Cupere of Utrecht and company, with the purpose of seeing whether a steam pumping engine might be worth considering for a fairly large drainage project in the province Utrecht, which eventually turned out to be an important factor in opting for steam drainage of the Mijdrecht Lake (see subsection 1.8).

6 February 1790. Demonstration at the request of the Pensionary of the States of Holland Emants, mainly for the States Committee for New Inventions.

5 April 1790. Demonstration for the Committee for the Drainage of the Mijdrecht Lake, again initiated by Mr. De Cupere.

20 October 1790. The full board of Directors of the Batavian Society received a visit from the Stadholder Prince Willem V of Orange, his wife and son (the later King Willem I, then 18), and a retinue of eminent personalities. The engine was explained and demonstrated. Bicker supplies the following oft quoted detail of a conversation with the Princess: “*After the explanations HRH asked what might be the reason that such a useful machine was not brought into more general use in our Country – whereupon one answered that (however ambiguous this might seem in view of the times and our well-known attitude) such reasons were easily found; that this device was entirely new, and that HRH well knew how difficult it was to start anything new in our Country, however useful it might be.*” Director Van Liender reports hearing about this visit while in Paris [1790-11-04], so he was not present.

10 November 1790. A final visit and demonstration, a sort of “open day”, included the entire Rotterdam Corporation, plus all the members of the Batavian Society in Rotterdam.

1.7.4 The Batavian Society’s direct involvement with the introduction of the steam engine ends

Thus, in November 1790, Steven Hoogendijk’s plan to use the Batavian Society to demonstrate the feasibility of using steam engines for land drainage purposes, was successfully completed. Although the Society would still look with interest at further developments, and did from time to time set Questions on specific problems for its essay competitions, it did not actively promote the further introduction of steam power. That was left to the hydraulic authorities, and to private industrial enterprise.

Van Liender was by now on his way to building up a solid connection with the Boulton & Watt Partnership, and to becoming a good friend of James Watt. He quite naturally slipped into the role of B&W’s agent in the Low Countries. As such, he would receive a 5 % commission on sales, but the number of engines remained small, and from the 1780s to his death in 1809 he may have received about £4000 in all, hardly a significant income for a merchant – particularly if one takes into account the associated expenses, such as his stay in Mijdrecht to supervise the erecting of the engine there. His primary motivation probably was and remained his general interest in modern technology, plus his desire to perform a public service by promoting the practical use of innovation.

1.7.5 Attempts to dispose of the Blijdorp engine; “Keezending”

The Batavian Society now had no further use for the Blijdorp engine, and they started looking for ways to dispose of it.

After the engine’s technical successes in draining the Blijdorp and Kool polders it would be logical to expect the polder authorities to be eager to take advantage of the situation to take over the engine at a moderate price. Past experience had already shown, however, that other factors came into play. In [Bicker, 1800] we find a story of several fruitless negotiations with the polder officials and landholders. For one thing, he writes, there were prejudices against anything new, but politics also played a part : the Batavian Society was seen as a hotbed of the despised Patriots, and thus (as Bicker reports it) the engine was considered to be “a Patriot contraption, which we want none of” (Dutch: *het is een Keezen ding, en dat moeten wij niet hebben*). For later historians [Huet, 1885 p50; Muller, 1937 pW111; van der Pols, 1977 p190; van der Pols, 1984 p26; van Lieburg & Snelders, 1989 p75; van der Pols & Verbruggen, 1996 p47] this became a catchphrase to illustrate the irrational rural conservatism in the face of proven advantageous innovation. It should, however, be borne in mind that being dependent on such a new device would entail a number of uncertainties, among them the cost and effort of operating and maintaining the engine, and of being dependent on imported fuel.

The Society then considered having the engine converted to rotative motion, and adapting it for industrial use, such as grinding corn, paint or tarraas. For this, the lease of the piece of land on which the engine stood, would have to be converted to freehold. The owner’s asking price was considered to be beyond all reasonability. The Society now decided to bide their time, performing minimum maintenance, which included occasionally operating the engine.

In **February 1791** the States of Holland decided to buy the engine. They were still considering the draining of the Nieuwkoop Lake, using part wind and part steam power. That drainage was eventually called off, and the engine remained at Blijdorp.

Not long after, the Mijdrecht drainage (discussed in detail in the next subsection) was running into trouble. Prof. J.Th. Rossijn, consultant to the States (later the Provincial Administration) of Utrecht, advised these on **23 January 1797** to acquire the Blijdorp engine and erect it alongside the existing Mijdrecht engine. This was decided, and in the autumn of 1797 the engine was dismantled, the parts brought to Mijdrecht, and stored in the Ter Schelling grounds where the Mijdrecht engine stood. It was never erected there, and the parts were probably scrapped shortly after November 1812.

In the autumn of 2004 the foundations of the engine were excavated, and found to be in remarkably complete and good condition. They were recorded, and subsequently destroyed for building work.

1.8 A pumping engine to reclaim the Mijdrecht Lake (Mijdrechtse Poel)

In the western part of the province Utrecht extensive peat extraction had left numerous lakes, pools etc. A very deep one (about 6 m) was the c.950 ha Mijdrecht Lake (Mijdrechtse Poel), separated from the Amstel river by a dike. The States of Utrecht planned to reclaim it.

Delegations from Utrecht had on two occasions witnessed demonstrations of the Blijdorp engine, with the impending drainage on their minds. Soon after their second visit on 5 April 1790, Van Liender received a list of queries, obviously drawn up by Utrecht's consultant Prof. J. Th. Rossijn, which he immediately copied and sent to B&W [1790-06-?]. By this time he had moved to Paris, and later Versailles, from where he managed the early stages of the project, with support on the spot from his old friend, Schieland engineer Dirk Smits. Watt replied almost immediately [1790-07-08], proposing two 48" engines; if the Blijdorp engine can be re-erected here, two new 44" ones will do. If ordered right away, engines can be ready in the spring of 1791. With this scheme, it will then take 15-16 months to drain the lake.

Rossijn would like to know many details of the engine, but Van Liender and Watt agree that a "need-to-know" basis is preferable, lest he should "carry our (B&W's) knowledge elsewhere" [1790-07-08; 1790-08-30]. The States of Utrecht decided on a single 48" engine [1790-10-21]. This would increase the duration of the initial drainage to, say, 30-33 months, but that is just as well: it will give the new dikes time to settle before being loaded with the full level difference. Rossijn gets drawings & instructions for foundations and house [1790-11-12].

Watt then addressed the ever-important problem of varying lift. For Mijdrecht this was a transient problem: during the initial drainage the lift would gradually increase to a final value, and would from then on remain virtually constant – no quick and repeated changeovers would be needed. In [1790-11-07] Watt proposed to have two – or even more – pump barrels, each with piston & clack, which could be fitted on the top flange of a "suction piece", a large cast iron pipe affixed on the pump well floor. The arrangement finally adopted was to start pumping with a 60" barrel, until level lowered 10-11 ft, then continue with the "standard" barrel of 48" (the interpretation of this scheme in [van der Pols & Verbruggen, 1996] is erroneous).

The States of Utrecht had around this time acquired a site for the engine: the Ter Schelling house & grounds (see Glossary section). Meanwhile, Dirk Smits was designing the building and its foundations. He became increasingly worried about the required depth of the foundation – 23'6" or even more, in soft swampy peat ground with a high water table [1791-03-14; 1791-05-16]. Soon the idea of getting the engine up and running by spring 1791 had to be abandoned [1791-01-13] – it was not until March 1791 that the excavating of the (dry) pit could be contracted [1791-05-16], followed in July by a contract for the piling [1791-07-10]. If this succeeded, the worst risks would be over – if not, there would be much trouble [1791-05-16]. In July, with the pit at 16', water suddenly welled up, necessitating four pumps (horse-driven chain or barrel pumps) to master. Pile driving started on 4 August, there is little or no hope that the brickwork can be started in 1791. In October, work is stopped for the winter [1791-10-18].

Watt is a bit surprised about the foundation problems. Surely, windmills must be securely founded, too? Van Liender explains, that for deep drainage with a cascade of windmills, the top mill is built first, and this does not need a full-depth foundation. The second mill is built after the top mill has lowered the level and the water table, so that the second foundation is unproblematic as well, and so on to the bottom mill [1791-09-17; 1791-10-18].

During the 1791/1792 winter stop something unexpected happened. Some builders ("Ignorant Quacks" as Van Liender calls them) managed to convince the States that they could easily and cheaply do what Smits had not yet managed – and without heeding Smits or Van Liender, the States entered into a £20,000 contract with them. They failed miserably, and in the spring of 1792 Smits was again asked to provide the answer. In Van Liender's opinion, this is a crucial stage: if we do not succeed now, the whole project is lost, which would deal a lethal blow to the introduction of steam power. Smits accepted, for an extra £27,000 – the number of pumps was increased to six, working round the clock, and requiring a stable of 80 horses [1792-06-12; 1792-08-24]. In August, Van Liender reports that the foundation problem has been overcome, and that the masonry is being raised to about 1 foot below the Amstel river level, where it can be left for the winter 1792/1793 with little or no pumping. Meanwhile, work on the beam and on the boiler can continue [1792-08-24; 1792-11-13; 1792-12-11].

Early in February 1793 the smaller castings were shipped from Hull, arriving just days before the France-imposed embargo became effective; the working barrels, pistons and clacks lying at Liverpool would now have to wait for an opportunity with a "neutral vessel" [1793-02-04; 1793-02-15].

In April 1793 work was restarted, but in the same month Van Liender's faithful ally Dirk Smits died of consumption, and one of his apprentices had to help out [1793-06-13]. This probably made Van Liender come to a decision he had already foreseen in 1791: early June 1793 he took up residence in a small country house in

Thamen, just opposite the Mijdrecht site [1791-10-18; 1793-06-13], to manage the execution of the project while awaiting the arrival of Watt's erector

In August and September 1793, the house is completed, the suction piece, steam cylinder, and cold water cistern are fixed in place, and the beam has been raised [1793-08-08; 1793-09-30]. In October, erector James Smallman arrives [1793-10-21]. He starts work rightaway, one of his workmen is blacksmith J. Duister [van Lieburg & Snelders, 1989 p75]. A vessel has also been found for shipping the remaining parts from Liverpool, probably in convoy.

In December 1793, James Watt Jnr. passed through Holland on his circuitous way home after his adventures in revolutionary France. He visited Van Liender in Thamen, and of course the two men would have discussed the engine as well as politics. It is doubtful, however, that James Jnr. would during his brief stay (a couple of weeks) have materially contributed to the management of the project.

The engine made its first strokes on 10 February 1794 (probably reported in lost letter [1794-03-26]), and runs well – in May Van Liender reported a lowering of the lake level by 13", and in July Smallman was given his leave [1794-05-06; 1794-07-31]. He started out from Rotterdam, but then apparently disappeared into thin air: he never arrived in England. A worried correspondence (has he been pressed?) followed [1794-09-04; 1794-09-10; 1794-09-23; 1794-09-25; 1794-09-30], and eventually Van Liender comes to the conclusion that Smallman must have been enticed to go to America, by promises of work in the engineering industry there, and that he had been planning to do so for some time. From 1970s (!) literature it transpired that this hunch was correct [Robinson, 1974; Flexner, 1978].

In May 1794 Van Liender wrote a (solicited) letter to the Editor of the cultural magazine "Konst- & Letter-Bode", quoted in full in [Bicker, 1800 pp76-83]. He reported a few highlights of the Mijdrecht project, clearly aimed at a general public, and at generating publicity for this further step in introducing the new power. The problems with the deep foundation were cursorily mentioned, mainly to state that they had been successfully surmounted.

The troubles, however, were not over. There was a shortage of coals (maybe the high price had kept stocks too small), the boiler was leaky, on 6 May 1795 the beam broke, and the pump chain or rod fractured three times. As there are also parts subject to wear, the Directors decided that a stock of spare parts, including an on-site spare copper boiler, would be needed. This added considerably to the expense.

Generally, the drainage proceeded much slower than envisaged, but it was hoped that cultivation could start in 1796. In a 1795 letter by Rossijn (quoted in full in [Bicker, 1800 pp83-86]) the enginemen were blamed, an accusation which Van Liender later repeated to Watt [1797-05-12]. Duister had been dismissed as being (though competent) unacceptably surly and headstrong, his young successor Maurer was said to neglect the engine, and Krijgsman was considered too stubborn. Improving the dike – by adding a dam of sand to its lakeside foot, see [1799-05-18] – does not appear to have had much effect. In [1800-02-18] Van Liender asked B&W (at the request of the Directors) for an English engineman. Too risky in times of war, was the reply [1800-04-15].

In a 1797-01-23 memoir [Bicker, 1800 pp99-126] Rossijn had already advised against an English engineman, and had recommended keeping Krijgsman on, and provide him with an apprentice. Rossijn also recommended using the old Blijdorp engine (and not windmills, as the Directors seemed to prefer) to increase capacity. This was decided, and in the autumn of 1797 the dismantled Blijdorp engine was brought to Mijdrecht to be erected there alongside the Mijdrecht engine. The work was contracted, but in February 1798 political problems intervened, as reported by Bicker: a group of Utrecht citizens petitioned the Assembly of the Batavian Republic to countermand this decision as being

..... detrimental and costly, the more so as this device tends to render English products indispensable in this Republic, while on the contrary the scoopwheel-windmills, as invented in Holland, have always been found to be superior to the Steam Engines, as evidenced by the one in their District.

We see here a parallel as well as a contrast with the c.1790 "Keezending" argument discussed earlier. In both cases the traditional and established technology was recommended above "new" solutions. In both cases the political context was conservative. However, in 1790 conservative meant pro-Orangist establishment, while in 1798 it had a patriotic (no capital P!) flavour, more directly connected with seeing England as the enemy.

The government requested a comment from the Provisional Administration of Utrecht, which was given after a week, defending the decision to erect the Blijdorp engine. The Assembly put the matter in the hands of a committee, which had apparently not yet come to a decision by 7 April 1798 when Bicker received a final note from Rossijn while preparing his essay for the printers. It seems likely that the matter went in abeyance, or was shelved in favour of more pressing issues – but in [1801-08-29] Van Liender mentions, that four large archimedean screw windmills are being built to assist the steam engine. It would appear that the protesting

citizens had eventually got their way.

In the spring of 1798 the 60" pump was replaced by the 48" one. The level at that time is not explicitly stated, but may be assumed to be not too far from the 10-11 ft originally envisaged as changeover point. Rossijn thinks that, had the boiler and the 60" clack been in better condition, the 60" pump could have been used to greater depth, maybe even to completion – showing the conservative design and load of the engine.

It gradually became clear that seepage was the main problem, after all [1800-04-25]. The sand dam had not brought the solution, and Van Liender despairs: "(...the large influx of water through the dykes....) which I am afraid shall oblige us to abandon that undertaking".

In the summer of 1808, a crack in the chimney caused a fire, with extensive damage to the timber structure, and to the condenser and air pump [1808-11-01]. Repairs were only completed in November 1808 [1808-11-01]. In [Simons & Greve, 1844 p130 and Huet, 1885 p58] it is suggested that the engine had to be replaced in its entirety, and that repairs were completed in July 1809. This appears to be in error on both counts.

The Mijdrecht drainage project was eventually abandoned in November 1812 [Huet, 1885 p58], and the polder allowed to fill up.

The dike seepage problem was essentially unsolved, and the cost to keep the polder dry was therefore excessive. The engine was scrapped, and no doubt the remaining parts of the Blijdorp engine with it.

Altogether this was an ill-fated project. First, the problems with the unprecedentedly deep foundation in soft peat, caused extra costs and a delay of nearly three years, and almost brought the enterprise to its knees. Then the unusually large dike seepage – again to blame on the soft and porous soil – taxed the steam pump to its limits, and often beyond, while political prejudices would not allow an adequate capacity increase. Serious breakages and a fire caused further expenses and delays. Finally, the continuing seepage made the cost of maintenance drainage prohibitive, particularly with the impoverished state of public finance.

1.9 Grist to a steam mill

Watt and Boulton had been considering engines with rotary motion for driving machinery ever since 1769 [Dickinson & Jenkins, 1927 pp146ff]. The first attempts were aimed at producing rotary motion directly (the "steam wheel") but eventually that idea was abandoned in favour of using a reciprocating engine and converting the resulting linear motion to rotary via a mechanism. The simple and effective crank had already been patented, and instead of challenging the validity of that patent, Watt invented and patented a number of other mechanisms in 1781 [Dickinson & Jenkins, 1927 p156]. As far as could be ascertained, no such engines came to Holland until, in May 1797, Van Liender was asked by a friend to inquire after the price etc. for a steam engine to drive his grist mill for malt and rye. In [1803-05-17] the friend was revealed to be the Rotterdam distiller Boon; the term "friend" ranged wider than today, it could also mean a business acquaintance, agent etc. Apparently Boon then drove his mill by a two-horse gin. His interest in steam did not so much arise from the need for continuous power. He only operated the mill for limited periods, and steam would rid him from the encumbrance of keeping a stable of probably eight or ten horses.

Watt offered the smallest standard engine made by the recently established Soho Foundry, a self-contained four-horse unit for £ 480 [1797-06-14]. Boon is interested and wants the engine as soon as possible, but there may be a snag: malt grinding is a privileged trade, so he may have to obtain permission. He has a peculiar request which Van Liender transmits in a rather roundabout way, as if he is embarrassed [1797-07-17]. Would B&W make the engine with all possible speed, but would they also take the full risk of the permission, by agreeing that the order be annulled at no cost, if permission should not be granted? Surprisingly, B&W readily agrees [1797-08-20] – apparently there is a ready home market for this kind of engine. Soon after, Boon reports that he has obtained permission [1797-11-05].

There follow a few letters with queries, mainly about available space, position of the boiler, and details of the power take-off from the crankshaft. Mid-February 1798 the engine is ready to be shipped, but embargo conditions delay shipment (via neutral Hamburg) to May [1798-04-28; 1798-06-13]. Willem Krijgsman (engineman at Blijdorp and Mijdrecht) puts the engine together [1798-12-25]. Some problems occur, first in starting her up, then in achieving full power [1799-05-18; 1799-08-16]. Apparently these problems were overcome, as nothing further is heard until Van Liender writes to B&W that another prospective customer has been to see the engine working [1803-05-17].

1.10 Iron machinery in windmills

In 1797 Watt advises Van Liender that B&W have established their own foundry in Soho. The latter immediately [1797-07-17] writes about an idea which he had apparently nursed before: the use of cast iron in the power train of drainage windmills. For a scoopwheel mill this consists of the windshaft (which carries the sails, also known as the Great Axis), the vertical shaft, and the watershaft (carrying the scoopwheel), with connecting gears. Traditionally these were all timber (mostly oak, gears of holm oak), with iron ferrules and

other straps, and iron necks or gudgeons running in stone bearings. Oak in the required large sizes (square cross-sections up to 36") was becoming increasingly expensive, and the life of oak parts is limited. Would cast iron be an alternative? Van Liender has heard that in England such ironwork is already being used in windmills. An earlier version of this idea had cropped up as part of a Question dated 13 August 1787, with the hand of Van Liender clearly recognizable.

Which might be the reasons why, notwithstanding the considerably increased price of heavy Oak timber, particularly of the Mill-Axles, the practice of using a single piece of timber for these, is continuing; as in a few Mills, standing near this City, Axles have been used built up of four pieces strapped together, which apparently answer well, as they continue to be used in these Mills, and as the Axles, built up of four pieces, must be considerably less expensive and possibly longer lasting and less prone to faults?

And would it in this Country, after the example in England, be advantageous to use cast Iron Axles?

As Van Liender surmised, the idea of using iron was not entirely new. John Smeaton (1724-1792) had from c.1767 used cast iron shafts in waterwheels [*Skempton, 1981 p65, reference supplied by R.Hills*].

It is not until 1798 that an entry is awarded a prize. Christiaan Brunings jnr. and two of his overseers – the millwright and sluice-builder S.Kros (1747-1813) and D. Spruytenburg – received a silver medal. They would favour an experiment, if these iron parts could be manufactured domestically [*van Lieburg & Snelders, 1989 p76-77*]. Brunings is Director of the Nieuwkoop & Zevenhoven drainage, where two adjacent lakes, left after peat extraction, are to be reclaimed using windmills. At the same time (1797), Van Liender is a member of the commission for this drainage. The condition that an experiment should be with domestically manufactured iron parts, is apparently soon dropped. One of the mills (eventually the one designated as Windmill Nr.9) is to be equipped with an experimental B&W-made cast iron gear train. In [1797-07-17] Van Liender suggests, as a further refinement, cast iron roller bearings to reduce friction. This idea is apparently soon and quietly dropped, after negative advice of Watt jnr [1800-04-15], and the gear train is delivered with brass bearings. A lengthy discussion develops, with memorials from both sides, until in summer 1801 the parts arrive. From the shipping list [1801-05-16] it is clear that the bevel spur wheels for the wind and water shafts are iron with wooden teeth (not to be supplied by B&W), and that the wheel for the windshaft has projections cast on for fitting a (presumably wood) brake rim. The weight and price of the iron parts exceed expectations.

It may be noted at this stage, that Van Liender did often act in two capacities. Here he was a member of the government committee to manage the drainage and to decide on the means to be used and on the money to be spent. On the other hand, he was the sole agent of one of the manufacturers. For engines up to 1800 the patent conditions gave B&W a virtual monopoly, so serious conflict was unlikely to arise. For the cast iron parts for windmills the situation was different – B&W was for such cast iron work an important works, probably superior in workmanship and expertise, but certainly not the only choice available. The only occasion when Van Liender uses this argument explicitly is in [1799-08-16] where he complains of having not heard from B&W for a long time (10 months) and writes “... otherwise I shall be obliged (against my will) to address myself elsewhere”. If this is seen in the light of the run-up to the complex dockyard engine (see subsect. 1.11), it is a bit of an idle threat. For the parts for windmills, not covered by patents, the unexpectedly high price was the issue, and other foundries (German, French) might be considered, but the committee accepted the B&W arguments, and the matter of Van Liender’s independence or otherwise was, as far as may be seen, never raised.

A report c.1817 mentions iron machinery of English manufacture in one Nieuwkoop windmill, namely the top mill of a team of four at the Schoutenvaart [*de Moes, 1994*]. This is obviously the same mill. The top spur wheel (brake wheel) was reported at the time to have been replaced by a timber one, broken bits of the old iron one still lying in the loft. The brake wheel is reported to be in an unusual position: at the rear end of the windshaft. The Drainage Commission documents and the correspondence do mention the possibility/desirability of having the brake wheel in another than the customary front position. In a general way this is touched upon in [1799-05-18]. In [1799-10-28b] B&W appears to respond with proposals for relocating, probably to rear. The Director’s definitive memorandum (order, in fact) of 1800 agrees with this. In [1800-08-05], Watt jnr wonders if Van Liender and the Drainage Commission – of which by this time Van Liender is President – are aware that the proposed position will reverse the direction of rotation of the scoop wheel, unless appropriate measures are taken. According to [*de Moes, 1994*] such measures may have included an inverted (left-handed) sail arrangement. The mill is set to work c.July 1803, and performs to satisfaction [1803-09-06]. The use of iron did not catch on in Holland, however, except for the pollend (the windshaft head chock, holding the whips), and – to a lesser extent – the windshaft itself.

In 1872/73 the Nieuwkoop & Zevenhoven polders’ maintenance drainage was converted to steam, and the windmills were demolished.

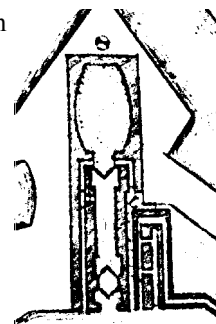
As a sideline, early in the correspondence, another windmill aspect crops up: in one of the new mills the brickwork of the base has suffered from frost, particularly the space in which the spur wheel on the watershaft turns, the *dry trough*. Van Liender proposes to fit a cast iron trough, probably as a lining in the masonry [1800-02-01; 1800-02-18; 1800-05-16; 1800-09-30]. This is made and it is a success, but again at disappointingly high cost, probably in part due to misunderstandings about the consequences (new patterns etc.) of specifying dimensions different from those customary in England.

The possibility of reclaiming the Nieuwkoop & Zevenhoven polder with steam power must have occurred to Van Liender. It is, however, not mentioned in any of the available documents. Maybe he soon realized that – after the immense problems with the Mijdrecht drainage – advocating steam power for this larger project might be a bridge too far.

1.11 Upgrading a naval dockyard – with help from the enemy

As the Maas river silted up in the 17th and 18th centuries, Hellevoetsluis – about 30 km SW of Rotterdam – became Rotterdam’s port for large vessels. The main naval base of the town was established here. In 1796 hydraulic engineer and supervisor Jan Blanken drew up plans to upgrade the base and dockyard [Blanken, 1798]. Shortly after, a commission was established to further develop and execute these plans. Van Liender was a member (as he proudly writes to Watt in [1797-05-12]), Blanken was appointed Director of the works.

The plans included a main basin, with a number of pairs of docks, of which one is shown in the sketch. The first dock was connected to the main basin via gates, with at its opposite end a second dock for larger vessels. Means would have to be provided to drain and refill either or both docks, and to raise their level above the main basin’s (this would e.g. allow heavily damaged and deep-drawing vessels to be raised before bringing them into the second dock). For this purpose, Blanken considered tidal mills – but he also hinted at the possible use of a steam pumping engine. This could also be used to drain the building site. The commission decided on steam, which meant that Van Liender would have to negotiate the buying of a B&W engine.



[Blanken, 1798]

B&W would thus be asked to supply strategic goods for a military naval establishment to a country with which England was at (mainly marine) war. A tricky and sensitive procedure, which may account for some unusual aspects. One was, that Van Liender (after his quite open letter [1797-05-12]) does not once mention the naval dock in the later correspondence. His first smokescreen is “plan to drain some low fenns & marshes” [1799-08-16]. In view of the sophisticated, flexible and powerful engine specified, this is unlikely to have fooled B&W. Neither is the later version “lake, head of water, bassin or reservoir or what you please to call it”, which is to be frequently emptied and filled in just a few hours [1800-08-19].

The familiar problem of varying lift returned here with a vengeance: the lift range would be high, changeover from one value to another would occur frequently, and would have to be quick and easy. In addition, Blanken considered that the engine would have to be “double power” (i.e. double-acting). Driving single-acting pumps would then pose additional problems. The resourceful Blanken devised an inherently simple (though complex-looking) and robust solution solving both problems. A full illustrated description of Blanken’s mechanism is given in [van der Pols & Verbruggen, 1996]. Van Liender was convinced of the scheme’s workability, but would like B&W’s opinion. He considered that this would best be achieved by Blanken and himself meeting a B&W representative in Hamburg, i.e. on neutral ground (two Dutch government officials visiting an enemy country, would be tempting fate). B&W appears to deliberately avoid this. Van Liender’s first proposal [1799-08-16] for a meeting in September or October ‘99 is politely turned down (cannot spare anyone right now). Almost a year later, Van Liender and Blanken travel to Hamburg without a prior appointment. With [1800-07-07] Van Liender sends B&W a sketch, and urges Watt Jnr. or Boulton Jnr. to come over, as a meeting will be more effective than correspondence. Watt Jnr. writes [1800-08-05a] that he is the only partner in the house, and cannot possibly leave. This does not prevent him a few days later to leave for some weeks, leaving his brother Gregory as caretaker [1800-08-09a].

Watt Jnr. wonders why Van Liender will not use the Mijdrecht changeover scheme [1800-08-05a] – apparently not realizing that this is totally unsuitable for frequent quick changeover. The Blanken scheme will cost at least £ 1000 more [1800-08-09a]. Watt Jnr. does consult his father [1800-08-09c].

B&W sends no further communications to Hamburg, and after about six weeks the two men return empty-handed [1800-08-19; 1800-09-09]. Van Liender writes in [1800-08-19] that expense is not an issue; would B&W please comment in writing?

Blanken’s idea, as briefly discussed above, is two-fold.

One mainstay is the driving of single-action pumps from a double-action engine. B&W goes along with this, and that issue is not further discussed in the correspondence. It involves a single triplet of pumps and chains and sheaves to link them. After some misunderstanding about units used, it is decided to use a 30³/₄" steam cylinder, one 30" central pump and 2x21" side pumps (English measure) for £ 1344 [1800-11-28]. This will raise 120 tuns of water per minute against an 18 ft head. Van Liender confirms this, and at BW&C's request sends a detailed drawing of the entire Blanken mechanism [1800-11-12].

The second mainstay is the mechanism to connect or disconnect pumps, to adapt capacity to the lift variations. This involves two additional triplets of pumps, plus additional levers, counterweights, and linkages. At first sight this looks very complex, but an engineer will quite easily see that it can be broken down into quite simple elements. B&W appears to steer clear of any discussion of this aspect.

They will not furnish the two additional pump triplets, which are thus to be added later [1800-09-30]. When Van Liender asks for comments [1801-02-24], BW&C's reply [1801-04-20] is uncharacteristically blunt: "we will not comment in any way as by letter of 30 Sept. 1800 it is understood that these parts are to be manufactured by yourselves". The referred letter [1800-09-30] does not stipulate anything of the sort, only postpones the additional six pumps. Moreover, in the past B&W always made a point of commenting extensively on customer-built items (buildings, timber structures & parts, etc.). This distancing is quite likely a ploy to preserve "plausible deniability" (to use a modern term) for BW&C.

The engine materials – without the pumps – are shipped 15 May 1801, the three primary pumps follow in September, their arrival is acknowledged on 3 November [1801-05-15; 1801-07-01; 1801-07-16; 1801-08-31; 1801-09-10; 1801-11-03]. The engine is erected by Duister, and in [1802-03-02] Van Liender reports that it has now successfully worked for some time. The additional six pumps are now in hand. They will for the time being be constructed in wood.

This is the last mention of the project in the correspondence, apart from some quibbling over details of the invoice, and letters covering payments. Various secondary sources [Huet, 1885 p70], [van der Pols, 1977 p191] indicate that the engine was a lasting success, and that the additional timber pumps were quite soon replaced by cast iron ones – probably furnished by BW&C. As it was part of a military establishment, no extensive reports on it were published in the open literature, as far as could be ascertained.

1.12 Draining a peat extraction project

The soil in the mid-western part of the Netherlands (roughly the province Holland) has thick layers of peat of varying quality. There were extensive extraction operations going on, mainly to satisfy the domestic and industrial fuel needs of the big towns. Such operations often left a deep hole in the ground, which after abandonment filled up with water. In the 18th century extraction was largely a matter of private enterprise. A consortium was formed, this would request a concession or license from the authorities, and would disband after completion of the project (or earlier, if results were disappointing).

East of Rotterdam lies a large and old polder, named Crimpenrewaerd or Krimpenerwaard. Around 1800 an enterprise was formed to extract peat from part of this polder. Their concession included the obligation to drain the area. A commission was formed (including Van Liender), which decided on steam power – mainly for reasons of cost. Director of the works was Ary Blanken, younger brother of Jan Blanken.

The polder discharges to the river IJssel, which at this point was (and is) still tidal, with a range of about 4 ft. The steam engine would draw water from an existing intermediate-level reservoir, which received the discharge of a number of windmills. The required lift varied between 3 and 7 ft, in tidal rhythm. The commission set the required capacity at 525 cu.ft. (Rhineland measure) or 100 tuns per minute. The engine was to be single-acting. Van Liender sent an inquiry to B&W [1802-10-12b].

The reply [1802-10-23] offered a single-pump arrangement with 31.5" steam and 48" pump cylinders, with the rather short stroke of 2.5' (30", i.e. a "square" engine). The price for the metal materials would be £ 960, delivery to Hull in 9-10 months. An important reason for the short stroke was, that this would reduce the foundation depth, hopefully avoiding problems of the Mijdrecht sort. The rated capacity would be attained at 7 ft lift and 20 strokes per minute. The minimum lift of 3 ft was to be accommodated by setting the entire pump below the lowest level. The discharge launder or floor would have side walls of about 5 ft high, and would thus accommodate the highest level. No mechanical changeovers for lift will then be needed.

Van Liender was not fully satisfied, by now he was convinced of the advantages of multiple-pump systems along the lines of Hellevoetsluis (1802-11-02). BW&C tried to convince him with three arguments (1802-11-11), to which Van Liender did not respond. Comments below are the author's.

(1) Multiple pumps would produce a consistently high load on the engine, thus increasing steam consumption and wasting fuel. BW&C might have added, that even a simple and quick pump changeover would, if needed four times a day, become quite a burden. Van Liender might have countered: the high engine load is used to advantage, through increased capacity. For 7 ft lift the engine load can be calculated to be 7.2 psi, a normal conservative value for a Watt engine. For the same pump the load at 3 ft lift will be only 3 psi, a low value

which might give rise to overstroking if not controlled by e.g. wasteful throttling.

(2) Multiple pumps produce more friction.

(3) They will need more complex machinery. After the success of Jan Blanken's nine-pump Hellevoetsluis arrangement, Van Liender would not be impressed by these two (albeit true) observations.

The order is given for the engine as proposed by BW&C [1802-12-17; 1802-12-31; 1803-01-05], but Van Liender plans a "roomy" discharge platform (Dutch: stortvloer) which will allow additional pumps and machinery at a later date. Subsequently there is very little discussion of details of the house (which will fully enclose the engine) or of the engine [1803-01-31; 1803-03-21; 1803-03-29; 1804-04-14]. The engine materials are shipped early 1804 via Hull and neutral Embden [1804-01-06, 1804-04-14, 1805-03-25a], and received in May. War has been resumed, but no export or import problems are mentioned in the correspondence.

Communications appear difficult, though [1805-03-25a].

Duister erected the engine, and ran the first trials in November 1804 [Blanken, 1806]. The weight distribution (always an important matter for Newcomen and Watt engines) needed considerable attention. From [Blanken, 1806] it appears that eventually the pump end of the beam had to be weighted with about 1400 lbs.

Ary Blanken wrote an essay about the engine, particularly about the trials run to measure its performance and convince the public. This was published by the Batavian Society [Blanken, 1806].

There is no evidence of any attempts to improve the pump arrangement after Van Liender's ideas. That may be in part, because the project was not very successful [Simons & Greve, 1844 p131]. No specifics are provided, but a plausible cause would be disappointing peat quality through high clay content. Some also appear to have considered the engine's capacity insufficient [Huet, 1885 p64-65]. Huet thinks, moreover, that the lift pump may have been troublesome, but his admiration for Simons and Lipkens (who later improved pumps) possibly made him somewhat biased.

At any rate, the pumping station was not used after 1813; the derelict remains were cleared in 1832 [Simons & Greve, 1844 p131].

1.13 Filling a drainage channel section

The hydraulic drainage province (Dutch: hoogheemraadschap, see Glossary) of Rijnland had during several periods of its long history used the old mouth of the Rhine river at Katwijk, as a channel to discharge the water of its many polders to the North Sea. This discharge was by gravity and controlled by sluices. In the early years of the 19th century Rijnland started a major upgrading project, cutting a large channel with new sluices.

Cutting the channel immediately created a problem for the higher agricultural ground along it. The soil dried out, so irrigation would have to be supplied. The farmers petitioned for a small windmill for this purpose, but Rijnland decided that a steam pump would be a better solution [t Hart & Riemens, 1968 p10-15].

Silting up of the channel was another major problem. It was to be prevented by regular scouring, i.e. by penning the water in the channel, and then at low tide opening the sluices. Filling the channel with sea water for this purpose, was to be avoided, as this might raise the salinity of the surrounding land. Rijnland looked for means to raise the level in the final stretch of the channel, by filling with fresh water. The planned steam pump would also take care of this.

Van Liender was approached as BW&C's agent, and he sent an inquiry for an pumping engine to raise 150 tuns of water per minute against a 7.5 ft head, 1.6 times the power of the Krimpenerwaard engine [1806-07-07].

BW&C's offer [1806-08-09] is unreadable. The Rijnland Directors, considering the expense, would settle for a Krimpenerwaard-size engine, but they were overruled by the General Assembly, and Van Liender ordered the engine as offered. BW&C, for good measure, argued, that the engine at £ 1550 would in effect be cheaper per unit of power than the Krimpenerwaard engine, which would now cost £ 1080. While this is strictly true, the difference is marginal.

The making of the engine suffered some delays (among these an interruption of the work, when BW&C is worried that the import license will be a problem, [1807-04-18]). The license turned out to be no problem, but the delays made chartering a suitable vessel difficult. Apparently the import license specified both the vessel and its master. Eventually the materials were shipped [1807-07-16; 1807-07-30, not found in the AoS] and received at Katwijk [1807-08-29]. Duister erected the engine, but had to divide his time between this engine – which is difficult to reach, especially in winter – and the De Heus engine in Amsterdam [1808-01-18; 1808-05-31]. Moreover, Duister appears to be stubborn and troublesome. It is not until late 1808 that Van Liender reports the engine to have been started up successfully [1808-11-01].

Notwithstanding the engine performing as specified, the pumping project was a total failure. It had been anticipated, that filling the canal to the required level for scouring, would take several days [t Hart & Riemens, 1968 p15], but there was an undesirable side effect. During this period normal gravity discharge via the channel was not possible. After one or two attempts this was given up, and sea water was from then on used. It is not clear if soil salinizing was less than expected, or if it was put up with. The sluice operators soon devised a way to slow down silting-up: at high tide they opened paddles (small sliding gates), situated in the upper part of the

main gates to ensure that the flood water entering would be reasonably clear of sand and silt. At low tide, scouring was then done as normal.

The other purpose, irrigating the high ground, suffered from the large capacity of the engine: the fast flow damaged ditches etc.

In fact, the engine was redundant almost from the start. It was not until 1836, however, that this hard-to-swallow fact was recognized. The farmers got their little windmill, and the steam engine was used by a salt works for pumping sea water or brine [*Keikes, 1978*] until 1854, when it was broken up.

1.14 A copper plate rolling mill

In 1803 Van Liender inquired, on behalf of a Mr. Hendrik de Heus, after a 4 horse engine, similar to the one in Rotterdam [*1803-4-14*]. At the time, De Heus made copper buttons, coin blanks etc. for which he rolled copper plate [*Meijer, 1990*]. The wording of the inquiry suggests that BW&C had referred a direct inquiry to their sole agent Van Liender. BW&C offered the engine for £ 370, delivery in 10-12 months from order [*1803-04-21*]. No order was given, but over the next four years the inquiry is repeated a couple of times [*1804-04-27; 1807-03-19a*], reflecting the uncertain times. During this period, De Heus appears to have established a new mill to roll heavier copper plate for ships' anti-fouling cladding, for which mill he now required a 12 or 14 horse engine. The latter was ordered, for £ 897, delivery in 3-4 months from order [*1807-05-19*]. De Heus could see no problems with the import license. When the engine was reported as ready for shipping (implied in [*1807-08-29*]), he applied for a license on 16 September 1807. Unexpectedly, this was refused – enforcement of the blockade had apparently been tightened [*Meijer, 1990*].

It has been assumed by some [*e.g. Meijer, 1990*], that the engine was then smuggled into Holland. The correspondence tells a different, quite complex, and dramatic story. Van Liender chartered a “neutral” vessel via a Rotterdam agent (an originally Dutch ship, now registered at the German port of Papenburg) [*1807-08-29; 1807-09-03*], for what he considered a reasonable sum, and instructed her Master to sail from Hull only after receiving notice that an import license had been granted. When the license turned out to be difficult, Van Liender asked BW&C to keep the engine at Soho until this has been resolved and a safe crossing arranged [*1807-11-25*]. That letter probably did not arrive at Soho until late January 1808, however. By then, the engine had already been shipped to Hull, and the agent there apparently acted without consulting anyone. He made his own arrangements with the Captain (at three times the price Van Liender had contracted for!), added a cargo of coals for his own account – and for a trifling additional freight – and sent the ship on its way (probably early December) without insuring the cargo. As luck would have it, the ship suffered heavy damage and required assistance to bring it to Terschelling (the island, not the Mijdrecht site). The cargo was confiscated. Van Liender eventually managed to convince the authorities that he had not tried to run the blockade. He obtained permission to bring the ship to Amsterdam, but he still could not get at the cargo. All this resulted in an angry letter [*1807-12-22*], wherein Van Liender blames the agent for all problems. Eventually Van Liender turned to his friends at the Court, and King Louis-Napoleon – overruling the Ministry – released the engine [*1808-01-07*] – but not the coals (as Van Liender notes with some glee on 1808-01-18). The engine had thus been brought over, but it had suffered some damage, and the additional cost had risen out of all proportion. Duister erected the engine – which was largely pre-assembled, and thus should be a relatively straightforward job. However, [*1808-05-31*] reports him still busy; probably the engine was started up shortly after. With [*1809-05-04*] Van Liender reports that the engine works well, but that its power – while fully the rated value – falls a bit short of what the mill actually requires and has had to be supplemented by a “wheel” (in Amsterdam a waterwheel seems unlikely, would this be a horse gin?). There's a lesson here: better specify ample power to begin with. In 1816 BW&C supplied a 23¾” replacement cylinder, increasing the rated power to 18 hp [*drawing in the AoS, Pf.395*].

1.15 An enigma

[*Hills, 1970 p217*] quotes from a c.August/September 1788 letter of Watt to a prospective customer: “We have lately made an engine of the power of 24½ good strong horses for a Dutch Distiller (since a bankrupt) which is now in London”. Of this engine, nothing is found in the correspondence, which is most peculiar. With the Batavian Society the Holland patentee, a direct contract between Watt and a customer in Holland appears irregular, and also quite out-of-keeping with the amicable relationship Van Liender-Watt that is developing. One speculation might be, that Van Liender contracted for the engine while in England, and without documents landing in the correspondence archives. Any correspondence of Van Liender or Watt with the (unnamed) distiller would either be lost, or rest undiscovered in the AoS. A rated power of such a precise number as 24½ seems strange, and a power of about 25 hp would be quite high for an industrial engine at that time (the later Boon engine is just 4 hp). Could this actually have been the cylinder size in inches?

1.16 Dead ends

In most or all cases where the use of steam power might be contemplated, steam was not the inevitable choice. Animal power, water power, and above all wind power were feasible and mature technologies. Steam might be considered if it had tangible advantages.

For **drainage**, cost was often an important factor. A steam engine could do the work of a number of windmills. It would often be cheaper to build than those windmills put together, and the total number of people employed in running a steam engine would be less than the number of millers needed to run the windmills. The “power on demand” provided by a steam engine is often contrasted with the unreliability of the wind. This may occasionally be a factor (e.g. town canal flushing), but in most cases it is taken care of by the above estimate of how many windmills the steam engine will replace. There is another and important reliability aspect: the polder drained is inhabited by people. Their security is important. Dependence on a single (or a very few) steam engines might put those people at risk if e.g. the steam engine would need a long repair period. Drainage committees would first decide if a drainage project is needed, and then, in some but not all cases, consider the cost and reliability aspects of e.g. steam and wind alternatives. Once that decision had been taken and the budget fixed, the further road was quite straight, and only extraordinary circumstances could stop or divert the project. A steam engine would have to be procured from BW&C, until 1800 for patent reasons, and for some time after that for reasons of expertise.

For **industrial power** the situation is slightly different. Animal and water power may come into play as alternatives, and also considerations such as Mr Boon’s (subject. 1.9): if machinery is operated only for short periods, a stable of horses may have to be kept on all year, whereas a steam engine can simply be shut down for extended periods at virtually no cost. In industry, operating in a volatile market, the “best” solution may change at short notice. Thus an engine project may be started, put on the back burner, revived, and maybe eventually abandoned.

The few such “dead ends” found in the correspondence, are all for industrial engines.

One prospective customer is Van Liender himself, who is probably toying with the idea of upgrading his white-lead manufactory [1790-08-30; 1790-09-23]. This is not followed up, one may suspect that he was put off by the volatile political situation.

In 1794 an inquiry was made for steam-powering a tilt hammer. The inquiry itself, probably a letter dated 1794-04-18 has not been found. In Watt’s response [1794-05-07] the whereabouts of the works is not mentioned, nor is the existing power source (waterwheel?). There would seem to be a connection with a glass works, using the waste heat of which was apparently contemplated.

In 1803 an existing wind-powered fulling mill in Leiden briefly considered switching to steam [1803-05-17; 1803-05-23].

1.17 Aftermath

The correspondence ends on 20 May 1809, about seven months before Van Liender’s death. No documentary evidence has been found, that his death was notified to BW&C, nor of the appointment of a successor.

In [Bacon Motto, p35] its author asserts that Van Liender appointed the Leiden textile manufacturer Jan Van Heukelom jnr as such, basing himself on [van der Pols, 1979 p193]. Van der Pols is less certain about this, he writes that Van Liender “apparently” had appointed Van Heukelom. He does not mention a source.

Van Heukelom figures once in the correspondence: with BW&C: Van Liender introduces him to the Soho company with [1805-03-25a+b], without however indicating him as e.g. a successor. At any rate, very little transpires of his activities, if any. Van der Pols adds that in 1815 he was given a “crash course” in steam technology at the Soho Foundry, again without a source reference.

Between 1807 and 1816 there is no evidence of engines for Holland being supplied by BW&C [Tann & Breckin, 1978]. In 1816 two 10 hp engines are mentioned in the AoS, both sold via “Heukoln”, clearly a corruption of Heukelom. The first is for the cotton spinner Scheibler (about whom nothing further transpires), the second is for Van Heukelom’s own cotton spinning mill.

According to [van der Pols, 1979 p193] BW&C dispenses with Van Heukelom’s services in 1816, and in future deals with Dutch customers either directly or through the London firm of Barings Bros.

By the time he died, Van Liender would seem to have become a relic of the pioneering days of business through personal relationships. In future such relationships would no longer play a significant role. The steam engine was starting on its long way to becoming a power source of choice, which could be ordered from an increasing variety of manufacturers.

1.18 Personal touches

Virtually all letters are in some way connected with specific engine projects. Many letters also contain remarks of a more or less personal character (admittedly a somewhat vague category). Letters [1779-05-14; 1787-11-15] are rare examples of entirely personal content.

Van Liender was an enthusiastic follower of scientific and engineering innovation. He was aware of the business aspects of engineering, but those were not the primary source of his keen interest. He would often assume others to share this attitude. When he reports on seeing the Watt invention(s) applied in, say, Germany or France, the tone of such reports is often an enthusiasm he apparently expected Watt to share, while the latter would probably grunt “piracy” and gnash his teeth [e.g. 1786-11-17; 1790-08-30; 1800-08-19; 1800-09-09]. On the other hand, he is supportive of B&W’s attempts to enforce their patents, even if only by making approving noises from the sidelines. Watt kept him informed in general terms [1792-08-24; 1792-12-31; 1793-08-01; 1793-08-08; 1794-01-09; 1794-01-23; 1794-04-05; 1794-05-07].

Van Liender had outspoken political views. He regarded the Stadholder and his oligarchy as oppressors. The English government – which, like the Prussians, supports the Stadholder regime – comes in for its share of vituperous criticism – which he apparently expected every sensible man, including Watt, to endorse. On the other hand he looked approvingly at developments in France, with an obvious blind spot for the excesses of Robespierre c.s. He regards the advancing French troops as liberators. Watt, if he responds at all, is fairly mild and conciliatory, except on one occasion [1790-10-29]; he has his own dislikes for the London administration, but his main concern in such cases is, whether or not certain policies are good or bad for business. He opposes war on general principle. [1788-02-12; 1790-07-26; 1790-09-23; 1790-11-04; 1790-11-16; 1791-01-13; 1791-04-14; 1791-07-10; 1792-11-13; 1792-12-03; 1792-12-11; 1793-10-21; 1794-07-31; 1794-09-23; 1794-10-02].

The Birmingham Riots of 1791 on B&W’s doorstep might easily have led to political notes, but this is hardly the case. They are mentioned, but more like a damaging natural disaster than as a politically significant phenomenon. The disturbances will however tend to frustrate the work of “moderates” in achieving government reform [1791-08-25; 1791-08-28; 1791-09-17].

When, after the 1787 Restoration, Van Liender felt no longer at ease in Holland, he considered emigrating to England, and he asked Watt for details on the cost of living [1787-10-09; 1787-11-15]. At a later stage he asked Watt to book accommodation for himself and his sister for an initial period. He had not yet moved from London to Birmingham, when news of Hoogendijk’s death reached him and he had to return to Holland to help settling the latter’s affairs [1788-02-12; 1788-05-29; 1788-07-09].

Watt does on various occasions complain about his health, particularly about headaches. Van Liender invites him to come to Holland and relax, but this is not taken up because of business pressures [1786-03-27; 1786-07-03; 1786-07-03; 1786-07-26; 1786-08-04; 1786-09-28; 1790-10-29; 1797-06-14; 1797-07-14]. Van Liender reports more summarily about his own (unspecified) health problems [1788-04-05; 1806-10-08]. The theme recurs in 1793, when Van Liender temporarily moves to the country home “ZorgVrij” (= CareFree). Watt – who at this time is confronted with his daughter Jessy’s consumption – obviously understands this meaning and complains (half seriously) that if a real ZorgVrij existed he would not hesitate to fly to it [1793-08-01; 1793-08-08].

Van Liender occasionally used the Watt connection to inquire (for himself or on behalf of others) after various articles which might be procured from England. Sometimes this was followed up by a request to buy or provide such articles. Examples are pencils, coal tar, a ship’s galley range, a lead melting pot, a goldbeaters’ mould, a copy press. On the other hand, he buys French wine for Watt [1790-09-23; 1791-01-13; 1799-05-18; 1801-02-24; 1801-04-20; 1801-08-29; 1801-08-31; 1801-10-13; 1801-12-12; 1802-02-05]. When Boulton wants to warn the business world about suspect dealings involving the East India Company (his letter with the details has not been found), Van Liender helps by inserting notices in several Dutch papers [1802-03-04].

When Watt fully retired and, after letter [1799-10-23a], withdrew from direct correspondence with Van Liender, personal remarks in the letters became rare. James Watt Jnr. enlisted his help in tracking down Watt Snr. and Gregory Watt travelling on the Continent [1802-09-16; 1802-10-12a], and Van Liender allowed himself one last snide remark about the “perverse” English Government which will be the ruin of England [1807-11-25].

1.19 Closing remarks on Van Liender and his role

Which forces did result in the introduction of steam power in the Netherlands? There was no generally felt need for a new power source: wind power, a mature and long-term reliable technology, was considered by most to be adequate at the time, though it admittedly had its limitations — particularly as far as regards short-term reliability and constancy of speed/power. Some individuals saw what happened elsewhere (mainly in Britain). Hoogendijk did indeed have a problem with wind power, but even though that was a problem which most citizens and officials could readily smell, Hoogendijk's proposals for looking at steam power as an alternative, were only reluctantly and half-heartedly followed. Waltman's brief, critical and incompetent 1757 report appears to have been used as an excuse to drop the matter completely. Similarly in Amsterdam, where the self-promoting Blakey was given the opportunity to prove his device. At the first hint of failure the matter was dropped – we do not hear of the new power source for a long time. Jan Hope's efforts to demonstrate the feasibility and advantages of steam pumping died with him in 1784. For the Mijdrecht drainage, a rather superficial political protest by a group of citizens in 1798 appears to have put a stop to the already advanced plans to re-erect the Blijdorp engine there.

It would appear to have been initially the bee in Hoogendijk's bonnet which kept the matter alive, his decision to create an institutional framework (the Batavian Society) – and his finding in Van Liender a younger ally who shared his independence, enthusiasm and drive – which made achieving continuity more likely.

To assess Van Liender's role, a number of “what if” questions might be put. Like with most such questions, any answers can only be largely or purely speculative.

(1) What if Van Liender had not appeared on the scene? Would, after the 1776 Rotterdam engine problems, someone else have persevered like Van Liender did? Names like Bicker, Blanken, Brouwer (and maybe Hope), and Rossijn come to mind, but it is difficult to imagine any of these as long-term torch-carriers.

(2) What if the Mijdrecht project had foundered, either through insurmountable foundation problems (as it nearly did), or through the States' “solution” in letting another group have a go? Van Liender's perseverance in the face of technical, political and other adversity appears to have been a crucial factor here.

(3) In both the above cases, the efforts to introduce steam power might well have remained fruitless; would such a delay in the general acceptance of steam have been detrimental to the economy of the Low Countries? Probably not. Wind and water power remained dominant and adequate for a long time. In the 1840s there still was a serious debate about the use of wind or steam power for the immense Haarlemmermeer drainage – viz. [Simons & Greve, 1844] and the Haarlemmermeer commission discussions [van der Pols & Verbruggen, 1996]. That debate resulted in the use of steam power, but this outcome was not a foregone conclusion. In her Introduction to the 1981 reprint of [Dickinson & Jenkins, 1927] Tann refers to a suggestion in [Tunzelmann, 1978] that “without the Watt engine, the British economy would have been held back but one month”. Lintsen argues that the general adoption of steam power in the Netherlands did not occur until the second half of the 19th century [Lintsen, 1995]. It seems unlikely that the rise of steam power at that time would have felt a significant influence from the success or failure of Van Liender's pioneering efforts almost a century earlier.

What manner of man was Van Liender? Obviously a man with a thirst for knowledge, and a practical science-conscious mind, with a wide range of interests. He would appear to have had a self-assured (but probably not arrogant) manner. If he was proven wrong, he did not mind admitting it. He displays a (sometimes naive) straightforwardness, coupled with a broad sense of justice – but with evidence of some blind spots, both political and technological. He must have had considerable social skills to move in widely differing circles. He got on well with the ruling establishment (e.g. the Pensionary of Delft [1785-10-04], the court of Louis Napoleon [1808-01-07]), but also with high-level engineers such as Jan Blanken (reputedly a difficult man), James Watt and Matthew Boulton, with academic people (Rossijn, Camper, etc.), and with workmen (e.g. Hornblower, Logan, Smallman, and the difficult Duister).

Van Liender's role was much strengthened by the fact that he did at an early time recognize Watt as an important force, and that he thus allied himself with what would pretty soon become the dominant driving force in the spreading of steam power: the B&W partnership. From shortly after 1775 until his death in 1809, van Liender was “Watt's Dutch Connection”, and the esteem in which he was held in Birmingham is illustrated by the fact that he was the only one of B&W's foreign business relations, who did not need a London guarantor in his dealings with the firm [Tann & Breckin, 1978 p553].

2. Life chronology: Jan Daniël Huichelbos van Liender

To the Author's knowledge, no biography of HvL exists, therefore any and all possibly relevant details found in any source have been included here.

Important sources of data were [Engelbrecht,1973] and [Akten], these have been supplemented with data from a wide variety of sources. The nature of these sources inevitably caused a certain bias towards money matters and public life. Attempts to turn this list of facts into a biographical narrative, would either retain this bias, or involve quite a lot of speculation and otherwise creative approaches. Such attempts have therefore not been made.

- c.1725 (but not later than 1728) Pieter van Liender (1697-1776) moved from Utrecht to Rotterdam to establish himself as a merchant there. He rented premises in the Vischsteeg (close to the Oude Haven or Old Port) for *f*700 per annum. The lease is mentioned in 1735 [Akten 2763/154]. Owner is, until 1725, Jan Huichelbos (?-1768) — an older merchant. The two men apparently embarked on some common enterprise, not entirely to Jan H.'s satisfaction, as on 1730-09-06 Jan H. sent a notary to demand accounts from Pieter [Akten 2113/389].
- 1731-08-19 Pieter marries Janetta Susanna Huichelbos (1710-1738).
- 1732-?-? Jan Daniël HvL born in Rotterdam (baptized 1732-12-11, Dutch Reformed Church, register does not specify actual birth date). Son later combines his parents' surnames. Two brothers, born 1734 and 1737, do not survive infancy. HvL's mother dies in 1738, aged 28.
- 1739-05-05 Pieter — now living on the Wijnstraat — remarries, to Ida van Hussen (?-1780), who lives on the Geldersekaade. 1740 daughter Petronella Cornelia born, but does not survive. The baptism register entry for this daughter states the family to live on the Geldersekaade; this may indicate that Pieter rented these premises, before buying them in 1758. It is not clear if this is the same house where Ida lived before she married.
- 1742-07 PvL incurs a debt to J.v.Aken concerning a white-lead manufactory, which debt is mentioned in 1746 in the inventory of v.Aken's estate [Akten 2828/266]. This must be the mill near the East Gate (Oostpoort) sold off by daughter Petronella in 1810. The manufactory is occasionally mentioned in the correspondence.
- 1743 Second daughter born, again named Petronella Cornelia (1743-1821).
- 1751-05 HvL is mentioned as a student in Utrecht [Akten 2779/387]. However, the comprehensive student register "Album Studiosorum 1636-1886" does not mention him at all. One possible explanation is, that maybe the Album lists only students who graduated, and that maybe HvL did not.
- 1758-04-24 Pieter buys premises (house with rear annexe, warehouse and grounds) on the Geldersekaade near the Koningssteeg, on the Oude Haven (Old Port), Proth.Reg.nr.4011B, which he rented before, and where he and HvL continue to live and trade for the rest of their lives. Sister Petronella lives with them. Around this time the style "P.van Liender & Zoon" appears. In 1810 the house is designated "Wijk B nr.59/60"; it does not survive.
- 1761-09-15 HvL makes a will, appointing his father Pieter sole heir, with bequests to sister and cousins; for the purpose of the stamp duty, he declares that his assets are worth less than *f*50,000 [Akten 2977/377].
- Steven Hoogendijk knows HvL's father (who is one of the executors appointed in Hoogendijk's 1768 will), so he probably met young HvL through him.
- c.1769 First attempts at contact with England (Watt, via Enslie) about steam power for drainage.
- 1772-10 With eleven others, acquires a "kolP" court (a ball game) in Kool, just outside Rotterdam; this is sold off in 1795 [Akten 3105/564, 3392/719, 3575/306, 3575/550]
- 1775-01 Wilkinson's New Willey foundry ships the cylinder for the Rotterdam engine via Chester.
- 1775 Consulting Member of the Batavian Society.
- 1776 Visits Wilkinson's New Willey foundry in England (probably in spring/early summer, letter 1786-05-31) where he sees the blowing engine; probably picks up the just-published pamphlet by N.D. Falck, immediately translates and critically annotates it. This is published in the same year [Falck,1776] (translator anonymous, but unmistakable, and revealed in [Bicker,1800]). HvL's foreword is dated 1776-08-05. The translation has the following in a HvL footnote on p18.
- Steam engines, built to Mr Watt's design, are now desired everywhere. I have erected one in Willy, which fully answers expectations.*
- The second sentence would seem to be a bit of an exaggeration — Wilkinson may have given HvL a bit of hands-on experience by letting him assist with either the blowing engine or the rebuilt/converted pumping engine (see the JW chronology section).

- 1776-10-22 Pieter van Liender dies, aged c.79, buried in Utrecht [*deaths register Rotterdam*].
- 1777-09-29 HvL is appointed Executor of Hoogendijk's will [*Havinga, 1969-08-02*].
- 1779 Journey to Paris [*1786-11-17*]. In [*1793-08-08*] HvL mentions a past period of serious indisposition, which can be roughly put in the late 1770s, and which led him to take a substantial holiday abroad, which became an annual tradition for health's sake. This journey to Paris may be that first holiday.
- 1780-04-13 After their father's death, HvL and his sister both make testaments appointing the other sole heir. HvL appoints his friend Sampson Coysgarne Lloyd as executor [*Akten 3008/475,476*].
- 1780 Journey to England [*Brieven 185*]. Expresses interest in shares in a mining adventure; this might well be the Halbeath colliery mentioned under date 1784-12-18 below.
- 1783 Journey to S of France.
- 1784-04-26 HvL and six others enter into a partnership for the trade in old iron and ropework [*Akten 3164/1402*]. R.Hills thinks the old rope trade may principally serve the paper industry.
- 1784-09-28 HvL and 31 other victims of the 8 March 1783 riots (see General Dateline section) file a notarial account of what happened to them [*Akten 3459/793*]. Why they did this, and why at this late date, remains unclear.
- 1784-12-18 HvL owns ¼ part of the "Halbeath" colliery near "Innerkithing" in Scotland, i.e. Halbeath near Inverkeithing in present-day terms. Other owners are J.J.Elsevier (¼), the heirs of N.des Amories (2x¼), and S.Coysgarne Lloyd and C.Lloyd jnr. (⅛ each). Ownership then goes back at least c.3 years. All reside in Rdam, including the two Lloyds who are British subjects. The others mandate them to sell or lease out the colliery [*Akten 3166/1174*]. This fits in with the following information, kindly provided by mr Alan Brotchie, Scottish engineering historian. In Scotland, only the Lloyds were known as owners, having acquired the colliery in Feb 1779 for £800. Subsequent large expenditure included a waggonway to Inverkeithing, but disappointing returns caused the Lloyds to put up the colliery for roup (Scottish auction) in Oct 1784. Nobody was prepared to pay the £5000 asked for, eventually the colliery was sold in May 1786 for £1800.
- 1785-09/10 5 weeks' journey to Liege, Luxembourg, Lorraine, Bar, Champagne, Paris, Brussels.
- 1785-12-29 Steven Hoogendijk makes a new will (as it will turn out, his final one), appointing HvL and Directors S.de Monchy and P.Hartog of the Batavian Society as executors [*Akten 3304/1186*].
- 1786-01-02 Steven Hoogendijk appoints S.de Monchy, P.Hartog (Directors of the Batavian Society), and HvL as executors for his possessions and interests in France and England [*Akten 3015/4, 17*].
- 1786-01-24 HvL and his sister appoint Paris bankers vdYver as proxies for their possessions and securities in France [*Akten 3015/32*].
- c.1786-04 Upon death of Dr Nozeman (President Director of the Batavian Society), HvL becomes a Director of that Society.
- 1786-08/09 5 weeks' journey to Hamburg, Hanover, Göttingen, Frankfurt, Köln, etc.
- 1787 Member of the Rotterdam Corporation, same year several positions within Corporation: Flagbearer, Bean Lord, Commissioner for Industry, Commissioner for the Exchange Bank, Commissioner for the Town Districts [*Engelbrecht 1973*]. After the Restoration of the Orangists in September, many Patriots feel no longer safe. HvL starts planning to move/flee to England [*1787-11-02; 1787-11-15; 1788-02-12*]; in connection with this, he mentions amongst his possessions to be left in care in Rotterdam, not only a house and merchandise, but also a manufacture — obviously the white-lead mill.
- 1787-11 Early November a Dr.Stokes seeks lodgings for HvL in Kidderminster and Shrewsbury [*AoS ref. MS 3219/4/101, 2 Nov 1787, via R.Hills*]. HvL and 5 others sell their share in the old iron & rope trade comp.(established 1784-04-26) to the remaining partner R.Twiss [*Akten 3572/663*].
- 1788-04-11 Apparently in preparation for his leaving the country, HvL mandates Pieter Lagendaal, merchant in Rdam, as minder for all aspects of his business during his absence or indisposition [*Akten 3475/719*]. On 1790-12-30 Lagendaal in turn similarly mandates merchant Pieter Stolker on behalf of HvL [*Akten 3480/1152*].
- 1788-05-15 Steven Hoogendijk empowers HvL and notary vdLoeff to manage all his affairs and to act for him [*Akten 3177/317*]. Hoogendijk's signature is a barely readable and uncontrolled scrawl, indicating serious disability (Parkinson?).
- 1788-05-25 Arrives in London, via Brussels, with his sister, and a friend (cousin?) and his two daughters, intending to stay in England for some time, maybe for good [*1788-05-29*]. On 28 May they visit "ye mill" (Albion Mills) accompanied by MB (who writes this to JW, see [*Tann, 1981*], [*1788-05-29*])
- 1788-07 Returns to Holland to attend to affairs of Steven Hoogendijk, who had died 1788-07-03. On 1788-08-09 the executors produce an inventory of the estate [*Akten 3307/937*]; it may be noted that the Rdam and Blijdorp engines, funded by Hoogendijk, are listed among his assets. 1788-09-16

- Declaration concerning death duties [*Akten 3307/1256*], 1788-11-26 A property sold off [*Akten 3307/1406*], several mandates for financial dealings, 1788-12-29, 1789-05-03 two persons mandated for remaining executory tasks [*3307/1500, 308/288*], 1789-05-11 HvL mandates his co-executors to act for him as he will shortly be going abroad [*Akten 3477/1076*], on 1789-05-15 the executors mandate Paris bankers vdYver for French possessions, 1789-09-02 Final account by the executors, HvL is again abroad by then [*Akten 3308/1071*].
- 1789-04-22 HvL dismisses S.Coysgarne Lloyd as executor of his will, appoints Pieter Lagendaal (who already has a general mandate, see 1788-04-11) and Herman Forsten [*Akten 3477/845*].
- 1789, probably Aug or Sep. HvL leaves the country again; this is the start of a 9 months' stay in Birmingham, fondly remembered in [*1791-01-13, 1797-07-17*]. JW introduces him to the Lunar Society.
- c.1790-06 HvL moves to Paris, continues correspondence with Watt, and with people in Holland, about projects.
- 1790-08-30 HvL inquires about a small engine for own use, presumably for his white-lead manufactory. Such an engine might be used for grinding the white lead, possibly also for rolling sheets of lead (to separate the brittle white lead). Steam might also be used to heat the lead/vinegar corrosion process (to replace the customary horse manure heating).
- 1790-12-30 P.Lagendaal (see date 1788-04-11 above) mandates P.Stolker, with all the powers given to him by HvL [*Akten 3480/1152*].
- 1791-04-08 HvL moves to Versailles [*1791-04-16*], continues correspondence with Watt, and with people in Holland, about projects.
- 1791-05 Jan Jacob Elsevier visits HvL and his sister in Versailles, staying five weeks. Together they make an eleven day trip to Nantes, including the counties La Perche, Le Maine, L'Anjou, La Bretagne, Le Touraine, La Beauce, and the towns Chartres, Le Mans, Angers, Nantes, Tours, Blois, Orleans
- 1791-09 HvL returns to Rotterdam.
- 1792 Hollandsche Maatschappij der Wetenschappen (Dutch Society of Sciences, Haarlem) awards a silver medal to HvL's essay on some problems with scoopwheels (essay competition Nr.64, set in 1790; set of three essays appeared in print 1793. HvL's entry advocates triple scoopwheels in a single windmill, individually connectable, to obtain a wide capacity range, at the expense of a rather complex mechanism) [*vLiender, 1793*].
- 1793-06-01 HvL and his sister move to a small country house *ZorgVrij* on the W bank of the Amstel river in Thamen, just N of the Uythoorn. The house has been rented for two years [*1793-06-13*]. HvL will supervise the erection of the Mydrecht engine, which is being built on the opposite bank of the river, in the grounds of country house Ter Schelling. In preparation for the coming over of B&W's erector James Smallman, HvL will closely supervise initial work. HvL will occasionally return to Rotterdam, his sister prefers to stay the winter in Rotterdam. JWj visits him in Thamen, see notes with [*1793-12-13a*].
- 1794-01-20 HvL has £47580 worth of French and Canadian bonds of various sorts, total annual interest £1342 [*Akten 3351/134*].
- 1795-01 After the "Velvet Revolution" HvL is elected to the Assembly of Provisional Representatives of the Province Holland of the Batavian Republic. He moves to The Hague, and serves on the Assembly's Finance Committee [*1797-05-12*] and as Treasurer. He is also a member of the Provisional Council for Rotterdam, where he is Commissioner for Industry, and later Member of the Municipal Council, again as Commissioner for Industry and Commissioner for the Districts.
- 1795-04-22 HvL, Corn.Lloyd, R.Twiss, J.Gerritsen form a new partnership for the trade in old iron & ropework, Gerritsen will manage, others put up capital of f 60,000; partnership will end 1800-12, unless prolonged [*Akten 3192/577*]. On 1795-05-15 the partners acquire premises (2 adjacent houses) on the Leuvehaven, Rdam [*Akten 3352/537*]. On 1801-02-04 these are sold ; it appears that Gerritsen is infirm and that the business is wound up [*Akten 3198/31, /751*]. A year later the proceeds are divided; widow Gerritsen has no claim and remains penniless (her husband had not invested any capital); the investing partners grant her a f 75 annuity for humanitarian reasons [*Akten 3199/48*].
- 1795-12-17 Sale of "kolf" court & grounds, in which HvL had 1/12 share (see 1770-10) [*Akten 3575/306*]; on 1796-05-06 a similar transfer is found, with only partly different parties [*Akten 3575/550*].
- 1796-04 Member of the Committee of Public Welfare in The Hague (Saluti Publici, he writes in [*1797-05-12*]), which appears to be in charge of public works as well, as he serves on several subcommittees concerned with docks, drainage, dikes and sea defenses, including the Commission for the Nieuwkoop & Zevenhoven drainage (of which Chr.Brunings snr. is President).
- early 1798 After the first Daendels coup on January 22 HvL dismissed from most posts (as he is a moderate), also loses post of Commissioner for drainage of Nieuwkoopse Poel, stays on Holland dikes & sea defences committee for the time being. Returns to Rotterdam

- mid 1798 After the second Daendels coup in July, HvL stays on the (now Republic-wide) sea defenses committee, and returns to Nieuwkoop-Zevenhoven Committee, now as President — Brunings snr. now heads the Republic-wide board for hydraulic affairs, forerunner of the Hydraulic Board (Waterstaat).
- 1800 Commissioner-Inspector of the board for hydraulic affairs.
HvL's contribution to a special issue of the Transactions of the Batavian Society on steam power, is a list of data on fifteen Newcomen and Watt engines [*v.Liender, 1800*]
- 1800-06-20 HvL grants full procuration for his firm to H.de Vos, merchant [*Akten 3499/952*].
- 1800-07/08 Journey to Hamburg with J.Blanken, purpose is meeting with JW, JWj or other B&W representative on neutral territory (the Batavian Republic and England are at war), to discuss Blanken's ideas for the Hellevoetsluis engine. In August they return empty-handed, making a detour via Magdeburg to see the salt works pumping engine there [*1800-07-07; 1800-07-09; 1800-08-05; 1800-08-09; 1800-08-12; 1800-08-19; 1800-09-09*].
- 1802-08/10 Journey to England with his sister; meets Gregory Watt [*AoS ref:MS 3219/4/44/49; MS 3219/4/44/74; MS 3219/7/51/35*].
- c.1806 President-Director of the Batavian Society
- c.1806-09 Serious indisposition [*1806-09-29*], no details.
- 1806-11-24 HvL and sister Petronella make a joint will, as their common household precludes a realistic distinction of each one's assets. They appoint the survivor as sole heir of the other, and sole executor of the will. Bequests of f2000 each to 5 relatives, all graphic art to an art society, after death of the survivor the Batavian Society will be his/her sole heir [*Akten 3515/1927*]. This turns out to be HvL's final will. The stamp duty reflects estimated total assets up to f300,000. Maybe the common assets and survivor arrangements would obviate the need for a full inventory of the estate after the first death; at any rate, none has been found after HvL's death in 1809. The condition upon the survivor to appoint the Batavian Society as his/her sole heir, is probably unenforceable and thus void; after HvL's death, Petronella does not heed it, and fairly soon (1811-10-18) makes a will with a much reduced position for the Batavian Society.
- 1807-09/10 Journey to Liege, Germany, Aix-La-Chappelle, MountJoy.
- 1809-05-04 Last known letter HvL to BW&C.
- 1809-12-03 HvL dies in Rotterdam of dropsy, aged 77, survived by Petronella.
- 1809-12-06 Buried in "Catharijnekerk" church, Utrecht, grave nr.141 (belonging to a mr Voet; HvL's father and his two spouses already rest there) [*Akten 339/540*]. The relevant fiche in the Utrecht municipal archives mentions "16 ells of cloth torn"; This refers to a custom, that after the service the cloth pall (more ells for a wealthier deceased) was torn in two, one half for the town's orphans, the other to another charity [*private communication mr C. Staal, Catharijne Convent Museum*]. No inventory or final account of HvL's estate have as yet been found; perhaps none was made, as Petronella was sole heir.
- 1810-03-20 Petronella sells white-lead factory (on corner Goudse Singel/Lange Warande, just outside the Oostpoort) for f13000 [*Akten 3522/735-745*].
- 1811-10-18 Petronella makes a will. The Batavian Society is reduced to a bequest of f1000 plus all HvL's printed books on art & science. Various bequests to relatives. To the Dutch Reformed Church and the Walloon church, f3000 each. One of f300 to J.Duyster (erector of several engines, friend of her late brother). Petronella's 1/32 share in the premises of the art society mentioned earlier, is bequeathed to that society, together with all the graphic artwork. To her seamstress and her maid f10,000 each. The remainder (or the shortfall) to be divided among all legatees in proportion to their bequests [*Akten 6/717*].
The will was drawn up in the presence of the notary at Petronella's home; presumably she was, at 68, in bad health.
She changes or completely renews this will a number of times, lastly on 1818-05-21 [*Akten 136/442, 339/540, 242/850*]; the changes reflect the decease of earlier legatees, the dissolution of the art society, the restriction of the remainder of the inheritance to a limited subgroup of the legatees, and stipulations about her funeral (same grave as her parents and brother).
- 1821-11-26 Petronella dies, aged 78 [*note on one of the testaments; no inventory of her estate has been found*].

HvL is usually referred to as a **merchant of Rotterdam**, without details. After his education, from some time in the 1760s he became a partner in his father's business, which was from then on styled "P.van Liender & Zoon", a style which HvL continued after his father's death in 1778. What was their principal trade? The many notarial documents rarely provide such details. There are occasional mentions of coffee, sugar, oil, ginger, liquorice, brandy, and lace [*Akten 2032/1033, 2040/471, 2858/383, 3006/799, 3011/155, 3289/341-352, 3008/563*]. Around 1780 the business has or acquires shares in various shipping enterprises [*Akten 3008/861*,

3008/874, 3008/1346, 3008/1364]. It mandates agents in St.Petersburg [Akten 2761/219, 3286/78], a banker in Paris [Akten 3006/456], the master of a ship to the West Indies [Akten 2984/284], intermediaries for procuring passes for the Tunisian and Turkish trade routes [Akten 3287/490, 3008/1346, 3008/1364]. Furthermore there are various interests, e.g. in a Scottish colliery [Akten 3166/1174], and twice a partnership in an old iron and ropework trading enterprise [Akten 3164/1402, 3192/577]. HvL owns a white-lead manufactory, inherited from his father.

He also owns many (mostly foreign) bonds.

All this would indicate a pattern of general trade (mainly in groceries/colonial wares, largely within European waters), and investment. Probably the latter is his main source of wealth.

From the mid-1760s HvL is wont to make a long journey abroad most summers; of these travels, only those are listed, for which references have been found in the documents.

Neither HvL nor his sister ever married. No direct evidence has yet been found as to his **religious affiliation**, apart from his baptism in a Dutch Reformed church, and a vague surmise in a general account of S. Hoogendijk's life, that most of his close friends would, like Hoogendijk himself, have been Remonstrants (Arminians). Sister Petronella's bequests to churches might indicate Dutch Reformed or Walloon church, probably the former. The place of burial provides no clues: the churches did at the time perform a general public burial function – inside for the wealthy, in the churchyard for others. It seems most likely that the Van Lienders were **Dutch Reformed**.

As mentioned elsewhere, HvL's **political views** were quite outspoken: he was a **Patriot**. There is no indication, however, that he was more than a supporter, he does not seem to have been politically active. His views probably did influence his public career. Before 1795 in a negative way (he was a member of the Rotterdam Corporation, but maybe he might have risen to more prominence than he did), after 1795 more positively, viz. his membership of several administrative bodies concerned with hydraulic management.

It is difficult to get a proper picture of his ideas and views, even though he expresses them frequently in no uncertain terms. His statements often read like slogans or (in modern terms) newspaper headlines, with frequent use of hyperbole, clichés, high praise (for France) or vituperous invective (for the English government). This may be in part due to the difficulties of expressing strongly felt opinions in another language than one's own. There are peculiar blind spots. He does several times extol the virtues of the social changes in France, but does not mention at all the deposing and subsequent execution of the King and Queen, nor the following Terreur period, though there are several letters in this period, and though (whatever one's opinion on developments may be) these events mark a time of intense political and social upheaval. Another case is the march northwards of France in early 1793. The factual situation is, that France attacks the United Provinces, the government of which is supported by England, Prussia and Austria. HvL, like many Patriots, looks to the French as liberators, and writes as if the United Provinces are at war with England.

HvL is sometimes referred to as an **engineer**; mostly he is mentioned as a merchant. He certainly started out as a merchant, but as one with an inquisitive mind, and a keen and broad interest in the scientific and technological developments of his time. A sort of boyish enthusiasm about inventions remains in evidence throughout his life. He gradually acquires more solid knowledge and experience of drainage and drainage equipment, and later of sea defences and hydraulic engineering in general, but where it matters he often turns for advice and opinion to "proper" engineers such as JW, Dirk Smits, Jan Blanken etc. When he has ideas of his own, he often puts them to such people. Some of those ideas are surprising for a merchant. He studies the properties of scoopwheels, and writes self-assuredly about them [1779-05-14]; [vLiender, 1793]. In [1801-09-24] he mentions factors which influence the tendency to crumpling or buckling of internal boiler flues. These are indeed the principal factors, then and today. In letters 1792-06-12 and 1792-08-24 he comes up with the idea of a horizontal engine to alleviate foundation and building problems, and defends it against Watt's objections – here he seems to be far ahead of his time. He advocates hollow cast shafts [1801-07-16], obviously to reduce weight, and roller bearings on mill shafts (not really new, but unusual, [1797-07-17; 1800-02-01; 1800-04-15; 1800-04-25]). His role in the erection of the Mijdrecht engine is also remarkable. On the other hand, a crucial non-Watt development in steam technology – the move towards "high" pressure or "strong steam" for e.g. road and rail vehicles (Cugnot, Murdoch, Trevithick) – seems to have completely passed him by. Perhaps he may be called an accomplished amateur engineer.

The reference in Petronella's will to a particular **burial place** (nr.141 in the Catharijnekkerk), owned by a mr. Voet, and where (with his gracious consent) her parents and brother had already been interred, is intriguing. It is obviously a vault; the burial registers in the Utrecht Archives record it being situated against the West wall, and to belong to a member of the Voet van Winssen family (Voet is a not uncommon name in Utrecht, and any connection with the eminent 17th century theologian G.Voetius, also interred in this church, is

as yet purely speculative).

After the church was returned to the Roman Catholic service in 1853 (when a set of restrictive c.1580 laws was repealed), the building was extensively restored, altered, and refurbished, which included laying a new tile floor over the existing stone floor, obliterating access to earlier graves and vaults [*private communication mr C. Staal, Catharijne Convent Museum*].

Petronella's 1811 will indicates a virtually complete break with the HvL science & engineering past, with only a token role remaining for the Batavian Society. Some private papers (e.g. the originals of [*Brieven*]) ended up in the Society's archives, only to be destroyed in the 1940 blitz.

There are as yet no indications as to the fate of the family business P.van Liender & Zoon.

The **art society** and the (obviously considerable) family art collection may reflect the fact that several relatives in Utrecht were well known for their artistic achievements. The collection included a painting depicting HvL and Petronella visiting a smithy [*Akten 339/540*]. There can be little doubt that this is the work discussed in [*Koolhaas, 1996*] as A. de Lelie's painting "The Visit to the Iron Foundry", which appears to survive in Germany.

From [*Bacon Motto, 1980*] and [*vdPols, 1977*] it appears that before his death, HvL appointed a **successor** for his commercial contacts with BW&C, Jan van Heukelom jnr. (1758-1835), who in 1815 was apparently given a "crash course" in steam engineering at BW&C. With letters 1805-03-25a+b HvL does introduce Van Heukelom to BW&C in a general way, not as successor. No further reference to Van Heukelom is found in the AoS, which has been searched up to 1812. In [*Tann & Breckin, 1978*] two textile mill engines are mentioned for 1815, with agent "Heukoln", which must be a corruption of Van Heukelom. From c.1816 all further dealings of BW&C with the Netherlands were conducted via a London firm, so by then Van Heukeloms activities must have come to an end.

3. Life chronology: James Watt

Much abbreviated, and largely confined to the items which might have some bearing on the correspondence in this compilation. For a much more detailed chronology see [Hills, 2002]

- 1736-01-29 Born in Greenock
mid 1755-1756 Apprentice mechanical instrument maker in London
c.1757- Employed by Glasgow University as instrument maker; opens a shop in the College
1763 Moves shop to the Trongate
1764-07 Marries his cousin, Margaret Millar (“Peggy”); they have three children John (1765, died in infancy), Margaret (1767-1796), James (1769-1848)
1768-1774 Erects several Newcomen engines
1766-1774 Civil engineering: surveys, proposals, designs
1768-08 First meeting with Matthew Boulton
1769-01-05 Patent for separate condenser engine
Closes shop & instrument workshop
1773-09-24 Mrs. Watt dies
1774-05-31 Moves to Birmingham
1775 Partnership with Boulton, application to extend duration of 1769 patent; first commercial engines (discussed in [Dickinson & Jenkins, 1927 pp44,110,111,112,115,206,207,245], inauguration dates from [Falck, 1776 p18]).
Pumping engine for Bloomsfield Colliery (nr.Tipton/Dudley), set to work 21 March 1776.
38” blowing engine for Wilkinson’s New Willey foundry nr.Broseley, set to work 28 April 1776.
Inverted-cylinder pumping engine to supply a waterwheel at New Willey (converted from older type engine), probably set to work late 1776. JW visits Wilkinson at least three times: Dec 1775 , Feb 1776 (blowing engine?), and Nov 1776 (pumping engine?).
mid 1776 Moves to live near Soho, marries Ann Macgregor (1744-1832); they have two children Gregory (1777-1804), Janet (“Jessy”, 1779-1794)
1776-08-22 Notes, probably based on info from HvL and/or MB, details about the Rotterdam fire engine:
Cyl^r 52 inches — 3 pumps 2 circular of six feet diam^r & one square of six foot square. area 92 4/7 square feet, Rhinland 16½ = 17 English — Length of stroke = 5 feet, strokes in minute = 13. When the engine works the 3 pumps it raises the water 29 inches Rh^d — 30 cwt Coals costs 16 florins at Rotterdam i.e. 30/- Ster: — [AoS ref. MS 3219/4/137, Notebook of JW 1770-1781].
The remarkable five-fold beam is not mentioned, and the number of pumps is in fact eight, viz. four round and four square; letter 1776-03-15 suggests a stroke of 6 feet
1780-02-14 Patent for copying machine (the first of five)
1781-10-25 Patent for five methods for converting linear to rotary motion
1782-03-12 Patent for expansive working, double action, double engine, rack-and-sector straight-line motion. steam wheel
1784-04-28 Patent for various forms of straight-line motion (including the “parallel motion”), steam tilt hammer, steam powered vehicles, sundry improvements
1785-06-14 Patent for “smoke-consuming” furnace
1786-11/12 Visits Paris with MB, probably returns mid-January 1787
1787-07-16 Corresponding Member of the Batavian Society [1787-09-07]
c.1788-02 Albion flour mill established near Blackfriars Bridge, London
1793-06 Start of lawsuit against Edward Bull
1790-09 Moves to Heathfield House on Handsworth Heath.
1791-03-03 Albion Mill destroyed by fire (suspected to be arson, see e.g. [1791-05-24])
1794 James Watt jnr., Matthew Robinson Boulton, and Gregory Watt acquire a financial interest in the new firm Boulton, Watt & Sons, set up for the projected new foundry.
1794-03-22 Injunction against Bull obtained [1794-04-05]
1794-06 Daughter Jessy dies of consumption.
c.1795 JW partially retires from the steam engine business.
1796-01-16 B&W injunction against alleged Hornblower & Maberley violation of 1769 patent.
1796-01-30 Soho foundry (established by the sons of JW and MB) opened by MB.
1799-01 Validity of 1769 patent upheld in King’s Bench ruling, thereby deciding the lawsuit against Hornblower & Maberley in B&W’s favour.
1800 The 1769 patent expires; B&W Partnership dissolved (BW&C formed by sons), JW fully retires
1802 Visits Paris during the brief Amiens period of peace, maybe also Germany [1802-10-12a]

1804-10-18 Son Gregory dies of consumption
1819-08-19 Dies at Heathfield (his widow dies in 1832)

Like with HvL, no sign of any specific **religious affiliation** enters in the letters, only the occasional conventional phrase (“May God give you strength ...”) or quote from Scripture finds its way there. According to several writers JW and many of his friends were **Dissenters** i.e. they rejected certain conformity rules of the Church of England. In the 17th century those were enacted in the harsh Clarendon Code (passed 1661-1665); after the 1688 Glorious Revolution the Tolerance Act granted certain groups of Dissenters (but not Catholics) freedom of worship, but e.g. continued to exclude them from political office. JW’s religion appears to have been more a matter of passive conformity than of conviction.

JW deplores war, but any more specific **political views** do not often show in his letters, and then mostly in a rather quiet and moderate manner (see e.g. [1790-09-23; 1790-11-16]). [Muirhead, 1858 p491] describes him as “a plain and homely, but honest and steady Tory” who e.g. abhorred people’s sovereignty (such as democracy etc.) in general, and the French Revolution in particular. His often unkind opinions on the Government in London are mainly in connection with the attitudes and measures (or lack thereof) which affect business and industry. His second wife Ann is much more vociferous, as the following fragment of her letter to JW of 24 January 1793 (AoS ref. MS 3219/4/6/61, via R.Hills) illustrates.

.....these cruel monsters of France have at last doomed their King to death and by so doing have sealed their own destruction for surely the hand of that God they deny will be raised against the vile Murderers. liberty uncontroled was not made for man the French were polite & friendly polished in their manner the arts & sciences flourished but surely their hearts were bad or they certainly could not have arrived so soon to that supreme degree of wickedness that they now openly profess

JW’s son James jnr was enthused about the French Revolution for some time; in 1792 he went to France to witness and support it, but he quickly became disillusioned at the bloody turn it was taking. His brief flirtation did bring him into disrepute in England for a while; ill-informed people sometimes ascribed such ideas to his father.

4. General chronology

Miscellaneous events in the lifetimes of Huichelbos van Liender and Watt, which may provide background to letters. From a historian's point of view this is a very fragmented list, mainly about a very turbulent and complex period of the history of the Low Countries. For a very detailed narrative about this period from the mid-18th century onward, see [Schama].

- 1698-04-01 Steven Hoogendijk born in Rotterdam.
- 1732 Jan Daniël Huichelbos van Liender (HvL) born in Rotterdam.
- 1736-01-29 James Watt (JW) born in Greenock
- 18th cent. The Republic of the United Netherlands becomes increasingly dominated by an establishment of wealthy citizens with an oligarchic character, nominally headed by Stadholder Prince Willem V of Orange (1748-1806, Stadholder 1751-1795). Unlike elsewhere, the nobility plays only a relatively modest part in this ruling establishment.
- 1748 A reform movement emerges. When the Prussian influence (Willem V was married to Wilhelmina of Prussia) increases and turns into dominance, various groups of dissidents unite in the early 1780s to form the Patriot party, an alliance with only limited coherence. It is France-oriented (the sociopolitical ideas of Rousseau and Montesquieu, evolving into a positive attitude towards the French Revolution). The Patriots are nicknamed 'Keezen', after the 'kees' or 'keeshond' dog which becomes their symbol. Their adherents are largely reform-minded wealthy town citizens. Their ideas, many of which were discussed by Pieter Paulus in his 1793 treatise on the equality of men, contain seeds of representative democracy — a radical and dangerous idea at the time, which led to experiments in the early years of the Batavian Republic. The establishment organises itself as the Prussia- and England-oriented Orangist party, which is covertly but actively supported by England, via ambassador Harris. After c.1790 France lends half-hearted support to the Patriots — but their own geopolitical interests prevail. The American insurrection (1775-1783) hardens the controversies. HvL is a convinced and outspoken (but otherwise not politically active) Patriot. Hoogendijk stays away from politics.
- 1762 Mathew Boulton establishes a manufactory of plate, silverware, buttons, buckles, at Soho near Birmingham.
- 1769 James Watt patent for the separate condenser.
- 1769-06-03 Steven Hoogendijk makes a will setting the stage for the subsequent founding of the Batavian Society.
- 1775 The validity of the 1769 patent is extended to 1800. Boulton & Watt Partnership formed by Mathew Boulton and James Watt for exploiting the 1769 patent, for its duration.
- 1776-03-09 First strokes of Rotterdam (atmospheric) fire engine.
- 1780-12-20 England declares Fourth Anglo-Dutch War, continuing to 1784.
- 1782 James Watt patents for double-acting engine and for rotative motion.
- 1783-03-08 8 March was the birthday of Stadholder Willem V of Orange, and in some towns including Rotterdam, labourers were given a day off to celebrate. The 1783 celebrations in Rotterdam were noisier than usual, becoming riotous when mobs started molesting citizens not wearing orange, demanding money at houses, smashing windows, looting etc. One of the principal firebrands was a woman known as Kaat Mossel. Probably (suspected) Patriots were singled out for abuse [*Geyl, 1947, p85; Schama ch3*]. On 1783-04-23 a volunteer corps is established.
- 1784-05-20 Paris Peace Treaty; Dutch maritime supremacy broken, and a crippling blow dealt to Dutch trade.
- mid-1780s Large and easy to work copper ore deposits are discovered in N Wales (Parys Mountain, Anglesey), affecting the till then dominant Cornish copper mining industry.
- 1786-09-26 France and England conclude the *Commercial Treaty*, essentially an agreement for free movement of capital, trade and people [*Uglow, 2002*], seen by many, and deplored by e.g. HvL in [*1790-09-23*] as a triumph of British interests.
- 1787-06-28 Willem V's Prussian wife is humiliated (her coach stopped and she and her entourage briefly taken prisoner) by Patriots, the Prussian army intervenes in September. The power of the Stadholder and the Orangist establishment are restored, with Prussian and English guarantees and severe repression against Patriots. Many of them flee, mainly to France, and in 1789 these refugees witness the French Revolution. HvL prepares to move to England, but also stays in France for a considerable period.
- 1788-07-03 Steven Hoogendijk dies, aged 90.
- 1789-05-05 Start of the French Revolution (fall of the Bastille).

- early 1790 Start of Birmingham Riots, at first mainly anti-Dissenter, but within months extending to social, employment, political and religious dissatisfaction issues. On 14 July 1791 the attack on Priestley (who escaped with his life, but whose house, library and laboratory were ransacked and torched) was the start of a fury lasting a week [*Uglow, 2002 ch.37*].
- 1790-10-20 Stadholder Willem V, his wife & family, the Grand Pensionary of Holland, and guests, visit the Blijdorp engine.
- 1792-09 French king Louis XVI deposed, Republic declared.
- 1793-01 Louis XVI and Marie Antoinette tried, Louis executed.
- 1793-02-01 France declares war on Britain and the United Provinces. Many Patriots somewhat naively hail the French as liberators. The war seriously impedes Anglo-Dutch trade. There may not be a formal embargo, but in practice there is.
- 1793-09 With Robespierre the Terreur starts, continuing until July 1794.
- 1793-10-16 Marie Antoinette executed.
- 1795-01 The Stadholder is forced to flee to England. The *Velvet Revolution* gives rise to the *Batavian Republic*, modelled after the French centralized state, with the Patriots nominally in power but in fact a vassal of France, which forces a declaration of war on England (Fifth Anglo-Dutch war until Amiens Peace Treaty 1802-03-27). Seagoing trade virtually ceases, England seizes the Colonies. Provisional Provincial Assemblies pave the way for a National Assembly, the first elected parliament (1796). The Batavian Republic is far from stable, torn between Unitarian and Federalist factions which cannot agree on a Constitution until after the second Daendels coup in 1798.
- 1798-01-22 Batavian Republic: coup by Unitarian leader Daendels
- 1798-04-11 First centralized (Republic-wide) board of hydraulic affairs, headed by Chr.Brunings snr. [*Bosch, 2000*]
- 1798-07 Batavian Republic: second coup by Daendels, resulting in a Constitution along largely Unitarian lines.
- 1799-01 Second Coalition War: England, Austria, Naples, Turkey and Russia against France.
- 1799-08-27 Anglo-Russian invasion Callantsoog (15 km S of Den Helder), early October withdrawal after battle near Egmond.
- 1799-11-09 (18me Brumaire) Napoleon seizes power in France, becomes Consul.
- 1800 Boulton & Watt Partnership dissolved upon expiry of 1769 patent; Boulton, Watt & Co. formed by Matthew Boulton jnr., James Watt jnr., and Gregory Watt.
- 1801-10 Batavian Republic: coup (under French influence); new constitution more decentralized, and partial return to power of the pre-1795 elite. Executive Committee of twelve. Spirit of reform wanes, the nation is getting weary of the incessant turmoil.
- 1802-03-27 Amiens Peace Treaty
- mid 1803 Peace breaks down, start of Sixth Anglo-Dutch War, until 1813.
- 1804-05-18 France: Napoleon becomes Emperor
- 1805 Napoleon effectuates a new constitution with a monocratic executive for what becomes the *Batavian Commonwealth*.
- 1806-06 Napoleon decides to further tighten his grip on the Low Countries by establishing the *Kingdom Holland* under his brother Louis Napoleon.
- 1806 Napoleon establishes the *Continental System* (i.e. Europe-wide blockade of England) which is to be strictly enforced, but continues to be evaded, circumvented or broken.
- 1809-12-03 HvL dies, aged 77.
- 1810 When Louis Napoleon turns out to be too independent for Napoleon's taste, Holland is annexed outright and is turned into a group of *French departments*.
- late 1813 While the French troops are withdrawing, the son of Willem V returns and becomes Prince Sovereign Willem I.
- 1815 Willem I is elevated to King of the *United Kingdom of the Netherlands*.
- 1819-08-19 JW dies, aged 83.

5. Table of engines

List of all known steam engines erected in the Netherlands during Huichelbos van Liender's lifetime (i.e. up to 1809), with for each engine the dates of letters which make reference to it.

The principal source for this list is [*Tann & Breckin, 1978*], supplemented by relevant letter dates, and data found in the letters and elsewhere.

date {ordered} started	purchaser	type of service	power (hp)	cyl. size (inch)	stroke (feet)	price	notes; letters in which engine is mentioned (<i>italic</i> for letters <i>from</i> HvL)
1776	Batavian Society <i>Design</i> S.Hoogen-dijk(?) <i>Erector</i> J.C.Homblower	Town canal control (Rotterdam)	55	52 Rhyndl	6 Rhyndl	c.f 30,000 (total cost)	Atmospheric engine. <i>1775-05-11b, 1776-03-15, 1778-08-29, 1779-05-14, 1785-10-07, 1785-10-11, 1786-03-10, 1786-03-27, 1786-05-31, 1786-07-03, 1786-07-11, 1786-08-04, 1786-08-07, 1786-10-13.</i> Engine dismantled 1785, a few parts (beam, ironwork) reused in Blijdorp engine.
{1777} 1778	Amsterdam <i>Design,</i> <i>Erection</i> W.Blakey	Town canal control (Amsterdam)				c.f 6,000	Blakey (Savery type) engine; see summaries of Blakey-HvL and Brouwer-HvL correspondence [<i>Brieven</i>], and [<i>Bicker, 1800</i>], <i>1779-05-14.</i> Dismantled mid-1779
1781	John Hope <i>Design,</i> <i>Erection</i> R.L.Brouwer	Estate irrigation (Heemstede)	5	17 or 18 Rhyndl	5 Rhyndl		Atmospheric engine. <i>1779-07-02, 1779-08-05, 1779-08-06, 1779-08-15, 1783-12-19, 1785-01-30, 1788-02-12,</i> summaries of letters Brouwer-HvL [<i>Brieven</i>]. Probably disused c.1800, ruins cleared c.1842.
{1785} mid-1787	Batavian Society <i>Design</i> J.Watt <i>Erector</i> M.Logan <i>Assistants</i> J.Duister, W. Krijgsman	Land drainage (Blijdorp)	21	34	6	c.f 25,000 (total cost)	<i>1783-12-19, 1785-01-30, 1785-03-29, 1785-06-03, 1785-08-04, 1785-09-04, 1785-10-04, 1785-10-07, 1785-10-11, 1785-11-29, 1785-12-10, 1786-03-10, 1786-03-27, 1786-05-31, 1786-07-?, 1786-07-03, 1786-07-11, 1786-07-21, 1786-07-26?, 1786-08-04, 1786-08-07, 1786-09-22, 1786-09-28, 1786-10-13, 1786-10-16a, 1786-10-16b, 1786-11-01, 1786-11-17, 1786-11-27, 1787-01-11, 1787-01-15, 1787-04-13, 1787-04-19, 1787-04-27, 1787-05-07, 1787-06-22, 1787-06-28, 1787-07-03, 1787-09-07, 1787-10-09, 1787-11-02, 1787-11-08, 1788-02-12.</i> Dismantled 1797, scrapped about November 1812.

date {ordered} started	purchaser	type of service	power (hp)	cyl. size (inch)	stroke (feet)	price	notes; letters in which engine is mentioned (<i>italic</i> for letters <i>from</i> HvL)
{1790-10} spring 1794	Utrecht <i>Design</i> J.Watt <i>Erector</i> J.Smallman <i>Assistant</i> J.Duister	Land drainage (Mijdrecht)	50	48	8	£ 1,580	<i>1790-06-?</i> , <i>1790-07-08</i> , <i>1790-07-26</i> , <i>1790-08-30</i> , <i>1790-10-21</i> , <i>1790-10-29</i> , <i>1790-11-04</i> , <i>1790-11-12</i> , <i>1790-11-15</i> , <i>1790-11-16</i> , <i>1790-12-16</i> , <i>1791-01-13</i> , <i>1791-01-27</i> , <i>1791-03-14</i> , <i>1791-04-14</i> , <i>1791-04-16</i> , <i>1791-05-05</i> , <i>1791-05-16</i> , <i>1791-05-24</i> , <i>1791-05-27a</i> , <i>1791-05-27b</i> , <i>1791-07-10</i> , <i>1791-08-05</i> , <i>1791-08-25</i> , <i>1791-08-28</i> , <i>1791-09-17</i> , <i>1791-10-18</i> , <i>1791-11-07</i> , <i>1791-11-15</i> , <i>1792-06-12</i> , <i>1792-08-24</i> , <i>1792-10-11</i> , <i>1792-11-13</i> , <i>1792-11-15</i> , <i>1792-12-03</i> , <i>1792-12-11</i> , <i>1792-12-18</i> , <i>1792-12-31</i> , <i>1793-01-03</i> , <i>1793-02-15</i> , <i>1793-06-13</i> , <i>1793-08-01</i> , <i>1793-08-08</i> , <i>1793-09-30</i> , <i>1793-10-07</i> , <i>1793-10-21</i> , <i>1793-12-13a</i> , <i>1793-12-17</i> , <i>1793-12-22</i> , <i>1794-01-07</i> , <i>1794-01-09</i> , <i>1794-01-23</i> , <i>1794-04-05</i> , <i>1794-05-06</i> , <i>1794-05-07</i> , <i>1794-05-12</i> , <i>1794-09-04</i> , <i>1794-09-10</i> , <i>1794-09-23</i> , <i>1794-09-25</i> , <i>1794-09-30</i> , <i>1794-10-02</i> , <i>1797-05-12</i> , <i>1798-07-31</i> , <i>1798-12-06</i> , <i>1799-05-18</i> , <i>1800-02-18</i> , <i>1800-04-15</i> , <i>1800-04-25</i> , <i>1801-02-24</i> , <i>1801-04-20</i> , <i>1801-07-16</i> , <i>1801-08-29</i> , <i>1801-08-31</i> , <i>1801-09-24</i> , <i>1801-10-03</i> , <i>1801-10-13</i> , <i>1801-10-15</i> , <i>1801-12-12</i> , <i>1802-02-05</i> , <i>1802-03-02</i> , <i>1803-05-17</i> , <i>1808-11-01</i> . Broken up c.November 1812
{1797} mid-1799	Boon <i>Design</i> B&W <i>Erector</i> Krijgsman	Corn/malt grinding for distillery (Rotterdam)	4			£ 420	<i>1797-05-12</i> , <i>1797-06-14</i> , <i>1797-07-17</i> , <i>1797-08-20</i> , <i>1797-11-05</i> , <i>1797-12-11</i> , <i>1798-01-07</i> , <i>1798-02-01</i> , <i>1798-02-18</i> , <i>1798-02-24</i> , <i>1798-03-12</i> , <i>1798-03-20</i> , <i>1798-04-28</i> , <i>1798-05-07</i> , <i>1798-05-08</i> , <i>1798-06-30</i> , <i>1798-07-15</i> , <i>1798-07-31</i> , <i>1798-12-06</i> , <i>1798-12-25</i> , <i>1799-05-18</i> , <i>1799-08-16</i> , <i>1799-10-28a</i> , <i>1803-05-17</i> .

date {ordered} started	purchaser	type of service	power (hp)	cyl. size (inch)	stroke (feet)	price	notes; letters in which engine is mentioned (<i>italic</i> for letters <i>from</i> HvL)
{1800} 1802-03	J.Blanken <i>Design</i> BW&C, J.Blanken <i>Erector</i> J.Duister	Naval dock drainage (Hellevoetsluis)	30	30¾	6	£ 1,344 (incl. one cast-iron pump 30" and two 21")	<i>1797-05-12, 1799-08-16, 1799-10-28a, 1800-02-01, 1800-07-07, 1800-07-09, 1800-08-05a, 1800-08-09a+c, 1800-08-12, 1800-08-19, 1800-09-09, 1800-09-30b, 1800-10-15, 1800-10-31, 1800-11-12, 1800-11-28, 1801-02-24, 1801-04-20, 1801-05-05, 1801-05-15, 1801-07-01, 1801-07-16, 1801-08-15, 1801-08-22, 1801-08-31, 1801-09-10, 1801-09-17, 1801-10-03, 1801-10-13, 1801-10-15, 1801-11-03, 1802-03-02, 1802-03-08.</i> Used for several decades.
{1802} 1804-11	Verveening <i>Design</i> BW&C <i>Erector</i> J. Duister	Land drainage (Krimpener- waard)	12	31½	2.5	£ 960	<i>1802-10-12b, 1802-10-23, 1802-11-02, 1802-11-11, 1802-12-17, 1802-12-31, 1803-01-05, 1803-01-31, 1803-03-21, 1803-03-29, 1803-04-14, 1803-05-23, 1803-09-06, 1803-09-27, 1803-10-24, 1803-10-29, 1804-01-06, 1804-03-02, 1804-03-13a, 1804-03-13b, 1804-03-26, 1804-04-14, 1804-04-27, 1805-03-25a, 1806-07-07.</i> Stopped 1813, broken up 1832.
{1806} mid-1808	Rhijnland <i>Design</i> BW&C <i>Erector</i> J. Duister	Canal pumping (Katwijk)	14	36	3.5	£ 1550	<i>1805-03-25a, 1806-07-07, 1806-08-11, 1806-09-29a, 1806-09-29b, 1806-10-08, 1806-10-16, 1807-03-19a+b, 1807-04-18, 1807-05-19, 1807-05-27, 1807-06-02, 1807-06-06, 1807-06-12, 1807-06-15, 1807-06-17, 1807-06-29, 1807-08-19, 1807-08-29, 1807-09-03, 1807-11-25, 1808-01-07, 1808-01-18, 1808-03-09, 1808-05-31, 1808-11-01.</i> Sold c.1836, broken up 1854.

date {ordered} started	purchaser	type of service	power (hp)	cyl. size (inch)	stroke (feet)	price	notes; letters in which engine is mentioned (<i>italic</i> for letters <i>from</i> HvL)
{1807-05} late 1808	H.de Heus <i>Design</i> BW&C <i>Erector</i> J. Duister	Copper plate rolling mill (Amsterdam)	14 (25 rpm)	20 ³ / ₄	4	£ 947	Early letters speak of a 4 horse engine, from [1807-03-19a] it is designated as 12 horse, from 1807-05-19 as 14 hp. In 1816 BW&C supplied new 23 ³ / ₄ " cylinder, increasing power to 18 hp. <i>1803-04-15, 1803-04-19, 1803-04-21, 1803-05-17, 1803-05-23, 1804-04-27, 1805-03-25a, 1807-03-19a, 1807-03-19b, 1807-04-18, 1807-05-19, 1807-05-27, 1807-06-17, 1807-08-19, 1807-08-29, 1807-09-02, 1807-09-03, 1807-10-29, 1807-11-02, 1807-11-16, 1807-11-25, 1808-01-07, 1808-01-18, 1808-01-25, 1808-05-31, 1808-06-23, 1809-04-12, 1809-04-27, 1809-05-04.</i>

6. International payments and the Bill of Exchange

In business dealings, it was felt at an early stage, to be desirable to effect payments without having to physically shift large amounts of cash. This was particularly important for international or other long-distance dealings. The goal could be achieved via a chain of mutually trusted intermediaries. From the 13th century the kingpin of such a system became the **Bill of Exchange** [*wissel(brief), lettre de change; I shall add the Dutch and French terms this way*]. In its basic form this is an unconditional signed instruction from a specified person with a specified domicile — the **drawer** [*trekker, tireur*] — to another specified person — the **drawee** [*betrokkene, tiré*] — to pay a specified sum to yet another person — the **payee** [*nemer, bénéficiaire*] — at a specified domicile.

If, for instance, HvL needs to settle an account with B&W, he could in principle do so by drawing a bill on his agent (the drawee) nearest Watt or Boulton (who would be the payee). This supposes HvL has a suitably domiciled agent whom he knows and trusts, and who trusts him, and knows his signature. Between the agent and Watt or Boulton there should be similar mutual trust. HvL can send his Bill by ordinary post, as it has little value to anyone else.

In practice, things are usually less simple. All three parties will often be firms, partnerships etc. on whose **order** [*order, ordre*] individuals act. The Bill may be lost in the mail. Payments via a mutually trusted drawee are not always easy to arrange. In order for the system to remain balanced over time (to obviate the eventual need for cash transports), Bills must go both ways. Shipments, invoices and payments take time, so a credit element is desirable.

This is where financial agents and banks come in. The Bill of Exchange specifies a time of payment in the future, the maturation date. It can do so by explicitly setting a date, but customarily the term **usance** [*uso, usance*] denotes the commonly agreed delay — the credit element. The length of a usance may be different for different locations — in HvL's time it was one month for London. If this was considered insufficient, a Bill might specify e.g. two or three usances.

The risk of loss can be lessened by writing two copies, denoted as **first** [*primawissel, première*] and **second** [*secundawissel, seconde*], where both must specify the domicile, and the second specifies that it can only be paid out if the first has not been. A Bill drawn up in a single copy is a **sola bill** [*solawissel, seule*]. HvL often sends both copies to B&W, but via different routes.

Another refinement is **endorsement** [*endossement, endos*], by which the “chain of trust” is extended and made more flexible. The payee may sign away his claim to another, by a signed statement on the back of the Bill, and the new **holder** or **endorsee** [*endossant, endosseur*] may subsequently do likewise, etc.

The Bill becomes a negotiable document within international financial networks. Banks, financial agents, and brokers will have a ready supply of Bills for various amounts, currencies, locations, and maturation dates. When HvL wants to settle with B&W, he may e.g. have a Bill drawn with himself as payee, then endorse this to B&W (as he writes e.g. in [1801-08-25; 1801-09-19]). This provides a tailor-made payment. He can also buy a Bill from a broker, at a premium, have it endorsed to himself, and then endorse it onwards to B&W (see e.g. [1801-08-15; 1801-08-22], by which he sends the first and second of such a Bill, the second has been preserved, see next page). In this case he will have to make do with the amounts, places and dates available, which is not always straightforward, as he occasionally writes in these letters. Upon receipt of a Bill, B&W would sell it to a broker (at a discount, the broker **discounts** [*disconteert, escompte*] the Bill). It can then be traded again, until its maturation.

Wherever trust plays a role, there is room for fraud. With the negotiable Bill of Exchange various ways of manipulating the chain of trust can be easily imagined, particularly with the long distances and slow communications between parties involved. Some of such practices were called **kite-flying** [*wisselruiterij, émission de billets de complaisance*].

Bills of Exchange are mentioned in e.g. the following letters [1798-06-30; 1800-09-30; 1801-08-15; 1801-08-22 (with second still attached); 1801-08-25; 1801-09-19; 1801-09-24; 1801-11-03; 1804-04-24 (with second still attached)].

It may be easily seen that modern instruments such as the **cheque**, the **traveller's cheque**, and the **credit card** are in fact adaptations of the Bill of Exchange for special purposes, with various means of certifying the trustworthiness of the parties, made possible by worldwide large banking networks, modern technology (e.g. PIN codes) and speedy communications, but still making extensive use of the power of the signature as well. The above should clarify passages such as the following (slightly edited) from [1798-06-30]. *A Second dated Hamburg, 23th June at two Usances by E: van Son (drawer), his own order on Mr. William Graves Senr. at Southampton (drawee) payable in London, the first accepted at messrs. Giles & Farrington in London (payee) amounting to £ 282.15.1, endorsed to HvL by Mr. J.B. Snellen (of G&F?), value in account with Mr.B(oulton?).*

A Bill of Exchange sent to B&W would be cashed or otherwise disposed of by them, and so one would not expect to find any in the B&W archives. There are several exceptions, e.g. with [1801-08-15; 1801-08-22] HvL sent BW&C both first and second of a Bill for £ 200, by different routes. Both arrived safely, BW&C cashed the first, and filed the now worthless second. This is reproduced below.

L^{da} L 200... Aff 3/40 London 11^e August 1801
Att Please to pay this my second p Exchange (First not paid)
to Messrs Foyssard & Loyds or Order
= Two Hundred Pounds Sterling Value in Account
of place to Adv^{ce} as Advice
To Messrs Foyssard & Loyds
N^o 21 Abchurch Lane London
J. Knowlton

The same happened in 1804, the second sent with [1804-04-24] was not used. This Bill in French, drawn from Embden in Germany on London, and endorsed on the verso — first to HvL, then onwards to BW&C — is reproduced below.

Embden le 7^e Avril 1804 p 250A.1A.6 Aff
audix juin prochain. — il vous plaira payer par cette Seconde de change
(la Première ne l'estant) à l'ordre de Messieurs Couderc D^e & P Brantel
de Cinq Cent quatre livres, quatorze Schellings & sept deniers Sterling
valant en Compte que paieront au Compte D^e B & C
Suivant l'avis de Vosseurs humbles Serviteurs
de Messieurs Minet & Sector
à Londres
J. Mijst

Voor ons aan de heer S. D
Heichelbus van Londen,
waarde van Commisparijfen
uitgeentrefsedens de goet,
hoyende voerencing in
ten Crimpervervaard
den 10 April 1804
Laurenz i. v. d. H. v. d. H. v. d. H.
forme te paye Meem v. d. H.
W. v. d. H. v. d. H. v. d. H.
meem
S. D. v. Heichelbus van Londen

7. Sundry biographical notes and glossary

Names of people, places &c. (Watt snr. and Huichelbos van Liender excepted), insofar as not explained elsewhere.

Johannes N.S. Allamand (1713-1787). Professor of Natural Philosophy in Leiden. Experimented with model fire engines, lectured on them to the Batavian Society.

Ambroggio & Sawyer's, agents in Rotterdam [1793-12-13; 1793-12-15; 1794-01-30].

Thomas Beddoes [1793-08-08; *Muirhead*, 1858 p429; *Dickinson*, 1935 p184]) Prominent physician, who researched and tested new methods for treating consumption, by letting the patient inhale oxygen or carbon dioxide or even hydrogen (with disappointing results). Amongst his patients was JW's son Gregory. B&W made pneumatic apparatus for him.

Bernard Forest de Belidor (1698-1761). Military and civil engineer and author of the four-volume "Architecture Hydraulique", a classic on hydraulics.

Lambertus Bicker (Rotterdam 1732-1801, he and others sometimes use the spelling Bikker) Bicker read medicine in Leiden, and established himself as a physician in Rotterdam. Professor of Physics. He became a member of the Dutch Society of Sciences (established 1752), and published on a variety of medical and non-medical issues. In 1769 he was co-founder of the Batavian Society of Experimental Philosophy, of which he was to be First Secretary for a long time. In 1772 he wrote a pamphlet advocating the use of fire engines for land drainage. In 1788 he visited HvL in England; in the same year he delivered a series of ten lectures on various aspects of the steam engine. In 1800 he wrote an extensive and detailed account of the early history of the steam engine in Holland [*Bicker*, 1800].

William Blakey (c.1712-after 1792, year of birth inferred from [*Brieven* 29]). Probably trained as a watch- and clockmaker. Blakey was one of several individuals (e.g. Punshow, Jones) who, in the second half of the 18th century promoted "fire engines" in competition with the Newcomen engine and (later) with the Watt engine. Their devices were mostly based on the Savery pump, with modifications to lessen the direct contact of the steam and the water column (interposing an air layer or a floating disk, or even a piston), to make it self-acting, and to improve the boiler (e.g. make it tubular, to be safe for the higher pressures required by any Savery pump with appreciable lift). Their claims, particularly about fuel consumption, were often extravagant. Blakey attracted more limelight than most, particularly on the Continent. This helped in giving him the image of a charlatan. However, HvL quotes a very sensible Blakey statement about trading capacity for lift, and Hills [2002] thinks that "*he may have been moving towards the concept of condensing in a separate vessel*". Blakey operated mainly in France and in the Low Countries; in 1776 he obtained a patent from the States of Holland. In 1778 Amsterdam commissioned him to erect an experimental pump for circulating the canal water, which became a failure. About this time his attention turned to Russia, and up to 1792 he made several attempts to get a foothold there. [*Bicker*, 1800; *Bootsgezel*, 1936]

Ary Blanken Hydraulic engineer, like his older brother Jan.

Jan Blanken (1755-1838) Son of a carpenter and millwright who, through private study and a burning ambition, surmounted the obstacles of his humble origins to become the foremost Dutch hydraulic engineer of his time. He managed the refurbishing of the naval dockyard of Hellevoetsluis c.1800, with a Watt engine driving an array of pumps of his design [*vdPols/Verbruggen*, 1996]. From 1808 to 1825 he headed the Government Hydraulic Board.

Matthew Boulton (1728-1809, sometimes spelled with single t in his first name, e.g. in JW's Patent Spec 1786-05 and Cession Contract 1786-11-08) Birmingham industrialist. 1762 established his Soho manufactory of silver & gilt buckles, buttons, silverware, Sheffield plate, gilded brass ornaments (ormolu) & other metalware. In 1768 he met JW, and in 1773 he acquired Roebuck's (q.v.) $\frac{2}{3}$ share in JW's 1769 patent. The Boulton & Watt Partnership (1775-1800) was established to exploit the patent. He had several other interests, an important one being coin making.

Rinze Lieuwe Brouwer (Oldeboorn, Friesland c.1728-after c.1783) ([1783-12-19; 1785-01-30] separate summaries of letters to HvL in subsect.11.2) Best known as the builder of an atmospheric pumping engine for irrigating the country estate Groenendaal (Heemstede) of Jan Hope (q.v.). Started 1781, this was the third steam

engine in the country, and arguably the first successful one. HvL recognized it as a shining example of what could be achieved (e.g. [1783-12-19]). Brouwer was educated at Franeker University. Described as a merchant, possibly in mirrors or mirror glass. Amsterdam from c.1755-1756 to c.1771. Twice married, probably widowed some time after 1771, as in 1779 (start of the surviving letter summaries [*Brieven*]) he appears to live by himself in various lodgings. During this period he was busy measuring currents in the IJ river, in order to contribute to a solution to the silting-up problems of the port of Amsterdam. In 1779 he was elected Consulting Member of the Batavian Society.

Christiaan Brunings snr. (1736-1805). Key figure in the centralization of hydraulic affairs in the late 18th century. Born in Neckerau, Germany, as the son of a clergyman, emigrated to the Netherlands in 1754 after his education in Heidelberg had been interrupted. Private studies of mathematics, physics and hydraulic engineering. 1769-1798 Inspector General of the rivers in the county (later province) Holland. After the Unitarian coup of January 1798, he is appointed President of the new centralized bureau for hydraulic affairs, a forerunner of the Hydraulic Board (Waterstaat). He remains active until his death on 1805-05-16. [*Lintsen, 1980; Bosch, 2000*]

Chr. Brunings jnr. Nephew of the above. Was Director-General of the Nieuwkoop/Zevenhoven drainage, where his uncle was President of the Commission until 1798 [*Bosch, 2000*].

Prof. Petrus Camper (1722-1789). 1749 Professor of philosophy, anatomy and surgery at Franeker, Amsterdam and Groningen. 1751 Fellow of the Royal Society of London. 1755 Professor of anatomy and surgery at Athenaeum Illustre, Amsterdam. 1785 Associé Étranger of Academy of Sciences, Paris. Best known for work in comparative anatomy. Orangist. [1785-12-10; 1785-12-30]

Prof. Christiaan Cornelis Hendrik Damen (1754-1793). 1787-1793 Professor in mathematics, physics and technology, Leiden University as successor to Allamand. [1794-01-16]

Jean Theophile Desaguliers (1683-1744). Lecturer of experimental philosophy in London, author of “A Course of Experimental Philosophy” (Vol.I 1734, Vol.II 1744). Also lectured on the Continent, including the Low Countries. Demonstrator for the Royal Society. He is often seen as one of the most important and successful popularizers of Newtonian mechanics.

J.J. Duister (? - 1813). Blacksmith and mechanic, worked in Rotterdam as a maker of fire-fighting equipment and weighing scales. About 1793 he was hired to assist in the erection of the Mijdrecht engine, at the request of the Batavian Society, to learn the steam mechanic trade, in order to reduce the dependence on others [*vLieburg & Snelders, 1989 p73*]. At Mijdrecht he also became the first engine-man (trained by Watt’s erector Smallman). Although competent, his character apparently made him difficult to get on with, and he was dismissed, probably in 1797. In 1801-1802 he erected the engine at Hellevoetsluis, proving his skills as an engine erector. In 1804 the Krimpenerwaard engine followed. In all these cases he operated under superiors (HvL, Jan and Ary Blanken) who understood what erecting a steam engine entailed, and with whom he could discuss the inevitable problems. For his next Engine, at Katwyk, this was different. HvL was only remotely involved, and the Rhyndland commissioners would at best only have a vague idea of mechanical engineering. They would probably see Duister as just another workman who could be ordered around. This would contribute to friction with the by now probably quite self-assured Duister, who at the same time also had another engine on his hands — the rotative for De Heus in Amsterdam. HvL and Duister seem to have got along well.

Anthoine George Eckhardt (? - 1816). (letters 1779-05-14, 1785-10-11, 1785-11-29, 1785-12-30). In 1771 invented an inclined scoopwheel, which he and his brother vigorously promoted. The wheel’s plane was inclined at roughly 30° from the horizontal, boards were fitted to the underside of the disk. These swept the water up a circular inclined channel of brick masonry. The design included various culverts and gates, the massive masonry mill-base needed was rather complex. Several trial mills were built for comparison with the common vertical scoopwheel. No significant advantages were ever shown, there were some drawbacks, but the idea continued to be promoted well into the 19th century [*Sipman, 1977*].

Jan Jacob Elsevier. Merchant, sometime member of the Rotterdam Corporation, Patriot, friend of the Van Lienders.

Engine load. The pressure differential across the steam piston which is used to calculate the work that can be performed per stroke (in a pumping engine the column of water the engine can raise). It is in pounds per square inch, but usually this is written as “pounds per inch”. For a Watt engine it cannot exceed perfect vacuum

(14 psi) plus steam pressure (say up to 10 psi), but in engine calculations much more conservative values are customary. Watt rarely reckons with more than 8 pounds per inch. In practice this leaves ample to spare for acceleration and friction, so that at a conservative load the engine will work quite briskly and be capable of making relatively many strokes per minute.

John Enslie (in some letters referred to as **Ainslie**, but he signs himself **Enslie**). Mutual acquaintance of HvL and JW who lived in Holland (or often stayed there; he appears to be a merchant), in the Rotterdam region. In 1763 JW buys a batch of fiddles and bows from Molewater & Enslie in Rotterdam [*Hills, 2002*]. Enslie travels to England mid-1770, is again in Holland 1785-03, translates the Dutch patent into English (1786-01). Reported as dangerously ill early 1796 [*AoS ref. MS 3219/4/40/26 from R.Hills; 1770-06-29, 1785-03-29, 1785-06-03, 1786-03-10*].

Freemasonic connections. It has been suggested, that masonic affiliations may have played a part in the diffusion of science and technology in the 18th century. The thought may have been fed by the observation that Desaguliers was not only an important protagonist of experimental philosophy, but also a key figure in the establishment and diffusion of modern freemasonry. JW was a Mason. [*van Lieburg & Snelders, 1989 p12*] state that Hoogendijk probably belonged to the “La Persévérance” lodge. A search in the Cultural Masonic Centre “Prins Frederik”, which holds the old membership records, had the following results:

- L.Bikker (= Bicker) was an active Mason; in 1762 he founded or co-founded the lodge “La Persévérance”, but already in 1764 he cancelled his membership. The lodge was disbanded in 1788.
- P.Hartog, Director of the Batavian Society, was an active member of the same lodge.
- S. de Monchy, Director of the Batavian Society, belonged to an older lodge (“La Concorde”)
- R.L.Brouwer belonged to an Amsterdam lodge (“La Bien Aimée”) from 1755 to 1767.
- The names Van Liender or Hoogendijk are not found in the records.

Dr. Ten Haaff Rotterdam [1794-01-16].

Jan van Heukelom jnr. (1758-1835) [1805-03-25]. Textile mill owner in Leiden. Possibly appointed by HvL as his successor for dealings with BW&C [*Bacon Motto*].

Hollandsche Maatschappij der Weetenschappen (Holland Society of Sciences). Established 1752 in Haarlem as the first “scholarly society” in the Netherlands. Still active.

Samuel Homfray (1761-1822). Ironmaster of the Penydarren works nr.Merthyr Tydvil (Glamorganshire, S Wales) [*Eyles, 1971; 1800-09-09*].

Steven Hoogendijk (Rotterdam 1698-04-01 - 1788-07-03). Born into a wealthy family of clockmakers. At age 25 appointed overseer of the town’s clocks. In 1745 he was appointed manager of a scoopwheel-windmill which he had designed and built for the control and flushing of the town’s canals. This mill had unusual features, and in other fields Hoogendijk also showed an innovative spirit. Problems with the unreliability of wind power drew his attention to the English developments of “fire engines”. A fact-finding mission the town sent to England at his request in 1757, was disappointing due to incompetence. Hoogendijk appeared to bide his time, taking no further steps for twelve years. In 1768 he inherited the estate of his brother Thomas, which made him one of the wealthier citizens of Rotterdam. He now gathered a group of supporters, and founded a learned society, the *Bataafsche Genootschap der Proefondervindelijke Wijsbegeerte* (Batavian Society of Experimental Philosophy), the broad scope of which did include investigation into the feasibility of using steam power for drainage [*Akten 2308/568; vLieberg & Snelders 1989*]. He met a large proportion of the cost, first of the Society, then of the two full-scale trial engines). He had the satisfaction of seeing the second one (a successful Watt engine) inaugurated on 15 September 1787, less than a year before his death. Throughout his lifetime he kept out of the limelight, preferring a back seat as an Ordinary Member of the Batavian Society. In 1771 he buys a house on the Haringvliet, Proth.Reg.3978B, tentatively identified as modern nr.88, a few hundred meters from where HvL lived. He probably got to know HvL through the latter’s father.

Hoogheemraadschap. The Dutch drainage management organization runs roughly parallel with the general civil administration tier structure of the state: Central government undivided, below that province (civil) & hoogheemraadschap(drainage) tier, and at the bottom municipalities (civil) & polders or districts (drainage). These drainage management tiers go back a long time – e.g. Rijnland, centered on Leiden, was established in 1255. Their task was originally mainly the collecting of the constituent polders’ discharge water into a reservoir (Dutch “Boezem”), and to discharge the excess to outside waters (rivers, sea). To this end the head of a hoogheemraadschap (Dutch “dijkgraaf”) had wide-ranging powers, including those of corporal and even

capital punishment. In later years the responsibilities were extended to sewage and water quality management. In addition, there are the engineering authorities Rijkswaterstaat (established during the Batavian Republic) and its provincial branches. The term *hoogheemraadschap* has no straightforward equivalent in English, Van Liender left it untranslated and unexplained. “Drainage province” appears to be halfway suitable.

John (or Jan) Hope (1737 - 1784-04-20) Member of the Hope banking family, in which Henry was the international banking genius. John participated in the family business, but he was also a socialite and a patron of the arts and sciences. He was a member-Director of the Holland Society of Sciences and (from as early as 1772) consulting member of the Batavian Society. Hope owned the Groenendaal estate at Heemstede, S. of Haarlem, with a water garden (ponds, no fountains). In his grounds R.L. Brouwer erected the first all-Dutch-built steam engine.

Jabez Carter Hornblower (1744-1814) Member of the well-known 18th century Hornblower family of engineers, the historiography of which was much confused by their preference for male first names starting with J (Jonathan, Jabez, Joseph, Josiah, Jethro, Jesse). Erector of the Rotterdam fire engine in 1775-1776, and for some time after he remained in correspondence contact with HvL (Summaries of some of his letters to HvL are in [Brieven], and reproduced in subsect. 11.3 of this book.). From c.1778 he was erector for B&W for a few years. He was dismissed when a Watt-Hornblower feud developed, as Jonathan jnr. patented his compound engine in 1781. In c.1788 he was declared bankrupt. By 1790 he was established in London, collaborating with J.A.Maberley. He became convinced, that the Watt patent was invalid through “prior art” (use of cylinder covers and of a separate condensing vessel by others). In 1796 B&W obtained an injunction against H. and Maberley for building a Watt-type two-cylinder rotative engine. Protracted legal proceedings resulted in the Watt patent being upheld in 1799 (just before it expired in 1800). H. continued to propose innovations in several fields, and to write articles on various engineering subjects. In 1810 he designed and erected a brewery in Sweden, and stayed there until 1813. [Harris, 1976].

Horse power: see the General Notes section.

De Jongh [1794-01-16]

Keezending A nickname for the B&W Blijdorp steam pumping engine, which might be translated as “Keezen contraption” or “Patriot contraption”. “Kees” was the nickname for an adherent of the Patriot movement (see General Chronology section). The Batavian Society, which established the Blijdorp engine, was seen — and resented — by the largely Orangist rural population as a Patriot organization. The term Keezending appears to have been first used in [Bicker, 1800 p75] where the author describes the Society’s failed efforts in 1790 to sell the engine (which had now fulfilled its demonstration function) to the polder authorities and landholders. Bicker writes (translated):

It was clearly noticeable that it was not so much the fear of extra expense, but rather the prejudice against anything innovative which frustrated these laudable efforts. In addition, the notion that the Founders (Ed.Note: of the engine, from the Batavian Society) were not much in favour of the Administration of the day, was an important reason to reject all offers: it was openly said: “it is a Patriot contraption, and we want none of it” (Dutch: het is een Keezen ding, en dat moeten wij niet hebben).

Whether this is an accurate report, or whether Bicker “stylized” it a bit, cannot now be ascertained. At any rate, the phrase has been perpetuated by later writers, and the 1987 exhibition commemorating the bicentenary of the engine, was entitled “Het Keezending”.

In the HvL-JW correspondence the term is not found, but a brief remark in [1788-02-12] echoes the general feeling:

Were public circumstances in another turn, than they now are, the Steam Engine would undoubtedly take footing in this country, but by being a work of Patriots it is quite condemned and abhorred.

Willem Krijgsman. Mechanic, got his first taste of steam engines with the Blijdorp engine, where he assisted erector Malcolm Logan and continued as engineman. About 1797 he succeeded Duister as engineman for the Mijdrecht engine. Not long after, he erected the rotative engine of distiller Boon.

Load: see Engine load

Jean André de Luc (1724-1817). Natural philosopher, with particular interest in the atmosphere. From Geneva, but mostly residing in London. During Watt’s instrument maker phase in the early 1770’s, de Luc provided him with instructions on making barometers. He became a close friend. C.1783 he saw a Perier-built

Watt type engine in Paris, about which he reports unfavourably to Watt [*Muirhead*, 1858 p.266]. In 1780 he was elected Corresponding Member of the Batavian Society [1783-12-19; 1785-01-30; 1785-03-29] summaries of some of his letters to HvL in [*Brieven*], [*Hills*, 2002]

Lunar Society A group of friends in the Birmingham area, with MB, JW, Josiah Wedgwood, Erasmus Darwin and J.Priestley as its nucleus, who gathered once a month near full moon (to light their way home), for philosophical discussions. All were quite independent inquisitive minds, religious dissenters and original thinkers. During HvL's 1789/1790 stay in Birmingham, JW introduces him to the Lunar Society. For a narrative history of the Lunar Society see [*Uglow*, 2000]

Alexander Martin HvL's agent in Hamburg (letter 1798-03-12)

Martinus van Marum (1750-1837) [1790-09-23 and probably the unreadable 1790-09-12]. Received a broad scientific education and settled as a medical doctor in Haarlem in 1776. He became lector, demonstrator and director of naturalia collections of Teyler's Museum and of the Dutch Society of Sciences. He grew up with the phlogiston theory (q.v) but c.1785 he was converted to Lavoisier's theory of combustion, using (with eminent chemists) the large electrostatic generator at Teyler's for supporting experiments and demonstrations.

Mijdrecht or Meijdrecht, a town c.7 km SE of Uithoorn. Between Mijdrecht and the Amstel lay the Mijdrechtse Poel lake, which was reclaimed using a B&W engine, see subsect.1.6.

Thomas Newcomen (1663-1729), ironmonger of Dartmouth, Devon. Invented and developed the first practical Fire or Steam engine for draining deep mines. After a period of development, in 1712 he built his first full-scale engine near Dudley Castle in the coal fields of central England. Newcomen did not apply for a patent, but instead joined the association of proprietors of the Savery patent, even though the two devices were entirely dissimilar. His engine was later incrementally improved by Desaguliers, and became known as the atmospheric or common engine, which was highly successful. Watt's engine was based on Newcomen's, with one crucial improvement — the separate condenser, patented in 1769. For a full account of Newcomen and his engine see [*Rolt & Allen 1997*], a brief description is given in the introductory section of the present book.

Pieter Paulus (1754 - 1796-03-17) As a young man he wrote, in 1772, an essay defending the House of Orange rule, but stressing the need for reform. Several ideological turns later, he wrote a treatise on the equality of all men (1793); this rather radical work became the ideological anchor for the Patriotic movement in its final years. P. thus provided the basis for action, but he himself was not much of an activist. In 1795 he was elected Speaker of the National Assembly of the Batavian Republic; he led several negotiations with the French, and between internal Patriot factions. His career was cut short by his sudden death in March 1796. [1794-01-16; *Schama*]

James Pearson clerk, later chief clerk at B&W and BW&C.

Jacques Constantin Perier (or Perrier) a blacksmith and later manufacturer in France whose firm in 1777/1778 negotiated to build Watt engines for the Paris water supply, but apparently tried to evade the Watt patent [*Muirhead 1858*, pp 265-267]. In [1783-12-19] HvL reports to De Luc that the Perier firm has problems due to building engines to foreign drawings without sufficient experience. The wariness expressed by JW to HvL in [1785-09-04] may be attributed to these French experiences. Late 1786 / early 1787 MB and JW visit Paris and JW writes to Roebuck that Perier has "erected a most magnificent and commodious manufactory of steam engines" but, as far as the rights to the Watt inventions are concerned, B&W remain wary of him [*Muirhead 1858*, p.267]. Late 1790 the firm, then named *Administration des Eaux de Paris*, appears to be in serious trouble [1790-12-16].

Phlogiston. In the early 18th century German chemist G.E. Stahl formulated a theory of combustion based on the general and qualitative observation that, with the flame, one or more substances appear to escape from the combustible substance. He postulated that one essential substance, which he named phlogiston, escaped in every combustion process. A gas supporting the flame (which we now know as oxygen) was supposed to absorb phlogiston, and was thus named "dephlogistonated air". Variations of Stahl's theory became dominant, but phlogiston proved to be an elusive entity, and from the late 1780s the rival "anti-phlogistic system" developed by Lavoisier and his colleagues on the basis of quantitative experiments, was widely adopted. Central to the "new" chemistry were the claims that the gas they named "oxygen" supported combustion, was responsible for acidification, and combined with "hydrogen" (formerly "inflammable air") to form water.

Priestley and Watt continued to defend Phlogiston until at least c.1800, objecting to the complex instrumental and quantitative character of the “new” chemistry’s experimental practice, as well as what they viewed as the dictatorial nature of its nomenclature [*Ugnow, 2002; Hills, 2002; private comm. L.Roberts*].

Joseph Priestley (1733-1804) Theologist, philosopher, chemist, physicist. Dissenter (Unitarian) preacher. Research about electricity and the physics and chemistry of gases. Staunch adherent of the phlogiston (q.v.) theory of combustion. Prominent member of the Lunar Society (q.v.). At the height of the Birmingham Riots (1791, see General Chronology section) his house, laboratory and meeting hall were ransacked and torched, including all his instruments, books and notes. He escaped with his life, and in 1794 emigrated to America, where he founded several congregations.

De Prony author of ‘Nouvelle Architecture Hydraulique’. Vol.1 appeared in 1790, HvL mentions Vol.2 to JW in [1797-05-12]. See [*Muirhead 1858, p.267*].

“**Proth.Reg.**” (short for *Prothocollaire Registratie*). A property registration system in use before the Cadastral System was introduced in the 1830s; it often allows identification of owners, but provides little if any topographical data.

John Roebuck (1718-1794) Doctor, chemist, entrepreneur. Friend and early supporter of JW, financing early full-scale experiments; in return he had a $\frac{2}{3}$ share in the 1769 patent. The 1772 Scottish depression and banking crisis drove him bankrupt in 1773. MB acquired the share.

Prof. J.Th.Rossijn (1744-1817) educated at Harderwijk University, Sep 1775 professor of Philosophy, Physics & Metaphysics at Utrecht University. Principal consultant of the States of Utrecht (and later the Provincial Administration) for the Mijdrecht drainage and its problems, see [*Bicker, 1800*] and the correspondence on the Mijdrecht engine.

Thomas Savery (c.1650-1715). Best known for his patented invention (1698) of a pumping device described in the introductory section.

John Smeaton (1724-1792). Civil engineer and scientist with a wide range of activities and interests [*Skempton, 1981*].

Dirk Smits (? - 1793-04). Surveyor and engineer to the Schieland group of polders near Rotterdam, who became as such involved in the civil engineering aspects of the Blijdorp engine. This made him well acquainted with the problems of deep foundations in soft peat ground. HvL consulted him extensively about the Mijdrecht drainage, where these problems were particularly severe. Portions of the HvL-Smits correspondence are kept at the Historisch Museum Rotterdam and in the archives of Schieland. While interesting, those letters are considered to be outside the scope of this compilation.

Soho Foundry The B&W partnership designed steam engines and licensed the use of the Watt patent designs for a periodical fee. The procuring/manufacturing of the engine was basically left to the licensee, although B&W would help if needed — for an additional fee. This business model (see the relevant section) would become useless with the expiry of the patent in 1800. One way of achieving continuity of the business was to start manufacturing engines. In 1795 preparations were started to establish an engineering works, usually referred to as the Soho Foundry, and operating as Boulton, Watt & Sons, later Boulton Watt & Co. From the start in January 1796, this was managed by the sons of JW and MB. The business continued under various names until 1895.

John Southern (c.1768-1815) engaged by B&W in 1782. Soon became Watt’s right-hand man. Admitted as BW&C partner in 1810. [*Dickinson 1935, p.131*].

Pibo Steenstra (?-1788) from 1763 Lector of Mathematics at the Amsterdam Athenaeum. Clashed with R.L. Brouwer on various subjects, including the usefulness of fire engines for land drainage.

Pieter Stol(c)ker living at Boompjes, Rotterdam, close to HvL [1794-01-16]

Mrs. Swellingrebel (?-1796; the name has many spelling variations) A lady, probably originally from Rotterdam, who c.1762 lent £ 6000 to John Fothergill, partner of MB in the Soho works. Fothergill died bankrupt in 1782. The loan was never repaid, but MB settled a £ 50 annuity on Mrs.S., which was handled

through HvL, and thus occasionally turns up in the correspondence [Uglow, 2002].

Ter Schelling a country estate on the east bank of the Amstel river, about 2 km N of the Uithoorn bridge. The estate was purchased by the States of Utrecht as site for the Mijdrecht Lake drainage pumping station. When the old Blijdorp pumping station was dismantled, the engine was stored in parts at Ter Schelling, where it would be re-erected if needed. This never happened for a variety of reasons (mainly political), and when the Mijdrecht drainage project was abandoned in 1812, the pumping station was broken up and the Blijdorp parts obviously went to the scrapman with it. [vWees, 1984]

Thamen a little parish about 1 km N of Uithoorn, now absorbed by the town of Uithoorn, on the Amstel river opposite the *Mijdrechtse Poel* lake. By the mid-18th century most of the parish had fallen victim to peat extraction, and what remained lay on the shore of the *Legmeer* peat lake. In 1793 and 1794 HvL stayed there in connection with the erecting of the Mijdrecht pumping engine which was commissioned early 1794. He took up residence at the small country house *ZorgVrij* (q.v.), quite near the engine, as JWj reports to his father (letter 1793-12-22, via R.Hills). JWj himself stays at “the inn about a mile away”; this must be the still-extant *Rechthuis*. [letters 1793-12-15, 1794-01-16, 1794-01-30, info about Thamen provided 1997-03-21 by Mr. Lustenhouwer, Uithoorn town council]

Uithoorn or Uythoorn. Location on the Amstel river c.20 km S of Amsterdam. Of old, there is a bridge here, but a town only grew up later, in the late 19th and 20th centuries. In the 18th century it was part of the parish of Thamen (q.v.).

Prof. BaviusVoorda (1729-1799) Professor of law, Leiden University [1794-01-16].

Gregory Watt (1777-1803) Son of JW. Educated at Glasgow College. Oct 1794 partner BW&S. From c.1797 suffers of consumption, stay in Cornwall, treated by Dr. Beddoes (q.v.). 1802 Tour on the Continent. 18 Oct 1803 died of consumption in his 27th year. [Muirhead, 1858; Dickinson, 1935].

James Watt jnr. (1769-1848) In [Muirhead, 1858] little is found on James jnr., [Dickinson, 1935, pp163ff] has slightly more; additional details were provided by R.Hills. In 1784 JWj was an apprentice at John Wilkinson’s Bersham Ironworks for a year. After that he went to the Continent for general studies (Geneva, Eisenach [German], Clausthal [mineralogy], Freiburg [mining]). In 1788, after his return to England, he worked for two years in the counting house of fustian makers Taylor & Maxwell. Around this time he became enthused about the French Revolution, and in April 1792 he and his friend T.Cooper went to France and addressed the Société des Amis de la Constitution on behalf of the Constitutional Society. Soon after, however, Robespierre suspected him of being a secret emissary of the British government. He fled to Italy, then went to Switzerland, Germany, and Holland, returning home in January 1794, disillusioned with the French Revolution, particularly the Jacobines (e.g. [1793-12-03]). His political ideas may account for his apparently friendly relationship with the convinced Patriot HvL (though, under all the usual phraseology, a reproachful and later even sour note in the latter’s letters is obvious). He now worked for a time as travelling representative of the Manchester firm of Walker. In Oct.1794 he was admitted as a partner in BW&S, and never again took part in public affairs. Fairly soon he, his brother Gregory and Boulton jnr. assumed the management of the business. [1786-09-28; 1793-12-15; 1794-01-16; 1794-01-30 and others, AoS ref. MS 3219/4/13/18].

Sir Joseph Yorke, Baron Dover (1724-1792). English diplomat. Started his career in 1749 as secretary of the English embassy in Paris. In 1751 he was transferred to The Hague as British Minister there. In 1761, after a brief mission as plenipotentiary at the abortive Augsburg peace conference, his status in The Hague was raised to ambassador, and on 26 May of that year he was installed Knight of the Bath. He stayed in The Hague until the fourth Anglo-Dutch war broke out in 1780. It is easy to see why MB with [1777-?] looked to Sir Joseph for advice on activities in the United Provinces. (private communication from R.Hills, see also [Schama ch.2])

ZorgVrij a smallish country house in Thamen, on the west bank of the Amstel river, rented by HvL from 1 June 1793 for a period of two years, as a pied-à-terre for supervising the erection of the Mydrecht engine at Ter Schelling (q.v.) on the opposite bank of the river [1793-06-13]. HvL and his sister would also use this as a summer residence. Its precise location has not been ascertained, but it would presumably have been between the Uithoorn bridge and the Thamen church.

8. Bibliography

Akten, selected notarial documents concerning HvL, held in the GAR, indicated by their Volume/Sheet numbers; main access codes 18 (up to 1810) and 314 (from 1811).

Bacon Motto, *De eerste industriële stoommachines van James Watt in Nederland [The first James Watt industrial steam engines in the Netherlands]*

Submitted for an essay competition set in 1980 by the Batavian Society. The question was designed by K. van der Pols (1906-1995), at the time Director of the Batavian Society, and an expert in the field. The question asks, in translation: *The history of a number of steam engines which the Boulton & Watt Soho foundry supplied to Dutch factories and vessels from 1798 to 1832, and the significance of these for the enterprises concerned.*

This was the dying gasp of the “Questiones” scheme that the Batavian Society had operated from its beginning. As usual, entries used a motto (here a fairly long Francis Bacon quote), the identity of the author being kept hidden for the judging process. The typescript of this entry was found in the papers of Van der Pols, accompanied by two opinions of experts to the Society. The paper was considered of insufficient quality, and was never published, so the identity of its author was never disclosed. It contains extracts of a few letters. Other data are from [vLieburg & Snelders, 1989 p191,195].

[**L. Bicker**], *De groote voordelen aangetoond, Welken ons Land genieten zou, Indien men Vuur-machines in plaatse van Watermolens gebruikte [Proof of the large benefits which would accrue to our Country from the use of Fire engines instead of Drainage mills]*

Rotterdam: Reinier Arrenberg, 1772

Published anonymously; in [Bicker, 1800], Bicker reveals his authorship.

L. Bicker, “Historie der Vuurmachines” [The History of the Fire Engines]

Nieuwe Verhandelingen van het Bataafsche Genootschap I (1800), p.1-132

An extensive and detailed survey of developments in the Netherlands up to 1799 by a founding member of the Batavian Society.

A. Blanken, “Verslag van de Aanleiding tot en het dadelijk Bouwen van een Stoom-Machine ten dienste van de Geotroyeerde Verveening in de Krimpenerwaard” [Report on the Occasion and the actual Erecting of a Steam Engine for the Licensed Peat Extraction in the Krimpenerwaard]

Nieuwe Verhandelingen van het Bataafsche Genootschap V (1807), p.1-39 + two plates

J. Blanken, “Verhandeling over het aanleggen en maaken van zoogenaamde drooge dokken in de Hollandsche zeehavens, byzonder toegepast op de gelegenheid van ‘s lands dok en werf te Hellevoetsluis” [Treatise on the Building of so-called Dry Docks in the Sea Ports of Holland, Applied in Particular to the Disposition of the Dock and Dockyard at Hellevoetsluis]

Verhandelingen van het Bataafsche Genootschap XII (1798)

J.J. Bootsgezel, “William Blakey — a Rival to Newcomen”

Trans. Newcomen Soc. **16** (1935-1936), p.97-110 + 3 plates

A. Bosch, *Om de macht over het water [About Power over Water]*

Zaltbommel: Europese Bibliotheek, 2000 - ISBN 90-288-1542-2

J. van Briemen, “Machine tot het opvoeren van water door vuur, deenstig v.a. tot fonteinen, cascades etc.” [Machine to raise water by fire, useful for e.g. fountains, cascades etc.]

September 1716, States of Holland, Arch.No.3515 Index to Patents, Netherlands National Archives

Brieven, a collection of 187 typewritten summaries of letters to HvL dated 1770-03-07 to 1780-10-20
GAR ref.173.01/95

Summaries (in Dutch) made in 1936/1937 by Van Gennip (1-26) and Rosier (remainder).

The original of this typewritten document must have perished in the May 1940 Rotterdam blitz. The carbon-copy now in the archive probably came from F.Muller’s private papers. The originals of these letters — pasted into a bound book — were also lost; they were probably all that remained of HvL’s private papers at the time for the following two reasons: (a) there is only one JW letter; if any of the numerous other JW letters had been preserved, they would have been part of this collection and show up in the summaries; (b) after HvL’s death, sole heir sister Petronella soon severed virtually all links with the Batavian Society, bequeathing to them just the scientific and engineering books; it is unlikely that she transferred the bulk of his private papers to them,

most of these were probably destroyed.

R.L. Brouwer, *Wederlegging der aanmerkingen van de heer Steenstra [Mr. Steenstra's criticisms refuted]*
Amsterdam: Doll, 1774

R.L. Brouwer, "Derde Antwoord" [Third Reply]
Nieuwe Verhandelingen van het Bataafsch Genootschap I (1800), p.179-210 + 3 plates
Reply to the Batavian Society Question of 6 June 1778, quoted in [Bicker, 1800].

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9. General notes

Abbreviations

HvL	Jan Daniel Huichelbos van Liender	Rdam	Rotterdam
JW	James Watt	Adam	Amsterdam
JWj	James Watt Jnr.	Bham	Birmingham
MB	Matthew Boulton	AoS	the Archives of Soho
JS	John Southern	GAR	Gemeente Archief Rotterdam [Rotterdam Municipal Archives]
B&W	Boulton & Watt		
BW&S	Boulton, Watt & Sons		
BW&C	Boulton, Watt & Co		

Documents and their location

The existence of many documents has been inferred from references in other documents. Most such documents have been located, but not all. Some of the archives searched, notably the AoS and portions of the National Archive, are too large for a comprehensive search (e.g. for misplaced documents) within an acceptable time, so the fact that a document has not been found does not always mean that it does not (or no longer) exist.

The transcribing process

All transcripts for which no transcriber is mentioned, are by myself. I have also reviewed all transcripts by others, and edited or supplemented them as needed. I have added English translations for any documents in other languages. Such translations are plain, with modern interpunction, and without attempts at emulating “period” flavour.

The letters from HvL have all been transcribed from (xeroxes of the) originals. The originals of the letters to HvL are all lost, sender’s copies have been used.

I have attempted to avoid modifications and interpretations, even the most obvious and smallest corrections. If one starts to correct obvious writing errors such as replacing “whit” by the clearly meant “with”, or changing ij to y (an error from habit, as in Dutch ij is very common, and y quite rare) — then why not change “agreeable” to “agreeable”, and end up with extensive editing and interpretation for the modern reader. I surmise, that some of the common “errors” in HvL’s English are influenced by his obviously thorough (and earlier) French and Dutch education, but I cannot exclude the possibility of such spellings being current in 18th century English (“agreeable” probably is). Examples of notable peculiarities are (1) HvL often (but not always) writes the indefinite article with a caret thus â (2) He does not discriminate between “of” and “off” (3) He persistently uses some deviant spellings such as “notwhitstanding” and “through” (for trough). The potential problem of my strict approach is, of course, that my own typos may be interpreted by later readers as errors of the original writer. Meticulous and repeated checking has reduced that possibility, but cannot eliminate it.

Use of initial capitals often appears rather erratic to a 20th century reader, and there are many instances where it is difficult to determine if capital or lower case is intended. HvL uses commas and semicolons in profusion (the distinction is sometimes difficult), which appears to result — at least for the modern reader — in interminable meandering sentences.

I have provided each letter/document with a header frame with archival details, notes, and occasionally some factual clarification. Lost, unreadable, or uncertain portions are in *italics* between (); Editor’s notes are clearly marked, and in italics too.

Thus, the compilation is mainly data, with a little — largely factual and explanatory — annotation and a modicum of interpretation. This may facilitate access to the content of the correspondence but it cannot pretend to fully replace hands-on research into the original documents.

Outgoing Watt and B&W letters, and the Watt copy press

The original letters of JW and B&W to HvL are all lost, what survives are copies in the Birmingham archives. From the late 1770s these were made using the copy press process invented by JW and patented by him in 1780. The original letter was written using ink to which some gum arabic or similar substance had been added. To copy, a damp sheet of very thin unsized copying paper (a “flimsy”) would be applied to the reasonably fresh letter, followed by a sheet of oily paper or other waterproof covering. Pressure would then be applied (rollers or a screwdown press) and some of the ink would transfer to the copying paper. As this is thin and unsized, the ink will penetrate through, and the copy is normally readable on the verso. The rather fragile flimsy is usually pasted into a letter book. The B&W letter books consist almost exclusively of such copies. The process was in general use until the advent of the typewriter in the third quarter of the 19th century. It requires reasonable care: regular writing and ink distribution, proper moistening, adequate pressure, proper storage, etc. In the B&W letter books many copies are stained, partially faded, or otherwise damaged, some have become totally unreadable. Digital photography plus basic image enhancement techniques have often helped in revealing a

surprising amount of information in such faded copies.

Drawings and other enclosures

In-text sketches have been reproduced, engineering drawings proper (none of which are in the letter archives) have not.

Many enclosures (drawings, plans, invoices, etc.) became separated from the letters; some may be in other departments of the AoS, some may be lost. Only limited effort has been spent in locating these.

Date format and units

Where numerical dates have been used, these are in the ISO format yyyy-mm-dd; this has also been used as a reference number for individual documents, being reasonably proof against insertion and deletion of documents while maintaining uniqueness and chronological order.

Rhineland linear measure (inch, foot etc.) is 3.3 % longer than Imperial measure.

Capacity was often expressed in tun (Dutch: ton), which has several definitions in the 5-6 cu.ft. range. HvL uses a tun of 5¼ cu.Rhineland ft. or c.5.79 cu.ft Imperial measure or c.164 liter.

Land was measured in morgen or mergen, a unit with many varieties; HvL uses the Rhineland mergen, which is 0.85 hectare or 2.1 acres, see e.g. letter 1790-09-26.

Power for pumping engines was usually expressed as “pounds of water to be raised one foot high in one minute”. With the rotative engine for industrial purposes, the notion of the equivalence of engine power to that of a number of horses appeared, at first in a rather unspecific manner. JW standardised this, mainly for descriptive use, about 1783 [*Dickinson & Jenkins, 1927 p353-356*]. His definition – as communicated to HvL in [*1803-05-23*] – is 1 hp = 33000 ft·lbf/minute. It remained in common use until the gradual (and even today by no means universal) replacement by the watt. One hp is equal to 746 W. For comparison, the continental “metric” horsepower of 75 kgf·m/s is equal to 736 W.

Exchange rate; wages

Amounts are variously given in guilders or Sterling; in [*1800-02-18*] it is stated that twelve guilders is “something more than a guinea”, i.e. one pound Sterling would be ten to eleven guilders. This is confirmed by e.g. [*1801-10-13*], and JW notebook entry 1776-08-22. [*1791-07-10*] uses *f* 11.20/£.

The wages of a highly skilled workman (such as an engineman, a rare skill at the time) would be *f* 500-600 per annum plus a few perks (e.g. rentfree house, see [*1800-02-18*]); a (probably live-in) manservant might earn *f* 100-200, a maid about half that.

10. Handwriting samples

Bekent is. die het water maar tot ten d'lijne hoogte
 10 voeten opbrengt. omdat men dan van teffect b'eter
 co'deelen. want volgens de opgaave van besocnde wa
 rigen moet het vermoogen van den machine met een 1/2
 diameter veel g'roter zijn als 20000: vriend te toe
 van. Dit is hoogendijk heeft er nu verscheide 2000 werken
 met lands van Luyck. die alle Bent. slaegen in Teve

never saw the like. four double furnaces are ar
 half a circle dug out of the ground, in which the
 placed of eight heavy pieces of cannon, and eight pi
 cannon are fired cast in one moment with light fire
 and brought over in a very large building; where they a
 and polished by eight steam engines, placed in ou
 against the wall of this large building, their workin

I have given every circumstance about your
 the most serious consideration, I have adjusted
 for the best according to my knowledge I expe
 you will do me no more than Justice.

he has left it to me to answer your letter. I ha
 but as Mr Watt & I are engaged in the Fire Engin
 profession, we do not enter ourselves as candida
 neither do we engage in any discussions upon
 But if you and your friends choose to employ

my lask to you I received a letter from Mr
 agent at Bergham which says "the cylinder
 " was a cylinder having a number of holes in the
 " we have been under the necessity of casting

1770-6-29
Jan Daniel Huichelbos van Liender

1807-11-25
Jan Daniel Huichelbos van Liender

1787-04-19
James Watt

1778-08-29
Matthew Boulton

1787-01-11
John Southern

11.1. Summaries of letters of William Blakey to HvL

English translations of typewritten summaries (in Dutch), extracted from [Brieven]. The summary number in brackets precedes the date.

*In several summaries the term **pulsometer** is used for Blakey's pumping device (which was based on Savery's pump, and which Blakey would probably have designated as something like "my pump"). Pulsometer was the proprietary name of a late 19th century revival of the Savery principle (1871, Hall, USA), anachronistically inserted by the writer of the summaries, presumably because it was widely known.*

[28] **1774-12-27 (from Paris)** WB replies to a letter with six queries from HvL; the queries are repeated below, with WB's replies.

1. What is WB's opinion of the plan to raise water with a lever engine? WB uses pulsometers, and it is self-evident that he prefers these over lever engines.
2. Has WB calculated his engine? WB's pulsometers are suitable for both shallow and high lifts. WB finds lever engines unsuitable for shallow lifts as encountered in Holland. For lever engines a much higher vacuum is required than for pulsometers, which often causes problems in summer.
3. Does WB know that the lift will be only 5 ft? At this small lift WB's pulsometer consumes only one-sixth of the fuel needed by a lever engine.
4. Does WB know that the quantity to be raised is 180 to 300 cu.ft per stroke? WB considers this a very large quantity, which the proposed lever engine is too small to handle.
5. Which manner of raising water does WB prefer? WB: the lever engine is unsuitable as 5 ft head corresponds to only 1/6th of atmospheric, so that the engine will not be fully utilized.
6. For which purpose are WB's four previous engines used? The first sucks from a 22 ft deep well and lifts another 10 ft; the second sucks 16 ft and raises 10 ft; the third is a portable engine sucking from 6 ft and raising 6 ft; the fourth sucks 25 ft and raises 25 ft. WB has a fifth engine raising water 40 ft and a sixth engine raising water for feeding a waterwheel which powers a marble-cutting works. All other engines serve to pump mains water or to irrigate gardens.

In conclusion, WB advocates his pulsometers, and he urges the granting of a patent in Holland. He guarantees fuel savings of 50% compared with any other engine. He adds a PS: if the boiler for the Oostpoort engine has not yet been manufactured, he can supply one which saves at least half the fuel, if not three quarters.

[29] **1775-01-13 (from Paris)** HvL had written to WB on 5 January, that fuel consumption is not an important issue in the Netherlands, as there are ample supplies of cheap peat. WB again recommends the pulsometer. WB then gives an example of how he calculates his cylinder diameter. His engines do rarely more than 4 strokes per minute. Everything depends on the more or less fierce burning of the fire. WB thinks that the envisaged boiler for the Oostpoort engine is too large. His own boilers are much smaller, with a diameter not more than three times the cylinder size.

WB had promised the Duke of Chartres to publish his inventions, but he reneges on this, wanting to keep everything for himself for the time being, as he is surrounded by people striving to enrich themselves at his expense, and as he wants to bequest his inventions to his children, as he feels the burden of age, having turned 63. The reason his boilers are so much smaller than those built by other engineers is, that he uses continuous boiler feed. This also results in large fuel savings.

Concluding, WB is prepared to undertake the erecting of the engine for HvL under the following conditions: He is to be paid 100 Louis d'Or on his departure from Paris, another 50 upon arrival in Rotterdam, and a final 50 after the engine has satisfactorily worked for 8-10 days, altogether 200 Louis d'Or. In addition he requests an assistant who speaks French or English, as he does not understand a single word of Dutch.

[30] **1775-01-16 (from Paris)** WB advises HvL to make the boiler cover not of lead (as commonly done nowadays) but of copper. He sums up the drawbacks of lead covers, and the advantages of copper. A copper cover is also convenient for fitting the steam pipe to. WB recommends ordering 20 copper plates from Wm. Pengree Esq., Snow Hill, London: width 3'2" at one end, 8" at the other, 4 lbs/sq.ft, plus 2 circular bottom plates of 3' diameter, 4 lbs/sq.ft, with somewhat to spare. WB knows Pengree for being one of the first and best copper experts in England, with large workshops, powered by 10 waterwheels. They charge 1 shilling per pound copper, exclusive of commission. In a PS WB gives an outline of one-sixth of the cover, showing the arrangement of the plates with overlap and rivets.

[32] **1775-01-30 (from Paris)** First of all, WB denies that he would have made proposals to alter the boiler and the cylinder. All he wanted to say is, that the boiler is much too big and could serve for two cylinders of that size. With WB's method even two more. Further, WB gives information about various manufacturers in England. Firstly, Abraham Darby of Coal Broke Dale in Shropshire, the first to make pig-iron with pit-coal, and who made all cylinders now in use in London, only one excepted. Then there is Wilkinson's New Willy works near Brownsley, 3 miles from Coal Broke Dale. Once Blakey saw ten cylinders in hand in the foundry pit there. New Willy was established in competition with the Coal Broke Co. and with the Carron Co. in Scotland,

but Mr Wilkinson is a master in this field. In London there is also Mr Bricket & Co.'s Falcon foundry near Black Friars Bridge.

Some theoretician appears to have been critical of WB's work, at any rate WB writes that he respects this "mathematician without practice" as much as he does Abbé Nolets of the Encyclopédiens Falsétics. This theoretician, whose name is not mentioned in the letter, appears to expect more problems with low lift than with high lift.

WB thinks he saw the boiler for HvL in Mr Wilkinson's store, Mr W. admitted he had an order for Holland (Ed. Note: probably the boiler plates, as the boiler was to be assembled in situ). According to WB this boiler is big enough to serve a 90" cylinder. Mr Wiggling of the Carron Co. claims to have cast cylinders up to 84", and Mr Darby claims he can make them up to 90" dia. and 15-16' length. Mr d'Auxiron is making a fire engine for a boat to ply between Rouen and Paris.

Again, WB pleads for the adoption of his engine. He would like to be the first in Holland, and then raise twice the quantity of water, without burning one additional bit of wood. He strongly advises against a 25' dia. boiler, this is much too large, and he has seen them wear out in a couple of years. If his travel expenses to Holland are thought too high, he will accept 50 Louis d'Or upon leaving Paris, 50 on arrival in Rotterdam, and 100 after the engine has worked satisfactorily for 10-14 days.

[33] **1775-03-06 (from Paris)** WB will be in Coal Broke Dale shortly and investigate if HvL's boiler is indeed being made there. He again points out his large experience with fire engines. He is not worried about 5-6 ft lift. Anyone seeing problems there, should not concern himself with engines. He has investigated the Haarlemmermeer drainage problem 40 years ago. He regrets that his coming to Holland is not considered necessary. The provinces Lorraine and Burgundy have shown more sense, and are now profiting. WB would not undertake the erecting of the engine without remuneration, as he would then be without income for several months.

In a PS, WB returns to the Haarlemmermeer drainage. He calculates, that the reclaimed land would be worth several million pounds, and would return thirty thousand pounds per annum. He reckons to require four years to do the entire job, and if pulsometers were used it would even take less time, and save 1/3rd of the fuel.

[35] **1775-03-28 (from Coal Broke Dale)** WB writes that he was right, and that HvL's boiler is in Mr Darby's stores in Coal Broke Dale. Mr Darby got the order from Mr Wilkinson; he will despatch the boiler over land to Chester. The cylinder is being made in Bursham (Ed. Note: this is at variance with earlier letters, where WB sees the boiler in Wilkinson's store; in letter 1775-05-11 HvL states that the cast cylinder and the riveted iron plate boiler were received from the New Whilly foundry).

Mr Darby has made three cylinders for WB, all for Lorraine. WB wants to send them to Rotterdam, would HvL despatch them further?

[71] **1776-12-15 (printed pamphlet, probably open letter to The Prince, from Liege)** This would seem to be an open letter to Stadtholder Prince Willem V, and unconnected with the fire engine project(s). The immediate cause for writing it is unclear, so is the choice of subject. The cause may have been the work of his friend Falconet. He agrees with the latter's attacks on the Encyclopedists, as these pretend to be scholars, while in reality they are fools, at least on subjects of which WB knows something. WB praises the Classics in all respects, whereas he has nothing but contempt for the achievements of his contemporaries. He discusses sculpture, hydraulic engineering, classical lifting devices, shipwrighting, and military fortification techniques, and for each he concludes that the Classics had a better understanding of the laws of nature than WB's contemporaries.

[63] **1777-02-02 (from Liege)** WB complains bitterly about the shameful way he is being treated by the Royal Engineer (Ed. Note: *l'Ingénieur du Roi, France*). The latter had told him, that HvL had petitioned the States General for permission to build a fire engine. WB cannot understand the cause of the Royal Engineer's change in attitude after three years of faithful friendship. He evidently intends to sacrifice WB to his vanity, and WB has found out that he is a hypocrite in the full sense of the word. By his cheating and back-handed fiddling he has defrauded WB of 200 Louis d'Or. WB regrets that HvL is upset about the bad relationship of WB and the Engineer. WB had made the Engineer a partner in one of his projects, but this has brought him (WB) nothing but losses. WB considers him to be a plague to society. Enclosed, WB sends a plan drawing, and in a PS he apologizes to HvL to have indulged in these nasty details of his quarrel with the Royal Engineer.

[64] **1777-03-23 (from Liege, Blakey's partner Devrier to HvL)** Devrier starts by thanking HvL for his sympathy with the misfortune which has befallen him in being associated with WB. Fortunately, however, their contract has been well drawn up. Each partner is liable for his own actions only. WB is not empowered to negotiate or sign on behalf of the partnership. Also he cannot incur debts or draw money. As a consequence, Baron de Fraiture does not owe WB any money. On the contrary, WB must complete the job, or pay damages to the Baron, and those damages will be considerable.

WB's accusations of Mr Pengrée are also unfounded. Mr Pengrée is entitled to full payment by WB. To facilitate Mr Pengrée's demands, Devrier is prepared to withdraw completely. Devrier admits being to blame as well, as he has recommended WB, who does not deserve any recommendation.

[65+65a] **1777-05-10 (from Liege)** WB further explains his conflict with the Royal Engineer, who is a nail in WB's coffin. The Conte de Waestenraad introduced him to Baron de Fraitures, with whom WB founded a company for the smelting of iron. The Royal Engineer drew up the contract, capital was set at 30,000 guilders. However, the Engineer also wanted the fire engines to be part of the contract. WB lacked additional money for this. What he had, was needed for his travels to Holland and England. The Engineer then told him to have spoken to the baron, WB would get the 2000 Livres reimbursed upon his arrival in England. Later the Engineer said, that the Baroness was against the entire undertaking, and so the Baron would put up only 15000 Francs. WB has always suspected that the Engineer's including an article about fire engines had been a sneaky manoeuvre. On 2 January the foundation charter was signed, and 200 Livres for WB were to be sent to mr Pengrée in England, but nothing of the sort happened. Neither did the Baron pay his contribution. All that happened was that workmen started on the Crooswick engine, which is now completed (*Ed.Note: Crooswick or Crooswijk, near Rdam, now absorbed in that town; no details known about a Blakey engine there*).

HvL had seen a pamphlet by WB, in which the HvL fire engine is attacked. WB now writes that this reproach is undeserved, as he did not know anything about the HvL engine when he wrote that pamphlet (*Ed.Note: this must be the Rotterdam engine; pamphlet not located*).

To further illustrate the incompetence of the Royal Engineer, WB sends HvL a copy of a letter by mr Lochepui. WB considers the Engineer as a swine without any talent, but extremely dangerous, but nevertheless he shall have his sixth part of the profit of those projects in which he has unfortunately become involved. Anyway, the Engineer has a right to live, even though he is out of his mind, humanity demands that. WB regrets having to write like this, but he must defend himself against this idiot.

(Ed.Notes: The enclosed letter contains 3 questions and as many replies. From the above letter it must be assumed that the questions were put by mr Carrey, who appears to be the Royal Engineer. From the above letter the replies appear to be mr Lochepui's. The questions have no connection with the Oostpoort engine, and so they are not further discussed in these summaries. WB has only enclosed this letter to show clearly, that he is right in calling the Royal Engineer an incompetent and untrustworthy customer).

[70] **1777-07-16 (printed pamphlet, open letter to Prof.Allamand, from The Hague)** This is a printed open letter to Allamand, professor of physics at Leiden University. WB proposes to use pulsometers to dredge the IJ river and the canals of Amsterdam. A plan is rumoured to increase the current velocity of the IJ by putting the bordering dams closer together, but WB shows that silt deposit will then occur at the foot of these dams, as experienced at London Bridge, and moreover the quiet conditions of anchored vessels will be disturbed. The spoil must be deposited in the IJ mouth at low tide to be transported to the open sea by the tidal current.

[74] **1777-10-20 (printed pamphlet, open letter to M.Morand, from The Hague)** WB defends himself against assertions by M.Morand, Médecin de la Faculté de Paris & Membre de l'Académie Royale des Sciences, in a fat volume he wrote about Coal (Charbon de Terre). In it, he mentions WB, putting several things down on him, against which he now defends himself. Morand writes that WB has written to several persons to induce them to invest money in an invention to smelt iron with pit coal instead of charcoal. He would demonstrate this as often as anyone would desire, and he is prepared to sell his invention for 500,000 Livres. He would even be prepared to establish a company. A person of great influence was said to have been won over. WB was said to have 12000 Livres at his disposition to build a furnace, but the whole thing was said not to have been taken up as yet. WB now states the facts as he sees them. The gist of his defence is, that he did not write to people soliciting money, but that, quite the reverse, people wrote to him, offering large sums of money for the disclosure of his inventions. Every time WB then made long journeys to contact those persons, they turned out to be absent, or when it came to payment they quibbled, so that WB got nothing. All this transpired in 1774. Then WB heard nothing for a period, until in 1776 a mysterious individual made him another proposal. This individual turned out to be the Royal Engineer (l'Ingénieur du Roi de France et de Navarre). This also came to nought.

Furthermore, Morand had asserted that the bellows could only be worked by a man of exceptionally heavy built. WB denies this, a normal workman can work them. Finally, WB writes, no one can fool him about ironfounding, as he has been closely associated with iron and steel for fifty years.

[69] **1777-11-14 (from Amsterdam)** WB is in Amsterdam, just having concluded an agreement with the Municipality (*Ed.Note: term probably inserted by summary-maker; at that time it would be the City Corporation*), to provide and erect a large engine. He encloses copy of a letter by his partner Baron de Fraitures, to show the meanness of Monsieur DesRues, whom HvL still trusted (*Ed.Note: would appear to be same as Devrier, see summary [74]*). WB also encloses two pamphlets he has published in France (*Ed.Note: to the Prince and to Allamand, summaries [70],[71]*).

[73] **1777-11-19 (from Amsterdam)** WB thanks HvL for his congratulations on occasion of the Amsterdam contract, but he considers the delivery period very short. The cylinders for mr Pion, for which HvL had undertaken the order with WB, and transport, have been sent to Cologne by mistake, and it is now intended to use them there.

[72] **1777-12-13 (from Liege)** WB regrets not having had time to see HvL when returning from Amsterdam to

Liege. He encloses a printed open letter to Morand, who had written an extensive treatise on coal, but WB does not understand where this idiot has dug up all this nonsense, about a subject on which any English farmer is more knowledgeable. (*Ed.Note: for this pamphlet see summary [74]*)

From this date, no further evidence of letters is found in the summaries. R.L.Brouwer has contacts with WB in Amsterdam until WB quite suddenly leaves for Liege in April/May 1779. Around this time his engine was dismantled [1799-05-14].

11.2. Summaries of letters of Rinze Lieuwe Brouwer to HvL

English translations of typewritten summaries (in Dutch), extracted from [Brieven]. The summary number precedes the date.

Many of the letters contain notes about the IJ. This is the main body of water of the Port of Amsterdam. At the time it was an open inlet of the rather shallow Zuiderzee, tidal with a reduced range (compared to the North Sea). Amsterdam, then the main port of the country, spent a great deal of money to combat silt and shallows.

[131] **1779-02-23** RLB has received documents sent by HvL via mr Brinkman. RLB would have submitted his entry due 1 March (*Ed.Note: for the essay competition set by the Batavian Society for improvements to the Rotterdam engine*), had not unpleasant circumstances impeded him; the making of the drawings has also suffered from setbacks. He asks for four extra days to submit his entry. RLB has a sketch of Blakey's device. They are still busy making improvements. It is rumored they will get money from the Treasurer, which RLB does not understand, as the entire job had been contracted for 6000 guilders.

[132] **1779-03-12** RLB is ill and must rest every afternoon, so he could not submit his entry for the essay contest on time. He would never have thought that Van den Wal would have drawn up such an insignificant report, and signed it with his name. Blakey's engine will be dismantled and sold to Russia. Blakey blamed the sun's rays—maybe those will be more favourable to him in Russia. For Amsterdam he is working on an entirely different model.

[137] **1779-04-25** RLB corrects his earlier statement that the Blakey engine would be dismantled and sold to Russia. Another engine, which Blakey is working on, is destined for that country. Eight days ago RLB has seen Blakey's engine, and he has made some sketches of it for HvL and Prof. Camper. He will have to go back to sketch the control slide valves. The engine is being modified all the time, and every bit of it looks slipshod and inadequate.

[138] **1779-04-28** RLB has met Blakey, and walked with him for half an hour, discussing the engine. Blakey had been busy packing the engine for Russia. In a few days the Amsterdam engine will work again, and RLB intends to be present. RLB includes his description of the engine, plus one by Blakey himself. One of Hoogendijk's servants has told the Town Clockmaker of Amsterdam, that the Rotterdam engine is to be demolished. RLB asks HvL if this is true, but hopes that it will turn out to be a false rumour. (*Ed.Note: that engine was eventually broken up c.1785*) RLB will go to the country for a few weeks to seek improvement of his health, probably to Nieuwendam (*Ed.Note: on the N. shore of the IJ mouth*), because there he will be able to continue his investigations of currents.

[139] **1779-05-14** RLB has tried to find out if Boulton has been in Amsterdam, but has got none the wiser. Still, it cannot be ruled out, as RLB's friend Van den Hart, who might have told him, has been seriously ill. RLB does not believe the Watt engines to have an important effect. Blakey's engine has now, indeed, been dismantled and Blakey has unexpectedly left for Liege, without seeing RLB and Prof. Camper first (as he had promised).

[141] **1779-05-27** HvL's letter has done much to cheer RLB up. He had been rather depressed of late, as his health left much to be desired, and his right arm had been numb. But now he has good hopes to be able to resume his research into currents. He cannot comprehend, that Steenstra and Blassière wrote a favourable report on Blakey's engine. Of Steenstra he cannot believe it, as that man has always reviled Blakey—not because he is knowledgeable about engines, but as Blakey was too poor to mollify him with a pile of ducats. Blassière must be truly incompetent to say anything favourable about something as misshapen as Blakey's engine. RLB has now sketched and scrutinized the inside of most parts, and there's literally nothing good about it.

[142] **1779-07-23** RLB is taking measurements of current velocities in the IJ. He sends the observations, there are eight more to follow, plus a drawing of the measuring device. 's Gravensande (*Ed.Note: a prominent Dutch natural philosopher of the early 18th century*) and others were of the opinion that the flow is proportional to the average velocity and the square of the velocity (*Ed.Note: !?!*). This is incorrect. According to RLB it is only proportional to the velocity, but it has also turned out that the flow is strongly dependent on the depth. The deeper the water, the higher the velocity. RLB has shown these observations to his friend Prof. Camper, and also to Maij, but the latter is not in his right mind. RLB wants no more to do with Maij, who did not even know HvL.

The third little volume on Eckard's scoopwheel (*Ed.note: an inclined type of scoopwheel, see Eckhard in Glossary section*) is now ready. RLB cannot understand the fuss raised over this thing. Also ready is the report of Steenstra and Blassière on Blakey's engine. Steenstra has compiled it. It is supposed to be a masterpiece. Would HvL procure for RLB a drawing of Boulton's engine? It would seem that Boulton promised 4000 guilders to Krants if he can arrange for Boulton to build an engine in Holland. He had done better to ask Steenstra, who would have taken more trouble.

The measurements on the IJ by several philosophers have now been included in the Yearbook. Steenstra's observations are definitely wrong. They are misleading, and poor to the highest degree. The IJ is silting up from all sides. The cost has already exceeded 250,000 guilders (*Ed.Note: probably mainly dredging to keep the port of Amsterdam accessible*). RLB had predicted this. He has discussed it with Commissioner Van de Poll, who

wants him to consult with Steenstra. RLB does not expect any results from that, as Steenstra and himself don't go well together. He would be willing to speak in public, in the presence of experts, councillors, and of mr Steenstra.

To realise his entire plan for the IJ, RLB would need 150 thalers, which he'd like to borrow from the Society. This would allow him to hire a boat and four men. Steenstra asserts that the outgoing tide flows much faster than the incoming one. RLB believes this to be in error. He wants to take additional measurements at 22, 24, 26, and 30 ft depth. The measuring device is suitable for this, if the tubes are stacked. It should then be possible to draw up equations of motion for the water. If the Society decides favourably, RLB can be reached at B. Meckman, 66 Nieuwe Lojerstraat.

The cost of wrought iron pistons and cases is 4.5 pennies a pound. RLB does not expect much support in Amsterdam, for which his pamphlet against the Lector is to blame.

[147] **1779-08-07** RLB feels much honoured by the honour bestowed on him by the Directors of the Batavian Society, in offering him Consultant-Membership. He hopes to live up to the distinction.

Maij and Steenstra are much to blame for the spoiling of the IJ. Within the next few days RLB will come to Rotterdam to take more accurate measurements of the engine. He hopes to be able to do this without the assistance of English workmen. He would like a copy of Boulton's drawing, as he will probably follow that example (*Ed.Note: This is obviously an early stage of the Heemstede engine project, completed in 1781 as an atmospheric engine; at this point Brouwer and Hope were considering a Watt type engine, either with or without the consent and cooperation of B&W; see summary [154] below, and letters [1779-07-02; 1779-08-05; 1779-08-06; 1779-08-15]*). No translation will be necessary, as RLB understands that language. RLB has spoken to Duitz, Steenstra's patron, and he is certain that they will have to implement his system to improve the IJ. RLB hopes to speak to Rainey soon, but has no great expectations. Artisans of such an advanced age should not travel abroad, and he displays too large a sign. (*Ed.Note: Robert Rainey had contacted HvL a week earlier about a possible belated entry for the essay competition about the Rotterdam engine; the summary of his letter appears self-confident, but not to exaggeration*)

[152] **1779-09-14** Enclosed, RLB sends two copies of the Lector's (*Ed.Note: Steenstra?*) report, with the request to give one to Steven Hoogendijk. He roams the IJ every day, the results of which he hopes to send to HvL shortly.

[153] **1779-11-02 (from Nieuwendam)** A fortnight after his return from Rotterdam, RLB has fallen ill once again. He has managed to do about fifty experiments on the IJ, but his condition deteriorated. He then fell gravely ill, which turned out to be his salvation, as he has now fully recovered and can draw once again. The experiments have been done at 16, 24, and 28 ft depth. Many setbacks occurred, as time and again the tubes burst and new ones had to be made. The new design with an iron reinforcement answers well. In 8 days he hopes to be able to send HvL the sketch of the Watt engine.

RLB has heard, and read in the paper, that the Batavian Society has admitted him as a member and in addition bestowed the silver medal on him. He asks if this honour is not a bit premature, perhaps in his case it would have been better to wait until he has concluded his experiments. His new address is Gerrit van der Laag, wine merchant, Droogbak, Amsterdam. He hopes that the engine will not be fitted with a disk- or scoopwheel. He intends to make a few modifications to his thesis and to the drawings.

[154] **1779-11-15 (from Nieuwendam)** RLB has written to Watt & Boulton for further data on their engine. Their reply differs much from the sketch they had sent earlier. (*Ed.Note: This is almost certainly the exchange of letters of Hope and Boulton & Watt [1779-07-02; 1779-08-05; 1799-08-06; 1799-08-15, and the note appears to indicate that RLB drafted the Hope letters]*) The steam cylinder would have to be 15 inch, with a 4 ft stroke and a 31 inch pump. RLB calculates, that W&B assign very little power to a 15 inch cylinder. He asks if the beams of the four English engines HvL wrote about, have equal or unequal arms. If they are equal, one can safely reckon 7 to 8 pounds per inch (*Ed.Note: this would mean per square inch, corresponding to a 50-57 % vacuum, a rather conservative but customary value — see the note about engine load in the Glossary section*); if unequal, then RLB will have to completely redo his thesis. He asks, if HvL would inquire in England after the following (*Ed.Note: RLB uses the term "buis" or "stoombuis" evidently for what most engineers would call the (steam) cylinder, and as such it has been translated*):

1. What would be the cost of a 15 to 17 inch cylinder with the boiler, but excluding the water piston.
2. What would be the length of such a cylinder for a 6 ft or a 5 ft stroke, and would a lever of 22 ft be adequate.
3. What would be the required boiler size. Would 6-7 ft be adequate. What is the plate thickness of the Rotterdam boiler, and is the bottom as thick as the rest.
4. What is the wall thickness of the steam cylinder, is it more than a half inch.
5. What is the price of the cast chains, or are these not reckoned per pound.
6. The price of the cylinder of the air pumps (*Ed.Note: the summary says "ligtpompen", which does not make sense; if the i is a typo for u, the meaning becomes air pumps. The plural may also be a typo*).
7. Have the valves been made in Rotterdam or in England.

Messrs. Watt & Boulton should not learn that these inquiries are made in England. (*Ed.Note: i.e. RLB obviously considers evading the Watt patent; summary 161 indicates that HvL did indeed make the inquiries requested*) The letters of these gentlemen are a bit devious. If the English prices are not much lower, RLB will order the castings and ironwork in Holland and Remscheidt. He will have the steam cylinder made of metal (*Ed.Note: i.e.*

brass or bronze), a thickness of a quarter inch will be adequate. Steam cylinder stroke 5 ft, cylinder length 6 ft, beam 24 ft, unequal arms. (*Ed.Note: the Heemstede engine would eventually be an atmospheric engine 17 or 18 Rhineland inch bore by 5 Rhineland ft stroke, no parts from England, set to work in 1781*)

RLB returns the original Watt engine sketches plus two copies, one for HvL, and one for Father Hoogendijk. Also a third copy, which RLB would like to have back with comments.

Furthermore he sends a letter to be forwarded to Dr. Bicker, in which he thanks for the honour bestowed on him., and one for Assembergh, asking him to hand the medal to HvL, who will then give it to RLB when the opportunity arises.

[155] (*Ed.Note: The description below refers to a drawing [156], which appears to be lost; it may well have been a copy of the Watt sketch mentioned above. Even without the sketch the description is clear enough, and it shows that the atmospheric-engine-reared RLB had some difficulty in interpreting the Watt design*)

A. Steam pipe from boiler to cylinder

B. Tube connecting the steam pipe with the space above the piston. RLB does not understand how the steam above the piston can be compressed, as there is no valve between A and the cylinder.

C. This pipe admits steam through the bottom of the cylinder

D. This pipe connects the space below the cylinder to the condenser. The purpose of this pipe is unclear.

E. Condenser.

F. Condenser cistern

G. Valve to admit water to the condenser

H. Air pump

J. Valve to keep the air pump piston covered with water

K. Feed pump

L. Furnace

M. Water pump with unknown purpose.

The stroke rate is said to be 18 per minute, and the force (*Ed.Note: i.e. engine load, see Glossary*) 10 lbs per inch, which RLB doubts.

The excess weight on the pump side must be large, as the pumps H and K must also be raised.

RLB is of the opinion that the Watt & Boulton engine as drawn cannot work, and he is convinced that Watt & Boulton represent a lot of quackery. They must think that a one-eyed man may reign as King in Holland. He recently saw two letters of Watt & Boulton, which clearly show that their engine is not more powerful than the common ones (*Ed.Note: there is no doubt that, basically, a Watt engine does not provide more power than a same-sized atmospheric one. What does not seem to occur to RLB is the fuel-consumption or efficiency issue. Perhaps not surprising when, in the correspondence with William Blakey, HvL explicitly dismisses this issue as being irrelevant in Holland with its plentiful supply of cheap peat.*)

[159] **1779-11-25 (from Nieuwendam)** RLB has again become gravely ill since 15 November. He is much weakened. He is glad, that the spiral drum (*Ed.Note: a novel rotative water-raising device which appears to have been a pet idea of Steven Hoogendijk*) will not be implemented. Who could have proposed such a device?

The Hartzinck scoopwheel is taken from Vitruvius. If the wheel is moved by the Belidor valve, it will cause jerky motion, firstly during initial starting, and secondly by the centrifugal force of the water remaining inside as the pawls suddenly halt the motion of the wheel. RLB believes that the discharge will be insufficient. Before implementing this wheel, a model should be made. RLB does not expect success, but experiments can never be bad, one always learns something useful from them. In his opinion, pumps are still the best for fire engines.

In 8 days he hopes to be fully recovered, and be able to return to Amsterdam. He then expects to come to Rotterdam for 3 days, to take a few more measurements. He hopes that De Mortake will consent to remaining in Rotterdam for the while.

[161] **1779-12-09** RLB thanks HvL for the information sent. The prices of the ironwork quoted in England, were more favourable than anticipated. RLB has communicated these without delay to Hope, for whom the engine is destined. RLB has been ill again for 8 days, but is now recovering. He has made, for Hope, a drawing of a fire engine after the principle of Newcomen. The beam is 24 ft, the cylinder diameter 17 inches. The water pumps must then be 38 inches. The stroke is 5 ft. (*Ed.Note: there can be little doubt that this is the drawing of which a photograph survives, and which has been reproduced in many publications, e.g. in [vdPols, Verbruggen, 1996].*) RLB will not venture to have an iron cylinder cast in Holland; a copper (*Ed.Note: i.e. brass*) one would be feasible. He knows of a good address. A wall thickness of a half inch should be adequate. For the other parts such as boiler, chains, pipes, and valves and inquiry has been made in Remscheid. He hopes to be able to work entirely without parts from England, but he is afraid the cylinder may have to be procured from there.

RLB is pleased, that the spiral-scoopwheel has now been abandoned completely. For the fire engine he knows no better device than the common lift pump.

Wagenburg has handed to him the Society's medal. This letter will be carried by his landlord, together with Brandligt's pamphlet opposing Steenstra on the IJ problems. RLB knows no one who knows as much about the IJ as Brandligt. RLB is still very weak and he suffers spells of dizziness, so that reading, writing, and drawing require a lot of effort. His address is at Adrianus Kaam, mirror merchant near the Vispoort on the Rokin. Maybe Hope does not want it generally known yet, that the fire engine is destined for him.

[169] **1780-01-28** After RLB had sent Brandligt's pamphlet to HvL, he has again suffered a relapse and has been gravely ill. His right arm is now almost totally useless. Mr Hope has decided that all parts for his fire engine shall be made in Holland, including the cylinder, which will then have to be made of bronze. The boiler of copper, 20 ft at the largest width, 18 ft at the bottom (*Ed.Note: these are obviously circumferences, not diameters*). Everything to be manufactured and erected under supervision of RLB, who is pleased no end. With this letter RLB includes a few sketches, dimensionally not entirely correct, for HvL's comment. As soon as the weather will be less bleak, RLB plans to come to Rotterdam to have another look at the fire engine. The beam will be 26 ft long, but 1/7 shorter on the water pump side (*Ed.Note: this would again refer to the Heemstede engine*). The fire grate will have air supply from four sides.

HvL had not understood some of the details in RLB's drawing, e.g the design of the Belidor valves was not clear. RLB now has a specimen of such a valve, so he would now be able to make a clearer drawing. Would HvL please return the drawing?

RLB is now having two devices made to measure the depth of the IJ. In this way he hopes to be able to draw up a definite law for the currents. His address is still at the mirror merchant Kaam, on the Rokin near the Vispoort (*Ed.Note: the typed summary gives the name as Vraam, but this could be a transcription error*).

[174] **1780-03-22** Illness has prevented RLB to reply to HvL's letter of ult.January. His arm has now recovered so far, that he is again able to draw. The pattern for the cylinder is ready. Work is in hand on the boiler and the chains. The cylinder diameter will be 18 instead of 17 inches. RLB had made the injection nozzle 1 inch, but Belidor's injection cock has only 6 lines (*Ed.Note: = 0.5 inch*) bore. RLB will correct this error. According to Belidor the injection volume per stroke should be 9 to 10 pints (*Ed.note: the pint was a somewhat variable unit at the time, but 0.5 liter comes close*). RLB asks information on the size and type of bricks used for the Rotterdam pumping station. The stroke of the working beam will be 3.5 ft (*Ed.Note: this working beam would probably be the auxiliary beam operating the house pump, visible in the 1779 drawing. As measured from the drawing, the pump arm of this unequal beam would have a stroke of about 3 ft*). The firing floor will be about 6 ft below the grate, with two sets of steps leading down. Air supply to the grate from four sides. Bottom of boiler 1.5 ft above grate, which is 2.5 ft wide. In 14 days RLB hopes to come to Rotterdam. (*Ed.Note: the following would refer to the house pump again; from these data a pound of 0.48 kg and a pump stroke of 3.5 to 4 ft could be deduced*) Lift of the water 30 ft, pump diameter 5 inch, water column weighs 261 pound, 33 pound water lifted per stroke. Pump well 10x12 ft.

On his way to Rotterdam RLB will take a look at the Leiden engine of mr De Pauw (*Ed.Note: This model was made in 1774 by instrument maker De Pauw for Prof. Allamand; it is now in the Boerhaave Museum in Leiden*). He will get an introduction from Prof.Allamand, of whom RLB was one of the earliest students. The proof of RLB's IJ map has been corrected. RLB encloses a brief paper of Slob about the silting up of the IJ, plus Steenstra's critical comments. Slob is right, RLB says, but Steenstra's pamphlet beats about the bush. The Amsterdam papers have run a plate of an invention of Witz, purporting to be a dredger. RLB will bring the plate when he visits HvL, so they can have a good laugh about it, because this machine would only work in the imagination of people with twisted minds. And what to think of the papers which kick up a fuss about such an absurdity.

[176] **1780-05-01** In his previous letter, RLB had promised to come to Rotterdam within a fortnight, but a knee injury and wound fever regrettably have made this impossible. He is now fully recovered and will depart tomorrow, via Groenendaal near Heemstede where mr Hope's engine is being erected. He will bring two sketches of dredgers for HvL's perusal, from which HvL can see what madness reigns in Physics today. His present address is at the Equerry Ary van Soest, at the Grootte Houtpoort, Groenendaal under Heemstede near Haarlem.

[179] **1780-05-28 (from Groenendaal)** RLB is now fully recovered and in 8 days will depart for Rotterdam via Leiden, where he will look at mr Pauw's engine. He hopes to stay in Rotterdam for 4 or 5 days.

The above is the last RLB letter in the summaries. From the letters RLB appears to be much at ease with the pen, and anxious to tell HvL about his exploits; but also his poor health is evident. Did he write about the successful conclusion of the Heemstede project in 1781? Were there more letters (now lost)? When did RLB die? In [1783-12-19] to De Luc, HvL refers to RLB without adding "late" or such, so one must assume he was still around then. Even in the brief honourable mention of the Heemstede engine in letter 1785-01-30 one might have expected a mention of RLB's role, if he had passed on.

11.3. Summaries of letters of Jabez Carter Hornblower to HvL

English translations of typewritten summaries (in Dutch), extracted from [Brieven]. The summary number precedes the date.

[66] **1777-05-24 (from Pensance, Cornwall)** JCH has returned to England after completion of the Rotterdam engine, and he now writes to HvL how he longs for Rotterdam. He profusely compliments HvL about the excellent treatment in Holland. His brother has in the meantime made an invention which allows to generate a vacuum with one-tenth of the fuel hitherto used. Hornblower will make a model. In London he has inquired after the fire-engines (*Ed.Note: hyphenated, the engines of the fire brigade*), but these have been moved, and he will return to them later. He has visited a Watt engine which supplies water to a distillery. The engine looks beautiful, but the fuel consumption is disappointing, 12 bushels of coal, compared with 9 bushels for the old engine. His father is building an engine to Watt's plan, so JCH will soon be in a position to compare. He concludes with compliments for messrs. Verster and Schouten.

[114] **1778-10-15 (from Tresaddren, Cornwall)** JCH apologizes for having waited so long in writing to his Rotterdam friends. If HvL were to learn, however, what has befallen him, he would wonder how JCH can still be among the living. He thanks HvL for the pamphlets and for the information about Blakey. As HvL knew, Hornblower was working on his brother's invention to raise water cheaply. Money, and the influence to obtain patents, were lacking, however. Then JCH was commissioned to erect a Watt engine, and he noted that this engine included many of his brother's inventions. Anyway, JCH is full of praise for Watt whom he regards as the best mechanical engineer alive, who has enormous knowledge of all kinds of physical phenomena. At present, he is in Cornwall, too, occupied with experiments on rotary engines. If these succeed, writes JCH, Rotterdam's problems will also be over. The rotative engine can then drive a scoopwheel. JCH is prepared to make a model. If this attempt were to succeed, HvL might assist in obtaining a patent in Holland. He would then get half the profit. In addition, JCH is busying himself with the prize subject (*Ed.Note: Batavian Society, problems with the Oostpoort engine, closing date 1779-03-01*). If Steven Hoogendijk were not so impatient, JCH would do a comparison experiment to remove all doubt. All sluices must be closed. Then let the fire engine pump until the Rotte level has been reduced by 1 ft. Then wait until the level has risen to its former value. Now have the windmills work until the level has gone down 1 ft again. This will prove the great advantage of the steam engine. JCH would like to know how the Eckhard windmills and the Blakey fire engine are doing. He has shown Blakey's French brochure to Watt, who had little favourable to say about it. Furthermore, England has had a visit from Father Pinto, who has a fantastic plan to raise water. When challenged to prove his claims, he took an air pump and a glass tube, evacuated the tube, and had mercury rise into it like in a barometer. He then was given a boiler and a tube of 40-50 ft long and started to build his engine, but then he lacked a drawing, which was in France, and he asked for permission to go and fetch it. In England they are still waiting for him to return.

JCH concludes with regards for messrs Verster, Schouten, and Kogel (father and son) and the gentleman at the Haringvliet (*Ed.Note: Hoogendijk*), whose health is regrettably deteriorating.

[128] **1779-01-25 (from Shiffnal, Shropshire)** JCH did not receive HvL's letter of 16 October until now. He cannot provide HvL with any information about the Jones engine. To be sure, he is familiar with the engine, but he is bound by a pledge of strict secrecy. However, as soon as HvL secures a patent, JCH is prepared to furnish all desired information, and moreover to give up half his profit to HvL. JCH includes a proposal for a contract. He asks HvL to have this draft contract perused by their mutual friend S.C.Lloyd. The problems with the pumps are largely attributable to leakage of the foot valves and of the floor. JCH thinks that the use of wood in the valves is to blame. He has not understood the sketches of Black's engine, which HvL sent him. He has shown them to Watt, who cannot make head or tails of them either.

[134] **1779-03-17 (from Shiffnal)** HvL is not prepared to enter into the proposal for a patent on Jones' engine. JCH is now prepared to send a drawing against payment of 100 pounds. HvL will then see, that the engine differs little from a Savery one, apart from the transmission, which is entirely new. If this engine is chosen, JCH will be willing to come for a remuneration of 15 shillings a week.

[135] **1779-03-23 (from Dimmington Wood near Shiffnal)** HvL has asked for information about the Jones engine. JCH can say that she appears to answer well, but he will write Mr Jones for more data.

[136] **1779-04-03 (from Dimmington Wood near Shiffnal)** JCH has asked Mr Jones, on HvL's behalf, what his conditions are for erecting an engine in Holland. JCH literally copies Jones' reply, which shows that Jones is prepared to send a complete engine if HvL secures him at no cost a patent, which grants only him (*Ed.Note: Jones or HvL?*) permission to import engines in Holland. In Holland they may then build as many engines as they desire, at the same price he charges in England. JCH wonders if this is to be regarded as a reply. As far as he knows, Jones' fee depends on the size of the engine. He recommends that HvL not take out a patent, but that he pay an agreed sum per engine. The purchase then automatically confers patent rights on HvL.

[160] **1779-11-14 (from Pwellheli, Carnarvonshire, N.Wales)** JCH has been very busy, and has not been able

to write earlier. He does not expect much from the modifications to the fire engine, if these should follow the prize-winning plan. Not that he is prejudiced, he does not even know the writer, but because he knows the situation in Rotterdam well (*Ed.Note: this refers to John Wright's entry, which was awarded a gold medal by the Batavian Society, but never implemented; modern scrutiny of this idea has detected a perpetual motion element*).

In Cornwall, JCH has made a coal hoist, as follows: a rope on a pulley has a bucket at one end and a basket on the other. A fire engine pumps water to a high cistern. Some of this water is used to fill the bucket, which starts to descend as soon as it is heavier than the basket. As the bucket end of the rope gets longer, and the basket end shorter, the bucket will accelerate downward. This is undesirable, so JCH hangs a chain from the bucket, long enough to always extend to the bottom of the shaft. As a result this end has a constant weight.

Currently he is also erecting an engine in N.Wales for Mr Weston. Then he will return to Cornwall to occupy himself with his hobby horse: the copying machine. He has advanced to the point where he can copy any plane object, e.g. a sheet of foolscap in less than 5 minutes. Against a proper sum, he is prepared to divulge the entire secret. (*Ed.Note: in February 1780 James Watt took out his first copying machine patent*) He closes with regards to Messrs. S.C. and C. Lloyd.

A direct letter [171] from John Jones to HvL, dated 1780-03-08, describes the engine, which is indeed on the Savery plan, with a float/piston separating steam and water; as such it appears very similar to the Blakey engine.

[177] **1780-04-17 (from Penshynder, N.Wales)** Via James Watt, JCH has learned about the essay competitions set by the Batavian Society. JCH has not submitted an entry, as he is convinced that, apart from HvL, no one in the Batavian Society is qualified to judge the entries. JCH is not enthusiastic about the ideas submitted, but neither is HvL. JCH appreciates HvL's perseverance in trying to improve the fire engine, but he thinks he detects a hidden pride in HvL, to perfect the engine without help from England. For polder drainage, JCH knows no better device than the scoopwheel. He is pleased to hear that another Society for the application of steam engines has been started in Haarlem (*Ed.Note: this refers to the Heemstede engine, a private project, not connected with any Society*). Boulton has visited Holland, but JCH cannot say what he has discussed with Hope, but he thinks that it must have come to nothing, as Boulton would not go to all this trouble for a small engine (*Ed.Note: see the Hope-B&W correspondence and the Brouwer summaries*). HvL errs, however, in calling Boulton's engine a fire engine. It utilizes the elasticity of the steam — ten, eleven, occasionally twelve pounds per inch. JCH continues with a description of the design and mode of operation of the cylinder. HvL should not attach any significance to the bad notices Punshon (*Ed.Note: one of the other entrants*) gives about Boulton's engine. Those people work an engine until it is worn out, without any maintenance.

JCH apologizes for having been, in his previous letter, less than clear on the coal hoisting device. He includes a better description, followed by some dimensions of a Boulton engine in Scotland and of one in Dennington Wood (*Ed.Note: obviously same as Dimmington Wood mentioned earlier*). JCH has learned, that a patent for a copying machine has been applied for — could HvL investigate if this is true? JCH will enclose two copies of a letter — one for HvL, one for Mr Lloyd.

JCH asks HvL if he will, during one of his evening strolls, would see Mr Prey, a painter living on the Delftsche Vaart, to whom JCH had promised to try to sell a few of his paintings. He has not sold any to date. If JCH does not succeed in disposing of them, he will return them as soon as possible. In his next letter JCH will explain the best method for transform linear to rotative motion. He concludes with regards to Messrs. Kogels, Monchy, Lozemans, Verster, Schouten, Cuthbertson, etc.

[185] **1780-08-23 (from Broselly)** JCH would use a scoopwheel in Rotterdam, now powered by a windmill, to drive it with a steam engine. Hitherto he could do his experiments without HvL's assistance, but now he needs some data. He wants to know the difference between the lowest and highest levels of the Rotte and of the boezem next to it. If his memory serves him right, the largest level difference was 4 ft, the scoopwheel diameter 18 ft, and the circumferential velocity 7 ft per second. JCH comments:

1. A circumferential velocity 7 ft/sec is excessive.
2. the construction must be such that no water is lost, even at low speeds, even as low as 4 ft/sec.
3. the quantity raised must be proportional to the level difference (*Ed.Note: probably meant inversely proportional*).
4. A scoopwheel should be able, in a given time period, to raise more water than a pump.
5. A scoopwheel is the simplest device in existence.

Concerning item 3, JCH notes that in this case the number of scoopwheels must be increased. JCH intends to drive the scoopwheel with a steam engine on the old plan (*Ed.Note: i.e. an atmospheric engine*). He hopes that HvL will be willing to bear part of the cost. He has ample free time now, and Amsterdam would offer an excellent opportunity to realize his plans. JCH has made a drawing of the entire plan. He is reluctant to send this to HvL, however, as there is a real chance that, in these turbulent times, it will get into the hands of adversaries.

JCH has made another invention, to wit a machine to copy letters with. However, he has heard that a patent for

such a machine has already been granted in England. He is afraid, that he will not profit by it. His machine is much cheaper than the one that is being regularly advertised, which sells for at least 6 guineas. As times are turbulent, JCH cannot divulge how his apparatus operates, but he is prepared to come over and bring two machines, each working on a different principle. JCH will attempt to patent these in Holland. HvL and mr Lloyd can then get a share in the business. On that occasion he will also bring a model of the scoopwheel for mr Hope. The power of the scoopwheel will correspond to that of a 42" cylinder, and it will be capable of raising 350,000 cu.ft. four foot high, with less fuel than usual with other engines. And if the quantity should not be proportional to the engine's power, it will certainly be so with its fuel consumption. Watt's steam wheel is in use at a few places in Cornwall, but only to power stamps. It is less suitable for land drainage. Its only advantage is a somewhat lower fuel consumption, but that is of no importance for the mines. HvL has been in England, as he was looking for a share in a mining adventure (*Ed.Note: see sect.3, HvL life chronology, entry 1784-12-18*). JCH wishes him the best of luck, but he does not expect much of it. The entire mining industry has the characteristics of a lottery.

The above is the last JCH letter in the summaries.

11.4. Summaries of letters of Jean de Luc to HvL

English translations of typewritten summaries (in Dutch), extracted from [Brieven]. The summary number precedes the date.

The main reason for including these summaries here is to provide possible background for the fully transcribed much later letters of HvL to De Luc [1783-12-19; 1785-01-30].

[106] **1778-08-05 (from Gouda)** Shortly after JdL had left HvL, he has started working on a solution for the problems with the fire engine, and he believes he has found a very simple solution. In order to be quite certain, however, he asks HvL for a drawing showing a section of the high and low boezems (reservoirs), of the pump heart with the positions of the valves, the top and bottom positions of the pistons and of the beam, and of the levels in the high boezem, and the lowest level of the low boezem. If HvL decides to use his proposal, JdL is prepared to refund the expenses made, if he turns out to have been wrong.

[117] **1778-11-10 (from London)** JdL is back in England, but to his surprise he has not received the cases which HvL would despatch. He is afraid that HvL may be ill, and inquires after his health.

[129] **1779-01-29 (from London)** (*Ed.Note: probably concerns modifications to the Oostpoort engine*) JdL now proposes to use a single pump piston (*Ed.Note: i.e. pump*). The pump cylinder must then be reinforced by encasing it in a brick jacket. The number of valves in the bottom must then be increased, as multiple valves make for a stronger bottom than a single large one. This way JdL hopes to reduce friction, and in his opinion it will then be possible to work at the full range of lifts. He admits, however, to not being an expert. He has made inquiries after Pinto. A portuguese gentleman has told him that Pinto had been in England for a long time, and may now live in Blackwell. He appears to be very secretive about his inventions. His invention seems to use a large suction header, into which pieces of burning wood are thrown at regular intervals. Much good is being said about the pump by the Birmingham engineer. This inventor has made another invention. He lets the steam act on the top of the piston as well. How this is effected, JdL does not know (*Ed.Note: note that by this time HvL had already exchanged several letters with JW*).

JdL thanks HvL for the depth soundings he has had performed, which will allow JdL to go ahead with his work for Holland.

[172] **1780-03-18 (from The Hague)** JdL has been elected Corresponding Member of the Batavian Society. He sends HvL a copy, for the Society, of his new book on hydraulic engineering in Holland. He is following developments concerning the Rotterdam pumps with interest. He intends to come to Rotterdam to make the acquaintance of dr Bicker. His query, when it would suit dr Bicker to see him, has remained unanswered, however, so he assumes dr Bicker to be absent or ill. For this reason he sends the book to HvL, who will please hand it to dr Bicker.

[173] **1780-03-.. (from Hellevoetsluis)** JdL had sent two parcels to HvL, which HvL would expedite to London. However, the boat that was due to take them has already set off downriver and is just waiting for a favourable wind to depart. It will be some two months before the next boat goes. JdL was due to embark for London at Hellevoetsluis. He will now postpone his journey and travel via Amsterdam, from where his parcels, which contain books, will be despatched. These books, written by JdL, treat of the hydraulic engineering conditions in Holland. One of them, Vol.3 "Description Hydraulique de la Hollande" describes a fire engine. JdL has heard that attempts to improve the fire engines had been given up. He hopes this is a false rumour. The problem is constantly on his mind, and he thinks he has found a solution which is as simple as it is definitive. If the attempts at improvement have not been given up, JdL will communicate his invention to HvL. He is very proud to be a member of the Batavian Society, and consequently he will have the title pages of Vols 3 and 4 of his book modified to reflect his new title.

12. Index to transcripts

Documents are ordered by date, expressed in the ISO numeric date format (yyyy-mm-dd) . Where the same date occurs more than once, this has been postfixed with -a, -b, etc.

A dash — before the date indicates that a search for the document has been unsuccessful, or that it is too faded or damaged to be included.

date	place	from -to	particulars
— 1769-01?	Rdam?	HvL to JW, possibly via Enslie	Ref in [1769-06-29] without date (which has been inferred from [1769-02-10]); not found in the AoS
1769-02-10	Glasgow	JW to Roebuck	
1769-06-03	Rdam		Will of S.Hoogendijk
1770-06-29	Rdam	HvL to Enslie	
1775-05-11a	Rdam	Enslie to JW	
1775-05-11b	Rdam	HvL to JW	via Enslie
1775-07-10	Soho	JW to HvL	via Enslie
1775-07-14	Soho	JW to Enslie	
1775-08-10	Rdam	HvL to JW	
1776-03-15	Rdam	HvL to JW	
1776-07-10	Soho	MB to JW	
1777?	Soho?	MB to J.Yorke	
— 1778-07?	Rdam	HvL to MB	Ref. in [1778-08-29] to HvL letter “several weeks ago”; not found in the AoS
1778-08-29	Soho	MB to HvL	
1778-09-25	Rdam	HvL to MB	
1779-05-14	Rdam	HvL to MB	
1779-07-02	Groenendaal	J.Hope to MB	
1779-08-05	Adam	J.Hope to MB	
1779-08-06	Groenendaal	J.Hope to MB	
1779-08-15	Bham	JW to J.Hope	
— 1783?	Bham	JW to De Luc	Ref. (undated) in [1783-12-19]; found (terminally faded) in AoS ref.MS 3147/3/84.
— 1783?	?	De Luc to HvL	Ref. (undated) in [1783-12-19]; not found in the AoS
1783-12-19	Rdam	HvL to De Luc	
1785-01-30	Rdam	HvL to De Luc	
1785-03-29	Bham	JW to HvL	
1785-06-03	Rdam	HvL to JW	
1785-08-04	Rdam	HvL to JW	
1785-09-04	Bham	JW to HvL	
1785-10-04	Rdam	HvL to JW	
1785-10-07	Rdam	HvL to JW	
1785-10-11	Bham	JW to HvL	
1785-11-29	Rdam	HvL to JW	
1785-12-10	Bham	JW to HvL	
1785-12-30	Rdam	HvL to JW	
1786-01-12a -	-	-	Privilege (Dutch)
1786-01-12b -	-	-	Privilege (contemporary English translation)
1786-01-13a	Rdam	HvL to JW	
— 1786-01-13b	Bham	JW to HvL	Ref. in [1786-03-10]; not found in the AoS
1786-02-05	Bham	JW to HvL	
1786-03-10	Rdam	HvL to JW	
1786-03-27	Bham	JW to HvL	
1786-05	Bham	JW	Patent specification
1786-05-31	Rdam	HvL to JW	
1786-07-03	Bham	JW to HvL	
1786-07-11	Rdam	HvL to JW	
1786-07-21	Rdam	HvL to JW	
1786-07-26	Bham	JW to HvL	

date	place	from -to	particulars
1786-07-?	Bham	JW to HvL	
1786-08-04	Rdam	HvL to JW	
1786-08-07	Bham	JW to HvL	
1786-09-22	Rdam	HvL to JW	
1786-09-28	Bham	JW to HvL	
1786-10-13	Rdam	HvL to JW	
1786-10-16a	Bham	JW to HvL	
1786-10-16b	Bham	JW to HvL	
1786-11-01	Bham	JW to HvL	

Note: from early November 1786 to early February 1787 JW and MB were away in France, JS signed some outgoing letters.

— 1786-11-10	Bham	JW to HvL	Ref. in [1787-04-27]; not found in the AoS, ref. may be erroneous
1786-11-08	Rdam		Contract of Cession
1786-11-17	Rdam	HvL to JW	
1786-11-27	Bham	JS to HvL	
— 1787-01-02	Rdam	HvL to JW	Ref. in [1787-01-11]; not found in the AoS
1787-01-11	Bham	JS to HvL	
1787-01-15	Bham	JS to HvL	
— 1787-02-24	Bham	MB to HvL	Ref. in [1787-04-13]; not found in the AoS
1787-04-13	Rdam	HvL to JW	
1787-04-19	Bham	JW to HvL	
1787-04-27	Rdam	HvL to JW	
1787-05-07	Bham	JW to HvL	
— 1787-05-10	Bham	B&W to HvL	Ref. in [1787-06-22]; not found in the AoS
1787-06-22	Rdam	HvL to B&W	
1787-06-28	Bham	JW to HvL	
1787-07-03	Bham	JW to Logan	
— 1787-08?	Rdam	HvL to MB	Ref. in [1787-09-07]; not found in the AoS
1787-09-07	Rdam	HvL to JW	
— 1787-09-14	Bham?	JW to HvL	Ref. in [1787-10-09]; not found in AoS ref.MS 3147/3/86.
— 1787-10?	Bham?	JW to HvL	Ref. in [1787-11-02]; not found in AoS ref.MS 3147/3/86.
1787-10-09	Rdam	HvL to JW	
1787-11-02	Rdam	HvL to JW	
1787-11-08	Rdam	HvL to JW	
1787-11-15	Bham	JW to HvL	
1788-02-12	Rdam	HvL to JW	
1788-04-05	Bham	JW to HvL	
1788-05-29	London	HvL to JW	
1788-07-09	London	HvL to JW	
1790-06-?	-	HvL to JW	Memorandum on Mydrecht engine
1790-07-08	Bham	JW to HvL	
— 1790-07-26	Paris	HvL to JW	Apparently lost in the post; see note in [1790-09-23] with which copy was sent
1790-08-30	Paris	HvL to JW	
— 1790-09-12	Bham	JW to HvL	AoS ref. MS 3147/3/87/254. Too faded for copying
1790-09-23	Paris	HvL to JW	
1790-10-21	Paris	HvL to JW	
1790-10-29	Bham	JW to HvL	
1790-11-04	Paris	HvL to JW	
— 1790-11-07	Bham?	JW to HvL	Ref. in [1790-11-15]; not found in AoS ref.MS 3147/3/87
1790-11-12	Bham	B&W to Rossijn	
1790-11-15	Paris	HvL to JW	
1790-11-16	Bham	JW to HvL	
— 1790-12-09	Bham?	JW to HvL	Ref. in [1790-12-16]; not found in AoS ref.MS 3147/3/87
1790-12-16	Paris	HvL to JW	

date	place	from -to	particulars
— 1791-01-03	Bham	JW to HvL	AoS ref. MS 3147/3/88/5. Too faded for copying or direct transcription.
1791-01-13	Paris	HvL to JW	
1791-01-27	Bham	JW to HvL	
— 1791-02-?	Rdam	Bicker to JW	Ref. in [1791-02-24]; not found in the AoS
1791-02-24	Bham	JW to HvL	
1791-03-14	Paris	HvL to JW	
1791-04-14	Bham	JW to HvL	
1791-04-16	Versailles	HvL to JW	
1791-05-05	Bham	JW to HvL	
1791-05-16	Versailles	HvL to JW	
1791-05-24	Bham	JS to JW	
1791-05-27a	Bham	JS to JW	
— 1791-05-27b	Bham	JW to HvL	Ref. in [1791-07-10]; not found in the AoS — probably just covering letter for forwarding of data in [1791-05-24] and [1791-05-27a]
1791-07-10	Versailles	HvL to JW	
1791-08-05	Bham	B&W to D.Smits	
1791-08-25	Bham	JW to HvL	
1791-08-28	Versailles	HvL to JW	
1791-09-17	Bham	JW to HvL	
1791-10-18	Rdam	HvL to JW	
1791-11-07	Bham	JW to HvL	
1791-11-15	Rdam	HvL to JW	
— 1792-02-11	Rdam	HvL to JW	Not clear if this letter ever existed
— 1792-02-18	Rdam	HvL to JW	Not clear if this letter ever existed
1792-06-12	Rdam	HvL to JW	
— 1792-07-05	Bham	JW to HvL	AoS ref. MS 3147/3/88/174; not readable/copyable
1792-08-24	Rdam	HvL to JW	
1792-10-11	Rdam	HvL to JW	
1792-11-13	Rdam	HvL to JW	
1792-11-15	Bham	JW to HvL	
1792-12-03	Bham	JW to HvL	
1792-12-11	Rdam	HvL to JW	
1792-12-18	Rdam	HvL to JW	
1792-12-31	Bham?	JW to HvL	
1793-01-03	Bham	JW to HvL	
1793-02-04?	Bham	JW to HvL	
1793-02-15	Rdam	HvL to JW	
1793-06-13	Thamen	HvL to JW	
1793-08-01	Bham	JW to HvL	
1793-08-08	Thamen	HvL to JW	
— 1793-09-21	?	W.Forman to HvL	Ref. in [1793-10-21]; not found in the AoS
— 1793-09-26	?	JW to HvL	Ref. in [1793-10-21]; not found in the AoS
1793-09-30	Thamen	HvL to JW	
1793-10-07	Bham	JW to HvL	
1793-10-21	Thamen	HvL to JW	
1793-12-03	Adam	JWj to JW	Partial transcript
1793-12-06	Adam	JWj to JW	Partial transcript
1793-12-13a	Adam	JWj to JW	
— 1793-12-13b	Adam	JWj to HvL	Ref. in [1793-12-15]; not found in the AoS
1793-12-15	Uythoorn	HvL to JWj	
1793-12-17	Adam	JWj to JW	Partial transcript
1793-12-22	Uithoorn	JWj to JW	Partial transcript
1794-01-07	Adam	JWj to JW	Partial transcript
1794-01-09	Bham	JW to HvL	
1794-01-16	Uythoorn	HvL to JWj	
1794-01-23	Thamen	HvL to JW	

date	place	from -to	particulars
1794-01-30	Uythoorn	HvL to JWj	
— 1794-03-19	Bham	JW to HvL	AoS ref. MS 3147/89/39; too badly faded for a coherent transcript
— 1794-03-26	Rdam	HvL to JW	Ref.in [1794-04-05], but not found in the AoS
1794-04-05	Soho	JWj to HvL	
— 1794-04-18	Uythoorn	HvL to JW	Ref. in [1794-05-06]; responded to with [1794-05-07], so it was received; it apparently got lost later.
1794-05-06	Rdam	HvL to JW	
1794-05-07	Bham	JW to HvL	
1794-05-12	Bham	B&W to HvL	
— 1794-07-31	Thamen	HvL to JW	Probably lost in the post; copy was sent with [1794-09-04]
— 1794-08-16	Soho	JW to HvL	AoS ref. MS 3147/3/89/68; not readable/copyable
1794-09-04	Thamen	HvL to B&W	
1794-09-10	Soho	B&W to HvL	
1794-09-23	Rdam	C.Stolker to JW	
1794-09-25	Bham	JW to HvL	
1794-09-30	Rdam	C.Stolker to JW	
1794-10-02	Thamen	HvL to JW	

Note: From the inception of the Batavian Republic in early 1795, to the end of the Napoleonic Wars in 1813, Holland was in a virtually permanent state of war with England. Napoleon attempted to stop all trade between England and the Continent, with limited success. Even in times of open warfare, resourceful Dutch and English traders and financiers found ways, see e.g.[Schama, 1977 ch.12].

There is a gap in the correspondence between Nov 1794 and May 1797. Probably there was no pressing business need for contact at that time. Later, HvL and B&W used duplicate correspondence via different routes (usually courier R'dam-London direct, plus post via Hamburg), "neutral" vessels, transshipment in Embden, etc.

In [1797-05-12] HvL brings Watt up to date from 1795-01. In [1797-07-17] HvL writes "nearly three years were elapsed I had not heard from you" which makes any letters of JW between c.1794-11 and 1797-05 unlikely (unless any were lost in the post).

1797-05-12	The Hague	HvL to JW	
1797-06-14	Bham	JW to HvL	Last letter to HvL personally signed by JW, subsequent letters are all signed for the firm.
1797-07-17	The Hague	HvL to JW	
1797-08-20	Soho	B&W to HvL	
1797-11-05	Rdam	HvL to JW	
1797-11-16a	Soho	B&W to HvL	
— 1797-11-16b	Bham	B&W to HvL	Duplicate of [1797-11-16a].
1797-12-11	Soho	B&W to HvL	
1798-01-07	The Hague	HvL to B&W	
1798-02-01	Soho	B&W to HvL	
1798-02-18	Soho	B&W to HvL	
1798-02-24	Rdam	HvL to B&W	
1798-03-12	Rdam	HvL to B&W	
1798-03-20	Soho	B&W to HvL	
1798-04-28	Soho	B&W to HvL	
1798-05-07	Soho	B&W to HvL	
1798-05-08	Rdam	HvL to B&W	
— 1798-05-14	Soho	B&W to HvL	Ref in [1798-06-30]; not found in the AoS
1798-06-30	Rdam	HvL to B&W	
1798-07-15	Soho	B&W to HvL	
1798-07-31	Rdam	HvL to B&W	
1798-12-06	Soho	B&W to HvL	
1798-12-25	Rdam	HvL to B&W	With draft memorandum
1798?			Undated draft memorandum "Remarques...".
1799-05-18	Rdam	HvL to B&W	With revised draft memorandum
1799?			Undated revised draft memorandum "Remarques...".

date	place	from -to	particulars
1799-08-16	Rdam	HvL to B&W	
1799-10-28a	Soho	B&W to HvL	Last letter to HvL in JW's hand
1799-10-28b	Soho	B&W	Undated memorandum (B&W reply to draft memorandum "Remarques...")
— 1799-12-?		HvL to B&W	Tender spec. for iron mill parts transmitted by courier (ref. in [1800-02-01]); not found in the AoS.
1800-02-01	Rdam	HvL to B&W	
1800-02-18	Rdam	HvL to B&W	
— 1800-03-15	Rdam	HvL to B&W	Ref. in B&W list of letters [c.1801-12], with enclosed memorandum, but not found in the AoS; see also letter [1800-05-07]
1800-03-25	Rdam	HvL to B&W	
1800-03-27	Rdam	HvL to B&W	
1800-04-15	Soho	B&W to HvL	
1800-04-25	Rdam	HvL to B&W	With copy of [1800-03-25].
1800-05-07	Rdam	HvL to B&W	Copy of memorandum enclosed.
early 1800	-		Undated definitive memorandum of Chr. Brunings jnr. Originally enclosed with [1800-03-15], this is the copy resent with [1800-05-07].
1800-05-16	Rdam	HvL to B&W	
— 1800-05-17	Soho	B&W to HvL	Ref. in [1800-06-05]; not found in the AoS
1800-05-19	Soho	B&W to HvL	
1800-06-05	Soho	B&W to HvL	
1800-06-15	Soho	B&W to HvL	
1800-07-07	Hamburg	HvL to B&W	
1800-07-09	Hamburg	HvL to B&W	
1800-08-05a	Soho	B&W to HvL	
1800-08-05b	Soho	B&W to HvL	Copy of [1800-08-05a]
1800-08-09a	Soho	B&W to HvL	
1800-08-09b	Soho	B&W to HvL	Copy of [1800-08-09a]
1800-08-09c	Soho	JWj to JW	
1800-08-12	Hamburg	HvL to B&W	
1800-08-19	Hamburg	HvL to B&W	
1800-08-21	Soho	B&W to HvL	
1800-09-09	Rdam	HvL to B&W	
1800-09-30a	Rdam	HvL to B&W	
1800-09-30b	Soho	BW&C to HvL	
1800-10-15	Rdam	HvL to BW&C	
1800-10-18	Soho	BW&C to HvL	
1800-10-31	Rdam	HvL to BW&C	
1800-11-12	Rdam	HvL to BW&C	
1800-11-28	Soho	BW&C to HvL	
1801-02-24	Rdam	HvL to BW&C	
1801-04-20	Soho	BW&C to HvL	Apparently lost in post. Copy sent with [1801-07-01]; that copy not found in the AoS
— 1801-04-28	Soho	BW&C to HvL	Ref. in [1801-07-16]; not found in the AoS
1801-05-05	Bham	BW&C	
1801-05-15	Bham	BW&C	
1801-05-16	Bham	BW&C	
1801-07-01	Soho	BW&C to HvL	arrived severely damaged
1801-07-16	Rdam	HvL to BW&C	
1801-08-15	Rdam	HvL to BW&C	
1801-08-22	Rdam	HvL to BW&C	
1801-08-25	Rdam	HvL to BW&C	
1801-08-29	Rdam	HvL to BW&C	
1801-08-31	Soho	BW&C to HvL	
1801-09-10	Soho	BW&C to HvL	
1801-09-17	Soho	BW&C to HvL	

date	place	from -to	particulars
1801-09-19	Rdam	HvL to BW&C	
1801-09-24	Rdam	HvL to BW&C	
1801-10-01	Soho	BW&C to HvL	
1801-10-03	Rdam	HvL to BW&C	
1801-10-13	Rdam	HvL to BW&C	
1801-10-15	Soho	BW&C to HvL	
1801-11-03	Rdam	HvL to BW&C	
1801-11-04	Rdam	HvL to BW&C	
1801-11-10	Soho	BW&C to HvL	
1801-11-18	Soho	BW&C to HvL	
1801-12-12	Rdam	HvL to BW&C	
c.1801-12	Bham	BW&C	
1802-02-05	Soho	BW&C to HvL	
— 1802-02-14	Bham	BW&C to HvL	Ref. in [1802-03-02]; not found in the AoS
1802-03-02	Rdam	HvL to BW&C	
1802-03-08	Soho	BW&C to HvL	
1802-08-03	London	HvL to BW&C	
1802-08-19	Bham	HvL to BW&C	
1802-09-13	N'hampton	HvL to BW&C	
1802-10-12a	Rdam	HvL to JWj	
1802-10-12b	Rdam	HvL to BW&C	
1802-10-23	Soho	BW&C to HvL	
1802-11-02	Rdam	HvL to BW&C	
1802-11-11	Soho	BW&C to HvL	
— 1802-11-19	London	JWj to HvL	Ref. in [1802-12-17]; not found in the AoS
1802-12-17	Rdam	HvL to BW&C	
1802-12-31	Rdam	HvL to BW&C	
1803-01-05	Soho	BW&C to HvL	
1803-01-31	Soho	BW&C to HvL	
1803-03-21	Soho	BW&C to HvL	
1803-03-29	Rdam	HvL to BW&C	
1803-04-14	Soho	BW&C to HvL	
1803-04-15	Adam	HvL to BW&C	
1803-04-19	Rdam	HvL to BW&C	
1803-04-21	Soho	BW&C to HvL	
1803-05-17	Rdam	HvL to BW&C	
1803-05-23	Soho	BW&C to HvL	
1803-09-06	Rdam	HvL to BW&C	
1803-09-27	Soho	BW&C to HvL	
1803-10-24	Rdam	HvL to BW&C	
1803-10-29	Rdam	HvL to BW&C	
1804-01-06	Soho	BW&C to HvL	
1804-03-02	Rdam	HvL to BW&C	
1804-03-13a	Rdam	HvL to BW&C	
1804-03-13b	Soho	BW&C to HvL	
1804-03-26	Soho	BW&C to HvL	
1804-04-14	Rdam	HvL to BW&C	
— 1804-04-19	Soho	BW&C to HvL	AoS ref. MS 3147/3/100/184; unreadable, defies even partial transcription
1804-04-27	Rdam	HvL to BW&C	
— 1804-05-09	Soho	BW&C to HvL	AoS ref. MS 3147/3/100/202; unreadable, no coherent transcript possible
1805-03-25a	Rdam	HvL to BW&C	
1805-03-25b	Rdam	HvL to BW&C	
1806-07-07	Rdam	HvL to BW&C	
— 1806-08-09	Soho	BW&C to HvL	AoS ref. MS3147/3/103/19; totally unreadable
1806-08-11	Rdam	HvL to BW&C	
1806-09-29a	Rdam	HvL to BW&C	

date	place	from -to	particulars
1806-09-29b	Soho	BW&C to HvL	
1806-10-08	Rdam	HvL to BW&C	
1806-10-16	Soho	BW&C to HvL	
1807-03-19a	Rdam	HvL to BW&C	
1807-03-19b	Rdam	HvL to BW&C	
1807-04-18	Soho	BW&C to HvL	Received 1807-04-30
— 1807-04-30	Soho	BW&C to HvL	Ref. in [1807-06-12]; not found in the AoS
1807-05-19	Rdam	HvL to BW&C	
1807-05-27	Soho	BW&C to HvL	Received 1807-06-12
1807-06-02	Rdam	HvL to BW&C	
1807-06-06	Rdam	HvL to BW&C	
1807-06-12	Rdam	HvL to BW&C	
1807-06-15	Soho	BW&C to HvL	
1807-06-17	Rdam	HvL to BW&C	
1807-06-29	Soho	BW&C to HvL	
1807-06-30	Rdam	HvL to BW&C	
— 1807-07-06	Soho	BW&C to HvL	AoS ref. MS 3147/3/104/4. Almost totally faded, no coherent transcript possible
— 1807-07-16	Soho	BW&C to HvL	Ref. in [1807-08-19]; not found in the AoS
— 1807-07-30	Soho	BW&C to HvL	Ref. in [1807-08-19]; not found in the AoS
1807-08-19	Soho	BW&C to HvL	
1807-08-29	Rdam	HvL to BW&C	
1807-09-02	Rdam	HvL to BW&C	
1807-09-03	Rdam	HvL to BW&C	
1807-09-08a	Rdam	R.Mees&Sons to BW&C	
1807-09-08b	Rdam	R.Mees&Sons to BW&C	
— 1807-09-24	Soho	BW&C to HvL	AoS ref. MS 3147/3/104/45; almost totally faded, no coherent transcript possible
— 1807-10-07	Soho	BW&C to HvL	AoS ref. MS 3147/3/104/54; almost totally faded, no coherent transcript possible
— 1807-10-19	Soho	BW&C to HvL	AoS ref. MS 3147/3/104/62; almost totally faded, no coherent transcript possible
1807-10-29	Soho	BW&C to HvL	
1807-11-02	Soho	BW&C to HvL	
1807-11-16	Soho	BW&C to HvL	
1807-11-25	Rdam	HvL to BW&C	Received late January 1808
1807-12-22	Rdam	HvL to BW&C	
1808-01-07	Rdam	HvL to BW&C	
1808-01-18	Rdam	HvL to BW&C	
1808-01-25	Soho	BW&C to HvL	Original maybe lost in post, duplicate sent with [1808-03-09]
1808-03-09	Soho	BW&C to HvL	
1808-05-31	Rdam	HvL to BW&C	
1808-06-23	Soho	BW&C to HvL	Original maybe lost in post, duplicate sent with [1808-12-16]
— 1808-08-17	Rdam	HvL to BW&C	Ref. in [1808-11-01]; possibly lost in the post
1808-11-01	Rdam	HvL to BW&C	
1808-12-16	Soho	BW&C to HvL	
1809-04-12	Rdam	HvL to BW&C	
1809-04-27	Soho	BW&C to HvL	
1809-05-04	Rdam	HvL to BW&C	<i>Note: This is the last HvL letter found in the AoS</i>
— 1809-05-20	London	BW&C to HvL	AoS ref. MS 3147/3/105/103; faded beyond even partial readability. <i>Note: This appears to be the last BW&C letter in the AoS</i>

No evidence has been found in the AoS up to 1813 of any contact with HvL's alleged successor Van Heukelom, or even of a notification to BW&C of HvL's death on 3 December 1809.

JW to Roebuck 1769-02-10

AoS ref. MS 3219/4/58/31. Docket: drainage in Holland — cast Iron model does well — Proposes to give (it) an outer case

Extract of this letter is in [Muirhead, 1854 Vol.I p44]

The transcript figures here mainly to point to possible early correspondence between HvL and JW (via Enslie?) which may yet come to light.

Glasgow Feb 10th 1769

Dear Sir

Yesterday I received a letter from M^r Enslie, with a particular acc^t of the lake near Rott^m, which as soon as I have studied a little, I will transmit to you; but from what I have seen, it will not be a proper place for us as the greatest part of the expence appears to be surrounding it with a dyke & making a proper Outlet into the river. The value of the ground is less & number of acres greater than we were calculating & the Quantity of water raised by the Water Mills immense. M^r Jardine would tell you better than I can write you what he (.....) the engine I am now making the outer case to it & a thinner bottom without which they will not answer so well heat being too long in penetrating cast Iron I have now sett it up in a most Convenient Place where the experiments can be made to your satisfaction its doing twice as well as the common is I think absolutely certain from what M^r Jarden saw & there is little reason to fear but what it will do all we expected. My headaches have not been so violent as usual this week & I hope are abating. M^{rs} Watt has not recovered so fast as we at first expected but is getting better the young ones are well My compliments to Mrs Roebuck & family I remain
Dear Sir

Yours sincerely
James Watt

Will of Steven Hoogendijk 1769-06-03

[Akten 2308/568; Havinga 1969-08-02]

This will sets the stage for the establishing of an (as yet nameless) Foundation which will qualify as Hoogendijk's principal heir. Hoogendijk made several later wills, alterations, and codicils, but by then the Batavian Society was already an established institution.

Op huyden den 3-en Juny 1769 compareerde voor mij Willem Boon, Notaris Publijk, bij den Hove van Holland geadmitteerd, tot Rotterdam resideerende, en voor de nagenoemde getuigen, de Heer Steven Hoogendijk, woonachtig binnen deze stad, mij Notaris bekend, hebbende bekwaamheid, zoo bleek, om van zijne tijdelijke natelatene goederen te kunnen disponeren, dewelke verklaarde bij dezen te wederroepen en vernietigen alle Testamenten en andere actens van uitterste wille bij hem Testateur voor dato dezer gemaakt, of gepasseerd, houdende all dezelve en yder van dien voor doot, null en van onwaerde, zoodanig als of dezelve nooit gemaakt of gepasseerd waren geweest: Ende vervolgens op nieuws disponerende zoo verklaarde hij Testateur bij deze te legateeren, namelijk:

Aan Mr. Nicolaas Beeldemaker, een somma van vijff duyzend Guldens.

Aan Mr. François Beeldemaker, een somma van tien duyzend Guldens.

Aan Maria de Haan, huisvrouw van Adriaan van Charante, een somma van een duyzend Guldens.

Aan de weduwe van Pieter Kemenaer, een somma van een duyzend Guldens.

Aan Jacobus Kleij, een somma van twee duyzend Guldens.

Aan de Diaconie der Publicque Nederduytse Gereformeerde Kerken dezer stad, ten behoeve van derzelver Armen, een somma van een duyzend guldens, mits dat hetzelfde altijd als een vaste post op den Blaffaert zal moeten blijven staan.

Aan de Opzienders der Remonstrantse Gemeente binnen deze stad, ten behoeve van derzelver Kerken en Armen, een somma van een duyzend Guldens.

Aan d'Opzienders der Luijterse Gemeente binnen deze stad, ten behoeve van derzelver Kerken en Armen, een somma van een duijzend Guldens.

Aan d'Opzienders der Mennonite kerke binnen deze stad, ten behoeve van derzelver Kerke en Armen, een somma van een duyzend Guldens.

Aan zijnen knecht Hermanus Rabels, indien hij op zijn testateurs overlijden nog in zijn dienst is, maer anders niet, zijn Testateurs geheele Horlogiemakers winkel, met alle de Horlogien en Gereedschappen, en de in en uitstaende schulden en indien hy vermeint het zelve geen vier duijzend Guldens zuiver waerdig te zijn, zal hij het zelve mogen laten taxeeren door twee personen te kiezen — een bij hem en een bij de nagestelde executeurs en dan minder bevonden werdende waerdig te zijn, zal het zelve tot die somme van vier duysend Guldens uit zijn Testateurs Boedel in contanten gelde gesuppleert moeten werden, verders nog een Pak kleederen met zijn toebehooren en een Chamberloe; Des verstaet hij Testateur, dat onder de Voorz. Horlogiemakers-winkel, Horlogien en gereedschappen niet zullen worden gerekent de Liefhebberij stukken van Globen, Vuurmeter en alle zoodanige verderen Liefhebberijstukken als tot het Horlogiemaken niet behooren, als zullende hij Testateur van alle 't zelve nader disponeeren.

Aan zijn Dienstmeijd Stijntje de Rouw, indien zij op zijn Testateurs overlijden nog bij hem is woonagtig, maer anders niet, een somma van vier duyzend Guldens, en daer en boven nog een Horlogie, 't zij staende, off zilver zakwerk, mitsgaders een Bedde met desselfs toebehooren, respectieve bij hem na te laten ten haren keuze.

Aan Govert Schauwer, schipper op zijn zeijljagt, indien hij op zijn Testateurs overlijden nog in zijn dienst is, maer anders niet, een somma van vijftigh Guldens voor ijder jaer, dat hij op zijn testateurs overlijden in zijn dienst zal zijn geweest, het jaer, waer in op zijn testateurs overlijden zal zijn getreden voor een geheel jaer te reekenen; welke vijftig Guldens 's jaars na die uitrekening in eene somma aen denzelven Legataris uitgekeert en voldaan zal moeten werden.

Aan Jan Hendrik Poll, knecht op zijn zeijljagt, indien hij op zijn testateurs overlijden nog in zijn dienst is, maer anders niet, een somma van vijf en twintig Guldens voor ijder jaer, dat hij op zijn testateurs overlijden in zijn dienst zal zijn geweest, het jaer, waer in op zijn testateurs overlijden zal zijn getreden voor een geheel jaer te reekenen: welke vijff en twintig guldens jaerlijks na die uitrekening in eene somma aen denselven legataris uitgekeert en voldaan zal moeten werden.

Ende aen Jannetje de Bruijn, hujsvrouw van Pieter Geerholt, naeijsster, indien zij op zijn testateurs overlijden nog in zijn dienst is, maer anders niet, een somma van vijff hondert Guldens.

Welke voorz. gelegateerde sommen voldaan en betaeld zullen moeten werden binnen de tijd van zes maenden na zijn testateurs overlijden, 't zij in 't geheel, off voor een gedeelte in contanten gelde of in Rentebrieven, off Obligatien, bij hem testateur na te laten, gerekent hondert ten hondert, 't zij die meer of

minderwaardig mogten zijn, ten keuze van de nagestelde Executeurs, zonder dat nogtans dezelve legatarissen inmiddels eenige Interessen zullen mogen preetenderen en dat zuiver en vrij, zonder eenigen aftrek van den Falsidie portie (als den aftrek van dien wel expresselijk verbiedende) en zonder dat de voorz. legatarissen gehouden zullen wezen ietwes te dragen off betalen, ter zake van het recht der collaterale successie, als dezelve daer van vrijstellende.

Ende in alle de verdere goederen en in alle 't gene hij testateur boven de hier bovengemelte legaten met'er doot zal komen the ontruimen en na te laten (niets daarvan uitgezondert) daer onder ook speciaal begrepen zijne na te latene goederen op en in het Koninkrijk van Groot-Brittannien, als mede de legaten, die op zijn Testateurs overlijden Caduck en vervallen zouden mogen zijn, verklaerde hij Testateur bij dezen tot zijn eenige en algeheele erfgenamen met volkome regt van Erfstellinge te noemen ende te stellen de nagenoemde Rentmeesters en Administrateurs en dewelke van tijd tot tijd in denzelve plaatsen zullen succederen van de Fundatie die hij Testateur in zijn leven gestigt mogte hebben, en zulks voor zijn overlijden nog niet gedaen hebbende, die hij dan bij dezen na zijn overlijden is stigende onder de zin-spreuk: CERTOS FERET EXPERIENTIA FRUCTUS, zijnde in her Nederduits: DE ONDERVINDING ZAL ONS ZEKERE VRUCHTEN GEVEN, en dat ten goede en behoefte van dezelve Fundatie, omme die uit de Revenuen en Inkomsten zijner voorz. verdere natelaten goederen te onderhouden en bestendig te doen bloeijen; welke voorz. Goederen voor altoos en ten eeuwigen dage vast verbonden zullen zijn en blijven, zo als hij Testateur die verbint bij dezen, ten fine en einde hier na gemelt, te weten:

Aan Anna Greenwood, een somma van vijff en zeventig Guldens jaerlijks.

Aan Arnoldus de Vet, een somma van vijftig Guldens jaerlijks.

Aan de weduwe van Jan Rabels, een somma van vijftig Guldens jaerlijks.

Aan Anna Zwanendrift, een somma van vijftig Guldens jaerlijks.

Aan Gerardus Kuijpers, een somma van vijf en zeventig Guldens jaerlijks.

Aan Aaltie Dumon, een somma van vijff en twintig Guldens jaerlijks.

En aan Jacobus van Lis, een somma van zes en twintig Guldens jaerlijks.

En aen Covitré, een somma van een en dertig Guldens en vier stuivers jaerlijks.

(Noot Bewerker: de vorige regel is in het origineel geroyeerd ofwel doorgehaald; de beschikbare tekstverwerkings-faciliteit kent die mogelijkheid echter niet)

Van welke jaerlijkse Legaten het eerste jaer verschuld zal zijn en betaelt zal moeten werden door de nagestelde Rentmeesters en Administrateurs, off die in derzelve plaetse zullen komen, een jaer na zijn Testateurs overlijden en geduurende also van jaer to jaer tot het overlijden van ijder van dezelve respective Legatarissen toe, ende dat zuiver en vrij zonder eenigen aftrek, of kortinge, hoe die genaemt zoude mogen zijn: dog zullen de twee laatst genoemde jaerlijkse Legatarissen derzelve Jaerlijks gelegateerde somme moeten halen bij gedeeltens, off in een elk jaer.

Ende ten Tweeden: Dat de verdere zuivere Revenuen en Inkomsten van de gemelte Goederen, als mede het beloop der voorz. jaerlijkse legaten, dewelke van tijd tot tijd, door het overlijden van de voorn. jaerlijkse legatarissen Caduck en vervallen zullen zijn, zullen worden geemploijeert tot het uijtvoeren van zijn Testateurs wille en begeerte omtrent de gemelte Fundatie, volgens het plan door hem Testateur deswegens te maken en te onderteekenen, insonderheit bestaende om ten nutte van zijn Vaderlant jaerlijks een of meer vraagstukken aan het Publijck te laten doen, kunnende de volgende drie vraagstukken dienen tot exempelen van zijn Testateurs oogmerk, als namelijk/

Eerstelijk: Wat is de reden dat de Rivieren van tijd tot tijd verlengen, en daer in droogtens komen, ook dat dezelve naeuwer en ondieper werden en den IJssel (Na Gouda) na rato veel minder vernaet en ondieper word als de Leck, off de Waal, dewijlze alle drie heel krom zijn, off wat de reden daer van is, en off daer remedie voor is, en zoo ja, waer in die bestaet ?

Ten Tweeden: Wat is het beste middel om Dijkbreuken voor te komen, met een ope Rivier en met IJsdammen ?

En ten Derden: Als er een, twee, drie, off meer voeten water in het Land is, off er dan niet middel zoude zijn om het water daer wederom uittehalen in een bepaalde tijd als men maer wil, zonder van Weer en Wind, off hoog water aff te hangen, en met minder kosten als de Watermolens ?

En dat wijders om te voldoen aen zijn testateurs oogmerk de zeven personen die hij van voornemens is te benoemen tot Directeuren van de gemelte Fundatie zullen hebben de faculteit op de antwoorden, welke op de

Het nevensgemelte is voor het passeren dezer geroyeert, vermits Covitré al voor eeniger tijd is overleden.

voorz. en nog andere vraagstukken zullen worden opgegeven te examineeren en die best voldoende vindende, daer voor te geven de door dezelve beloofde premien off belooningen, dat mede dezelve aengestelde Persoonen zullen hebben de magt, om in zulke zaken daer het noodig zal wezen te nemen werkelijke proeven, en tot dat einde te laten maken de Instrumenten daer toe noodig en d'onkosten deswegens vallende, egter niet excederende de voorz. zuivere jaerlijkse Revenuen en Inkomsten, te betalen of doen betalen uit dezelve jaerlijkse Revenuen en Inkomsten alzo het Capitaal van de gemelte Goederen altoos in het geheel in wezen zal moeten werden gelaten: Begeerende hij Testateur verders ingevalle 't eene of 't andere jaer nog eenige gelden van de voorz. zuivere jaerlijkse Revenuen en Inkomsten mogten overschieten, dezelve overschietende gelden door de Rentmeesters en Administrateurs uitgedeeld zullen moeten worden aen noodlijdende — Timmerluijden, Metselaers en Kleermakers, die des Winters uyt het Werk geraekt zijn en haer noot te kennen geven.

Sluijtende den Testateur uit zijnen Boedel en natelatene Goederen (behoudens derzelve Eer en Waardigheid) die van den Edelen Agtbaren Gerechte, de Weeskamer en Heeren Weesmeesteren, respectie deze stad, en van alle andere steden en plaatzen, alwaer zijn sterfhuis zoude mogen komen te vallen eenige goederen gelegen, off minderjarige daerin geraekt, woonagtig zouden mogen zijn.
(Noot v.d. bewerker: een soortgelijke bepaling wordt in vele 18e-eeuwse testamenten gevonden; de praktische betekenis ervan is onduidelijk zonder gespecialiseerde kennis, maar lijkt binen het kader van deze studie niet van groot belang)

Stellende den Testateur tot eenige en absolute Executeurs van deze zijnen Testamente de Heeren Pieter van Liender, koopman binnen deze stad, Jan van Eck, majoor van de Burgerije dezer stad, en Mr. François Beeldemaker, substituut secretaris van 't Hoogheemraetschap van Schieland; Tot dien einde aen dezelve gevende alle zoodanige maght, als aen Executeurs kan, off mag werden gegeven, En speciaal (boven en behalve de magt hier vooren bereids aen dezelve gegeven) om op zijn Testateurs overlijden te zijnen sterfhuize in te treden en te bezorgen, dat zijn doode lighaem behoorlijk ter aarde werde gebragt en begraven, en te verrigten alle het gene dienaengaende noodig zoude mogen zijn, met de gevolge en aenkleven van dien; om een staet en inventaris van zijn Testateurs Boedel te maken, off doen maken, zullende zijn Erfgenamen en die in dezen verder eenigzints geraekt zijn, volkomen tevreden moeten wezen met denzelvengemaekten inventaris onder de simpele affirmatie van de voorn. Executeurs dat dezelve is deugdelijk en opregt, zonder hunnes wetens ietwes te hebben overgeslagen, om de goederen, onroerende of roerende bij hem natelaten, waarvan niet anders is gedisponeerd, te kunnen en mogen verkoopen, 't zij publijk, of onder de hand, en aen de koopers van dien opdragen en transporteren, vrij en onbelast, zonder daer toe noodig te hebben enige ontslaginge van den Souverein van den Lande, eenig Decreet, Consent, off auctorisatie van Hoven, Wethouders, off Gerechten; zullende de kooppenningen komen in de plaetze van dien en wezen van dezelve natuur; om alle schulden en Lasten zijnes Boedels te voldoen en betalen, en ook de Legaten door hem besproken aan de legatarissen en ijder derzelve, en om dienvolgende zijnen Boedel te redden en tot effenheid en Liquiditeit te brengen en zulks na derzelve Oordeel gedaen en verrigt hebbende dan van derzelve Ontfangh, Uitgeeff en Verrigtinge te doen reekening en Bewijs aen de Rentmeesters en Administrateurs van de voorsz. Fundatie als zijne Erfgenamen, ten goede en behoefte van dezelve Fundatie, en te formeren een kostenstaat van zijn Testateurs Goederen, zoodanig als die als dan nogh zullen zijn en bevonden werden, en vervolgens dezelve goederen overleveren aen de Rentmeesters en Administrateurs der gemelte Fundatie, om voor altoos en ten Eeuwige dage vast en verbonden te zijn en blijven ten fine en einde hier vooren gemelt, zullende volkomen genoeg en contentement moeten werden genomen met de Rekening bij dezelve Executeurs als vooren te doen onder de simpele affirmatie van dezelve Executeurs, dat alles bij hen is gedaen en verrigt te goeder trouwe, zonder dat bij zijne voorsz. Erfgenamen, off ijmand anders directelijk, off indirectelijk daer tegens zal kunnen werden gedaen eenig Debat off Contradictie, als hetzelve wel expresselijk verbiedende; Gevende hij Testateur wijders bij voor, of na overlijden van een of meer van de voorn. Executeurs off dat de plaetze van een of meer op enige andere wijze kwamen te vaceren aen de andere de magt om in die plaetze, een off meer Persoonen te surrogeeren om aen te stellen, met een en dezelve magt ende dat van tijd tot tijd, zo dikwils zulx noodig zijn en vereijst werden zal.

Verzoekende, Committerende en stellende dat hij Testateur tot Rentmeesters en Administrateurs van de hier vooren gemelte Fundatie, en zulks van de Goederen bij dezelve ten goede en behoefte van de voorz. Fundatie te erven, de Heer Mr. Adriaan Prins, oud Burgemeester dezer stad en bewindhebber van de Oost-Indische Compagnie ter kamere alhier, de Heer Mr. Paulus Boogaart, Heer van Alblasserdam, Regerend Burgemeester, Raed en Vroedschap dezer stad, de Heer Abraham Gevers, Raed en Vroedschap en oud-Burgemeester dezer stad, Gecommitteert in 't Ed. Mogende College ter Admiraliteit op de Maze, en Bewindhebber van d'Oost-Indische Compagnie ter kamere alhier, de Heer Mr. Willem Prins, Oud President Schepen dezer stad, en beëdigd Hooftparticipant van d'Oost-Indische Compagnie ter kamere alhier, de Heer Mr. Paulus Gevers, Bewindhebber van de West-Indische Compagnie ter Kamer op de Maze, de Heer Mr.

Nicolaas Martinus Boogaart van Alblasterdam — Oud Commissaris van het Zee Gerecht dezer stad, en de Heer Mr. Adriaan Gevers Deinoot, oud Schepen van den Hove en Hooge Vierschaar van Schieland (*Noot bewerker: de voorafgaande zin is grammaticaal onjuist, tenzij in de eerste regel het woord "dat" vervalt*). Tot dien einde aen dezelve gevende alle zodanige magt, als aen Rentmeesters en Administrateurs kan, of mag werden gegeven; En specialijk boven en behalven de magt hier vooren bereids aen dezelve gegeven om de Gelden dewelke ledig zouden mogen leggen, alsmede die van tijd tot tijd zullen werden afgelost wederom te beleggen, of te emploijeren tot den aankoop van Effecten die dezelve Rentmeesters en Administrateurs en dewelke in derzelver plaetze zullen succederen goed en raedsaem zullen vinden, als mede bij voor off na overlijden van een off meer van de voorn. zeven aengestelde rentmeesters en administrateurs off andere vacature van derzelver plaetze aen de overgeblevene om in die vacerende plaetzen te surrogeren andere personen, zijnde medeliefhebbers van Natuurkundige wetenschappen, met een en dezelve magt ende dat van tijd tot tijd zo dikwils zulx noodig zijn zal. Begerende wijders, dat de Goederen en Effecten tot de gemelte Fundatie behoorende, altoos en ten eeuwigen dage zullen moeten blijven onder de bewaringe van de voorn. Rentmeesters en Administrateurs, off die in derzelver plaatze zullen komen, in een kist met drie sloten, waer van de de drie oudste Rentmeesters en Administrateurs ijder een sleutel zullen hebben en dat d'Effecten op en in het Koninkrijk van Groot-Brittanniën altijd zullen moeten staen ten namen van die van de voorn. Rentmeesters en Administrateurs.

Stellende hij Testateur tot Directeurs van de gemelte Fundatie zoodanige Personen, als na zijn overlijden bevonden zullen worden door hem Testateur onder zijn hand en onderteikening daer toe genoemd te zullen zijn; Tot dien einde aen dezelve gevende alle zoodanige magt, als dezelve daar toe noodig zullen hebben en door hem kan off mag worden gegeven, en specialijk boven en behalven de magt bereids hier vooren aen dezelve gegeven om zoodanige Reglementen en Bepalingen te maken, als dezelve zullen oordeelen best aan zijn Testateurs oogmerk te kunnen voldoen, en ook bij overlijden van een of meer van dezelve off dat de plaatze van een off meer op eenige andere wijze kwame te vaceren, aen de overblijvende om in die vacerende plaetze te surrogeren andere personen, zijnde mede Liefhebbers van Natuurkundige Wetenschappen, met een en dezelve magt ende dat van tijd tot tijd, zoo dikwils zulks noodig zal zijn.

Ende zoo wanneer op zijn Testateurs overlijden de hier voorgemelte Fundatie haer volle beslag nog niet mogte hebben gekregen na het oordeel van de hier voorengestelde Executeurs, in dat geval verklaarde hij Testateur dezelve Executeurs bij dezen te qualificeren om het gene daeraen mogt deficiëren te suppleren en vervullen en ook ingevalle hij de Personen tot Directeurs van de voorn. Fundatie niet mogte hebben benoemt, dan aen te stellen en te benoemen zeven bekwame en kundige Personen, Liefhebbers van Natuurkundige Wetenschappen, off zoveel als'er aen het zevental zouden mogen mankeren.

Eijndelijk verklaarde de Testateur aen zig zelve te reserveren en behouden de Vrijheid, magt en vermogen om na dato dezer, onder zijn hand en onderteikeninge, inhoudende dag en datum met, of zonder getuigen, te bespreken Legaten en Praelegaten, mitsgaders te maken veranderingen en vermeerderingen in zijne voorenstaende dispositie, en specialijk ook met de relatie tot de hier voorengemelte Fundatie en de Reglementen dienaengaende, alles en respectievelijk zoo als hij Testateur zal komen goed te vinden; willende en begerende dat hetzelfde zal moeten werden nagekomen, en van zoodanige kragt en waarde zal zijn en gehouden moeten werden, alsoff in dezen vervattet, of wel voor Notaris en getuigen, op de kragtigste wijze, gedaen en gepasseerd ware.

Alle 't welke den Testateur van woorde te woorde duidelijk voorgelezen zijnde, zoo verklaarde hij het zelve te wezen zijn Testament en uiterste wille, Begerende, dat het zelve in dienvoegen zal moeten werden nagekomen en agtervolgt, mitsgaders stand en plaets grijpen, hetzij als een Testament, off Codicil, zoodanig als best zal kunnen geschieden en bestaan; Tot dien einde verzoekende met behulp van allens Heeren Regten en Regteren.

Aldus gedaen en gepasseerd binnen Rotterdam, ten tijde voorschreve, ter presentie van Cornelis Proons en Daniel Meesters, als getuigen, hiertoe verzogt.

w.g. St^d Hoogendijk
w.g. C^s Proons
w.g. D. Meesters
w.g. W.Boon, nots.Pub.

(Ed.Note: The following is an attempt at translation into English of this important will. Even though no serious effort has been made to emulate what an 18th century English will would have looked like, a number of terms defied translation. A better result might have been obtained with the help of an expert in Dutch — and possibly English — historic notarial terms; no ready access to such information has been found, however. For the annuities a late notarial change via strike-through and a marginal note, has been incorporated in interpreted form)

Today the 3rd of June 1769 appeared before me Willem Boon, Public Notary, accredited at the Court of Holland, residing in Rotterdam, and before the witnesses mentioned hereinafter, Mr. Steven Hoogendijk, residing within this town, known to me Notary, shown to be of sound mind to make dispositions about his worldly goods to be left, who declared to reverse and nullify any Wills and other acts of last will which he Testator may before this date have made or executed, declaring null and void any of those as if they had never been made or executed: And subsequently disposing anew, he Testator declared now to bequeath as follows.

To Mr. Nicolaas Beeldemaker, the sum of five thousand Guilders.

To Mr. François Beeldemaker, the sum of ten thousand Guilders.

To Maria de Haan, wife of Adriaan van Charante, the sum of one thousand Guilders.

To the widow of Pieter Kemenaer, the sum of one thousand Guilders.

To Jacobus Kleij, the sum of two thousand Guilders.

To the Parish welfare of the Public Dutch Reformed Churches of this town, for the benefit of its Poor the sum of one thousand Guilders, provided that this will forever remain as a fixed item on the Register.

To the Overseers of the Remonstrant (Ed.Note: =Arminian) Parish in this town, for the benefit of its Churches and its Poor the sum of one thousand Guilders.

To the Overseers of the Lutheran Parish in this town, for the benefit of its Churches and its Poor the sum of one thousand Guilders.

To the Overseers of the Mennonite Church in this town, for the benefit of its Church and its Poor the sum of one thousand Guilders.

To his Servant Hermanus Rabels, provided he will still be in the Testator's service on the day of his death, but else not, Testator's entire Watchmaking shop, with all the watches and tools, and the claims and debts, and if he considers this to be worth less than four thousand Guilders, he will have the liberty to have it valued by two assessors — one to be chosen by him and the other by the executors, and if found to be worth less, it will have to be supplemented in cash to the sum of four thousand Guilders, further one package of clothes and accessories and a dressing gown; The Testator considers, that the Hobby pieces Globes, Pyrometer, and all further Hobby pieces which are not part of Watchmaking, are not part of the Watchmaking shop, Watches and tools, and he Testator will further dispose about those.

To his Maid Stijntje de Rouw, provided she will still be living in at the Testator's house on the day of his death, but else not, the sum of four thousand Guilders, and in addition a Watch, standing or silver pocket type, plus a Bed with its accessories, which he will leave to her choice.

To Govert Schauwer, skipper of his yacht, provided he will still be in the Testator's service on the day of his death, but else not, the sum of fifty Guilders for each year he will have been in his Testator's service on the day of his death, the year of his death to be counted for a full year; which fifty Guilders per year after the final reckoning will have to be paid to the legatee in a single sum.

To Jan Hendrik Poll, hand on his yacht, provided he will still be in the Testator's service on the day of his death, but else not, the sum of twenty-five Guilders for each year he will have been in his Testator's service on the day of his death, the year of his death to be counted for a full year; which twenty-five Guilders per year after the final reckoning will have to be paid to the legatee in a single sum.

And to Jannetje de Bruijn, wife of Pieter Geerholt, seamstress, provided she will still be in the Testator's service on the day of his death, but else not, the sum of five hundred Guilders.

Which aforesaid bequests must be paid within a period of six months after his testator's death, either entirely or partially in ready money or in Securities, as left by him testator, reckoned at one hundred per cent, whether they may be worth more or less, as chosen by the Executors hereinafter defined, without the selfsame legatees in the mean time being allowed to pretend any interest, and all this clear and unencumbered, without deducting the (.....) portion (and on the contrary expressly forbidding such deduction), and without the aforementioned legatees being required to pay any death duties, as they are declared to be exempt from those.

And as regards all further goods and in all things he, testator, will on his death vacate and leave (nothing excepted) and expressly including his possessions in the Kingdom of Great Britain, and further the bequests which may be void and lapsed at the time of his death, he Testator declares to appoint as his sole and general heir with full rights of inheritance the hereinafter mentioned Stewards and Administrators and those who from time to time will succeed them, of the Foundation which he Testator might have founded during his

lifetime and, failing this, which he is founding upon his death, and having as motto: CERTOS FERET EXPERIENTIA FRUCTUS (EXPERIENCE IS CERTAIN TO BEAR FRUIT), and that for the benefit of the same Foundation, to maintain it from the Income from his aforementioned goods to be left, and to make it steadily flourish; which goods will be always and forever be and remain bound, as he Testator binds them with these, to the ends hereinafter, as follows.

To Anna Greenwood, the sum of seventy-five Guilders per annum.

To Arnoldus de Vet, the sum of fifty Guilders per annum.

To the widow of Jan Rabels, the sum of fifty Guilders per annum.

To Anna Zwanendrift, the sum of fifty Guilders per annum.

To Gerardus Kuijpers, the sum of seventy-five Guilders per annum.

To Aaltje Dumon, the sum of twenty-five Guilders per annum.

And to Jacobus van Lis, the sum of twenty-six Guilders per annum.

Of which annuities the first year shall be owing and payable by the Stewards and Administrators mentioned hereinafter, or those that will come in their place, one year after the death of him Testator and continuing year after year until the death of each of these respective Legatees, and this clear and unencumbered, however named: but the last-mentioned annual Legatee will have to collect the annuity in portions, or once a year.

And Secondly: That the further clear and unencumbered Income from the abovementioned goods, as also the abovementioned annuities as they will from time to time become void and lapse as the respective legatees die, will be employed to execute Testator's will and desire about the abovementioned Foundation, according to the Plan to be made and signed by Testator, in particular, for the benefit of his Fatherland, to set each year one or more problems to the Public, for which the following three Questions may serve as examples of his Testator's purpose.

Firstly: what is the reason that Rivers from time to time lengthen, and that dry parts appear therein, also that they become narrower and shallower and that the IJssel (below Gouda) becomes less narrow and shallow than the Leck or the Waal, all three being very curved, what is the reason for this, whether there exists a remedy, and what that consists of?

Secondly: What is the best means of preventing dike breaches, with an open River and with Ice pileups?

And Thirdly: If there is one, two, three or more feet of water on the land, whether means would exist to extract the water from there within a specified time as desired, without depending on Weather, Wind or high tide, and costing less than the Watermills?

And furthermore, to satisfy his testator's aim the seven persons he intends to appoint as Directors of the aforementioned Foundation will have the faculty to examine the replies received on the aforementioned and other problems and, finding the best answering ones, to award for these the promised premiums or awards, that further these same appointed Persons will have the power, to perform real experiments, and to have made the needed Instruments, and the cost of same, but not exceeding the clear annual Income, to be paid out of the same Income, thus always leaving the Capital of the mentioned Goods whole: Testator further desires that in case there would be, in any year, left some of the aforementioned clear Income, the Stewards and Administrators will hand out these left over monies to destitute Carpenters, Masons and Tailors out of Work during the Winter season, if they make their need known.

Testator excludes from his Estate and Goods to be vacated (saving their Honour and Dignity), those of the Honorable Court, the Orphan Chamber and the Orphan Masters of this town, and of any other towns and places where his house of death might be situated, any goods situated, or underaged person happening to be in there, might reside.

(Ed. Note: this clause, similar to one found in many 18th century wills, is unclear without expertise in such wills; it does not seem of great importance within the subject of this study)

The Testator appoints Mr. Pieter van Liender, merchant in this town, Mr. Jan van Eck, major of the Citizenry of this town, and Mr. François Beeldemaker, deputy secretary of the Hoogheemraetschap of Schieland as only and absolute Executors of this his Will; To this end giving them all such power as can, or may, be given to Executors, And particularly (over and above the power already given to them above, to enter

Testator's house upon his death, to take care that his dead body is properly buried and to do everything deemed necessary for that purpose, with all that may entail; to make or have made an inventory of his testator's Estate, and his heirs and any others involved must be fully satisfied with this inventory, made up under simple affirmation of the abovementioned Executors that it is proper and sincere, without to their knowledge omitting anything, to sell, either publicly or privately, the goods to be left behind, movable or immovable, which are not disposed of otherwise, and to transfer them to the buyers clear and unencumbered, without needing any exemption from the Sovereign of the Land, or any Decree, Consent, or authorization from any Courts or Aldermen; the proceeds will replace the goods in the Estate; to pay all debts and charge on his Estate, including the bequests to each of the legatees, and subsequently to manage, and Liquidate the Estate, and if this is to their judgement done and completed, to provide reckoning and evidence to the Stewards and Administrators of the aforementioned Foundation as his heirs, for the benefit of this Foundation, and to draw up a list of his Testator's remaining goods, and to transfer those goods to the Stewards and Administrators of the abovementioned Foundation to be bound and stay bound always and forever to the aforementioned purpose, where the Reckoning by these Executors shall be accepted as totally satisfactory, under the simple confirmation of these Executors that all they have done and completed has been done in good faith, without his aforementioned heirs or anybody else directly or indirectly can raise any objections, and in fact prohibiting such Debate or Contradiction; and he Testator further stipulates that after the death of one or more of the aforementioned Executors, or after the position of one of them might otherwise vacate, the others have the power to appoint one or more Persons in such position with the same powers, and this from time to time, as often as needed or required.

He Testator is Requesting, Committing, and appointing as Stewards and Administrators of the aforementioned Foundation, and as such of the Goods to be inherited for the benefit of said Foundation, Mr. Adriaan Prins, former Burgomaster of this town, and Director of the East Indies Company in the chamber here, Mr. Paulus Boogaart, Seigneur of Alblasterdam, Reigning Burgomaster, Councillor and Corporation member of this town, Abraham Gevers, Councillor, Corporation member and former Burgomaster of this town, Commissioner in the Honorable and Mighty Board of the Admiralty of the Maze, and director of the East Indies Company in the chamber here, Mr. Willem Prins, former Head Sheriff of this town, sworn Principal Participant of the East Indies Company in the chamber here, Mr. Paulus Gevers, Director of the West Indies Company in the Chamber on the Maze, Mr. Nicolaas Martinus Boogaart of Alblasterdam — Former Commissioner of the Maritime Court of Justice in this town, and Mr. Adriaan Gevers Deinoot, former Sheriff of the Court and High Tribunal of Schieland. To this end giving these all powers as can be given to Stewards and Administrators; And especially, over and above the powers given them above, with regard to any monies which might be laying idle, and those which should be redeemed from time to time, to invest, such monies or employ them to purchase Securities, which the abovementioned Stewards and Administrators and those which may succeed them will consider good and proper, and further upon the death or otherwise vacating his position of one or more of the abovementioned seven stewards and administrators, the remaining ones will replace them by other persons, being amateurs of the Natural Sciences, with the same powers, and from time to time as often as shall be needed. He further desires that the Properties and Securities belonging to the Foundation mentioned, will be always and forever in the care of the abovementioned Stewards and Administrators, or those that will take their places, in a chest with three locks, of which the three eldest Stewards and Administrators each will have one key, and that the Securities on and in the Kingdom of Great Britain must always be in the name of the above-mentioned Stewards and Administrators.

He Testator is appointing as Directors of the aforementioned Foundation such Persons, as will be found after his death to be named in his hand and over his signature; To this end giving same all such powers as they will need to this end and which he can or may give, and especially over and above the powers given above, to make such Rules and Stipulations, as they will judge best to further his Testator's aims, and also upon the death of one or more of the aforementioned Executors, or after the position of one of them might otherwise vacate, the others have the power to appoint one or more able and competent Persons, being also Amateurs of the Natural Sciences, in such position with the same powers, and this from time to time, as often as needed or required.

And if on his Testator's death the abovementioned Foundation should, in the opinion of the afore-appointed Executors, not fully established yet, for that case he Testator states that he qualifies these Executors to supply and fill any deficiencies and, should he not have appointed Persons as Directors, to appoint and nominate seven capable and competent Persons, Amateurs of the Natural Sciences, or a many as might fail of the number of seven.

Finally, the Testator declares that he reserves and maintains for himself the Freedom, power and

capability, after today's date, in his own hand and over his own signature including day and date, with or without witnesses, to set legacies and prelegacies, and further to alter and supplement his aforementioned dispositions, and in particular with respect to the aforementioned Foundation and the associated Regulations, everything to his Testator's approval, and desiring that same shall be complied with, and have such power and value as if included in these presents, or as if they had been done and executed before a Notary and in the presence of witnesses, in the most powerful way.

All which, having been clearly and word for word read out to the Testator, he declared this to be his final Will and Testament, desiring that the same shall be complied with and followed as such, either as a Testament or as a Codicil, whichever be the most appropriate; To this end seeking the help of Justice and Judges.

Thus done and executed in Rotterdam, at the time mentioned earlier, in the presence of Cornelis Proons and Daniel Meesters as witnesses, requested to serve as such.

(signed) Stⁿ Hoogendijk
(signed) C^s Proons
(signed) D. Meesters
(signed) W.Boon, nots.Pub.

HvL to John Enslie 1770-06-29

AoS ref. MS 3219/4/71/1. Copy from R. Hills. Note the reference to 1769 correspondence. A tun (Du. ton) of water could be 5 or 5¼ or 6 cubic Rhineland feet, from later correspondence, HvL appears to use 5¼, or c. 0.164 m³.

DH^f John Enslie

Rotterdam 29 Junij 1770

Weledele Heer en Vriend.

Na UWED: Een voorspoedige en behouden overtocht gewenst te hebben; neeme de vrijheijd UWED: met deze letteren op te wagten; zijnde mij na Uw vertreck te binnen gekoomen (i)n't verloopene jaar gehoudene correspondentie met (UWED) end d'H^f James Watt over de fire Engines; endewijl ick niet wanhoopte die werktuigen ter een of anderer tijd in gebruijck alhier te zien brengen, zoo zult UWED: mij verpligten, wanneer UWED: gelegentheijd vind die Heer te spreekken, van zijn ED: nogh eenige nadere ophelde(*ring te vraa*)gen die zijn ED: in deszelfs missives belooft heeft omtr(*ent*) zijne machines op te zamelen, en aan te teeckene(*n om aan*) zijn ED te vraegen of hem oock ergens eene in Engeland of Schot(*land*) bekend is; die het waeter maar tot een kleijne hoogte van (*ca.?*) 6:8 of 10 voeten opbrengt; omdat men dan van t effect beeter zoude kunnen oordelen; want volgens de opgaave beroemde waterwerkkundigen moet het vermoogen van een machine met een cylinder van 52 duijmen diameter veel grooter zijn als UWED: vriend t zelve heeft opgegeeven. d'H^f Hoogendijk heeft er nu verscheijde zien werken in Henegouwen en t Land van Luijck, die alle 13 en 14 slaegen in iedere minuut gaeven; en UWED: vriend heeft maar 10 slaegen in den minuut opgegeeven; volgens mijne nadere en nauwkeuriger bereeckening & volgens de gronden door Desaguliers en Belidor opgegeeven; kan een machine met een cylinder van 52 duijmen diameter het waeter maar 4 voeten opbrengende ledere minuut 800 tonnen waeter opbrengen; en vier onzer waetermoolens kunnen in dezelve tijd maar 840 tonnen waeter opbrengen; dus doet dezelve zeer na het effect van 4 waetermoolens: UWED: zult mij niet kwalijk gelieven te neemen, dat ick UWED: met deze commissie chargere; wensche UWED: bestendigh welzijn en verblijve met alle estime WelEdele Heer & Vriend UWED:DWDienaer

J:D:Huichelbos van Liender

(English translation)

Dear Sir and Friend,

After having wished you a speedy and safe crossing, I take the liberty of having these writings waiting for you. After your departure I remembered last year's correspondence with yourself and Mr. James Watt about fire engines. I still hope to eventually bring these engines into use over here, and you would very much oblige me, should you find an opportunity to see this gentleman, by asking him for some further clarification about his engines, which he promised in his letters to gather and write down, and also to make a note to ask him if he knows of any in England or Scotland with c. 6, 8 or 10 feet lift. This would allow better assessment of the performance, as according to the data provided by renowned hydraulic engineers the power of an engine with 52 inches diameter cylinder would be much greater than your friend has stated. Mr. Hoogendijk has recently seen several at work in Hainault and in the Liege region, which all did 13 or 14 strokes per minute, whereas your friend has indicated only 10 strokes per minute. According to my further and more accurate calculations, and to the principles formulated by Desaguliers and Belidor, a 52 inch diameter cylinder doing a lift of just 4 feet would raise 800 tuns of water per minute. Four of our drainage mills would raise only 840 tuns in the same time, so the engine performs almost as well as 4 drainage mills.

Please excuse me for charging you with this request. I wish you lasting health and I remain respectfully, my dear Sir and Friend, your obedient servant,

J:D:Huichelbos van Liender

John Enslie to JW 1775-05-11a

AoS ref. MS 3147/3/505/2a. Addressed: Mr James Watt in Glasgow.

Covering letter for [1775-05-11b]

Rotterdam 11 May 1775

Dear Sir

The Inclosed Letter is from a Friend of mine in this Town, who is concern'd with another Gentleman in erecting a Fire Machine by way of trial, which is to be wholly at their own risk & Expence —

They want Therefore as you may easily imagine to procure all the information possible from such as have Experience of these matters —

I shall therefore esteem myself much oblig'd to you, if if you'll be so kind as answer his Letter as soon as possible; I remain very Sincerely

Dear Sir Y^r Friend & Hum^{ble} Serv^t

John Enslie

HvL to JW 1775-05-11b

AoS ref. MS 3147/3/505/2b.

Transcript of text found in [Bacon Motto]. Refers to a notice or advertisement in the English press, which was apparently the first mention of the 1769 patent which came to HvL's attention. He loses no time in making inquiries, via mutual acquaintance John Enslie, who forwarded this letter to JW. New Whilly refers to John Wilkinson's New Willey foundry in Brosely (info from R.Hills). The parts for the Rotterdam engine were received via Chester in 1775-01. The Rotterdam engine made her first strokes on 1776-03-09. Reviewed, using a transcript by R.Daalder and a xerox of the handwriting. R.Daalder found the draught in MS 3147/3/505 near item 26 [1787-11-02].

M^r James Watt
Glasgow

Rotterdam, 11 May 1775

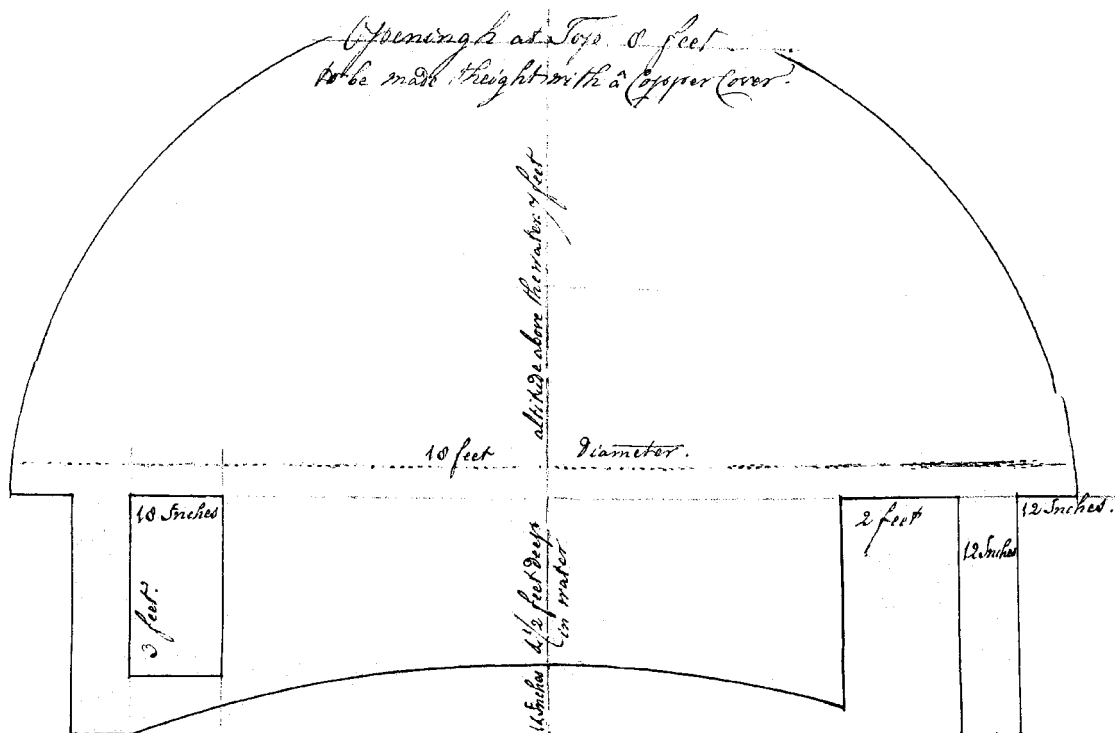
Having seen in one of your periodical papers that you have obtained an exclusive right for a new invented fire engine, I take the Libertij of addressing myself to you by this letter begging you will be so kind and mention to me what sort of invention or appovement yours is, because I am busij at present in company with some few other Gentlemen of erecting at the rempart of this town a fire Engine, which will be a common lever Engine, for which we have received from New Whilly in Shropshire the Cylinder of cast Iron of 52 inches diameter and 9 feet long, and the boiler of Iron plates nailed together, the diameter at the flange 18 feet, and at the bottom 16 feet, the height from the bottom to the flange four feet and from the flange to the top or brim 7½ feet. Th'intended height of the water ½ foot above the flange. This boiler will be with an inside flue of the height of three foot and of the breadth of 2 feet and 18 inches, which you will conceive better by th'annexed draught of its profile. This our engine will serve for bringing up the water from 6 inches to 5 feet, never higher; with wooden pumps some round of 6 feet diameter, and some square of 6 feet square; of which Eight are already fixed, and within a few days we think to put up our boiler and within three months we hope to see th'Engine work, which will be the first ever erected in this Country; and when its effect answers but tolerably our expectations, must be a certain forerunner of a great many others.

One M^r Chrijsell from Bristol has obtained a patent for his boiler of a new construction; which according his brief account must be a very shallow one; me thinks his notions about that point are not at all absurd; and I believe that in common the depth of water in the boilers is to great for to have a quick boiling; and an oeconomical expense of fuel. I am very curious to know Sir where in your improvement consists and in expectation of your desired answer I remain with esteem

Sir

Your most ob^d & humble serv^t

J:D: Huichelbos van Liender



JW to HvL 1775-07-10

AoS ref. MS 3147/3/80/8-9. Copy from Hist.Mus.Rdam. Transcript by R.. Daalder.

In [Brieven] a c.1935 typewritten summary of this letter was found. The clarity and candidness with which Watt explains his engine is remarkable.

J.D.Huichelbos van Liender at Rotterdam

Soho July 18th 1775

Sir

Your letter of the 11th May lay some time in Scotland before it was sent (*hither*). I only receiv'd it the latter end of last month, since you heard of me by (*our mutual*) friend Mr. Enslie I have compleated my improvements upon the steam engine (*and*) obtained an act of Parliam^t granting me the exclusive right to the (*invention for*) 25 years to come throughout Great Britain and the Plantations, Colonies (...). My engine consists of a cylinder and piston and works the pumps by a great lever as usual. The Improvement consists in keeping the Cylinder always of the same heat with the steam from the Boiler; by covering it with materials which transmit heat slowly and by using no injection of water into the Cylinder by these means the Cyl(*inder*) is filled by less than half the quantity of steam necessary in common engines. For them the cylinder is cooled by the water thrown in to condense the steam and w(*hen*) fresh steam enters it destroys or reduces to water the greatest part of what is inte(*nded*) to fill it; but in this new engine as the Cylinder is never cooled so it can conden(*se*) no part of the steam and is thereby more easily filled.

Secondly in common fire engines the vacuum is not made perfect, because were (*they*) to throw in so much cold water as would compleatly condense the Steam they wo(*uld*) lose so much more steam when they filled the cylinder over again that they would find themselves greater losers in point of Steam than they were gainers in point of power. They therefore generally confine their power to 7 lb of a column of water for each square Inch of the Piston and even that is more than they ought to use. To remedy this inconvenience I condense the Steam in a vessel appropriated to th(*at*) purpose which communicates with the Cylinder during the time of condensation only. This vessel I call a condenser the engine keeps it perpetually exhausted of air & wa(*ter*) by a pump and the steam rushes from the Cylinder into it with great violence upon opening a valve for that purpose when the condensation is wanted and the steam is there made as cold as is necessary to make the vacuum compleat. An engine I have made here is loaded to 13 lb pr. inch and uses only one third of the fuel of a common engine.— I am now erecting some engines of double the power of yours which will be compleated in about 4 Months when they are set a going I shall inform you of the particulars of their size and powers. The boiler you send drawing of is a very good one and if properly built up will perform well in proportion to the coals it will use. Cheysel is an ignorant quack and his book calculated to deceive the plain fact in relat(*ion*) to the evaporation of water is this, that the quantities evaporated are proportioned to the heat that enter(*s*) the water — caeteris paribus in proportion to the surface exposed to the heat(?) in proportion to the upper surface of the water nor to the quantity of (*water*) the latter has no more to do in the matter than that it is longer in (*coming*) to boil, but after boiling the quantity evaporated will be as the fuel (...) provided it be properly applied and no part of the heat lost upon (*other?*) bodies. I use boilers exceeding little different from the common ones (A ?) Cwt of Newcastle coals properly applied should evaporate from 14 to (18?) cubic feet of water in such a boiler as yours is. To people in Britain my terms are as follows. The savings in fuel are to be estimated by comparing the effect of a Cwt of coals burnt in my engine with that of a Cwt burnt in any common engine they chuse to pitch upon, and these savings are (?) to be divided into three parts, two whereof belong to the user of the engine and the other third part to me to be paid annually so long as they use the engines or my priviledge continues, so that in places where coals are dear my profits are greater, than were they are cheap, and are always proportioned to the profits of the users. The engine itself will cost about the same Sum as a common one and I charge no profit upon the first erection. A common engine can also be converted into one of mine but the Alteration will be attended with some expence. Out of Britain I would not chuse to erect my engines unless the state where they are to be erected will first grant an exclusive priviledge for a reasonable term of years and no person here can make them for exportation without my consent. I shall always be happy to hear from you to know how your engine answers expectations and in what forwardness you now are.

I am with regard Sir Yours etc.

J.W.

Address to me engineer here,
in Absence to M Boulton Esq^t

JW to Enslie 1775-07-14

AoS ref.

The enclosed reply to HvL must be letter 1775-07-10.

M^r John Enslie Rotterdam

Soho, near Birmingham July 14 1775

Dear Sir

Inclosed I send an answer to your friend M^r van Lienders letter which I hope will be satisfactory and if he wants any further information I shall be very ready to give it him — I have lived here above a year so am perfectly ignorant of the transactions of our friends in Scotland except by hearsay — I have been all that time in bringing my fire engine to perfection except three months I spent at London solliciting my Act of Parliam^t — I have now entered into partnership with M^r Boulton of this place to carry them into execution and to supply the Kingdom with them we have already got a good many orders for 'em. I intend going to Scotland soon and to stay a month or so after which I shall return here to live M^r Boulton will answer any Letters your Friend may send in my absence.

I ever remain

D^t Sir Your Oblidgd Serv^t

JW

HvL to JW 1775-08-10

AoS ref. MS 3219/4/78/12. Transcript probably by R.L.Hills.

The JW letter referred to can only be [1775-07-10]. HvL writes that the jacketing of the cylinder had occurred to him "long time ago"; one wonders if he was aware, that jacketing is quite useless on an atmospheric engine with condensing in the cylinder (which would be the only type he could have known about). Re final paragraph: ten years later an exclusive privilege for Watt in the Netherlands turned out to be less straightforward than HvL thought.

to James Watt

Rotterdam, 10 August 1775

I am much obliged for your Kindness in answering my letter so circumstantially; so far as I can judge of your improvement by your description; I own I have a very good opinion about it, The Keeping the Cylinder of the same heat with the steam must undoubtedly have a good effect long time ago I had that thought; but your thought of not condensing the steam in the cylinder but in a separate vessel is certainly an ingenious one, and must give a great advantage to an engine constructed upon that principle, but the contriving such an engine appears to me not an easy matter, how open your description is, for which I give you my hearty thanks, or are always some material circumstances, which when nor known, makes th'understanding very difficult nor is it to be exacted that you should discover to me all th'essential parts of an invention which has cost you so much trouble and time of which I wish with all my heart you may reap all th'advantages such a noble improvement deserves. I sollicit you earnestly to keep your word in informing me of the particulars sise and power of th'engine which will have double the power of ours, which you are about in erecting now when completed.

I think our boiler will be built properly up he will not be set under the cylinder, bur next to the same, having a communication pipe and receptacle for the steam between them. this construction brings our Cylinder between fore and six feet lower as otherwise it must have been, which is a great advantage for our whole building here. our fuel will be Sunderland not Newcastle coals. Our Engine is now so far advanced that the walls to Support the Cylinder are built up and in a few days he will be suspended upon them. the lever wall and chimney are about the same height, th'ashpit is made and the fireplace begun. the smiths are busy in nailing th'upper part or dome of the boiler with red hot nails, all these things go not so forward as in a country where all the people employed is used to every part, that she take in hand, which is not at all the case here. Our Engineer M^r Jabes Carter Hornblower speaks no Dutch att all; so that he give his direction by an interpreter when I am not on the spott.

I should never advise you to erect out of Brittain any of your Engines without an exclusive priviledge of the State where they are to be erected; in this country such a priviledge would easily be obtained without being liable to great Expenses.

I offer you my ready service in this Country and remain ...

HvL to JW 1776-03-15

AoS ref. MS 3219/4/78/13. Transcript probably by R.L.Hills.

The Watt letter referred to is [1775-07-18]. Only a few days before, on 1776-03-09, the Rotterdam fire engine had made its first strokes. HvL is understandably elated and justifiably proud, and loses no time in writing to Watt, not forgetting however to press Watt for further data on the improved engine.

to James Watt

Rotterdam, 15 March 1776

I never should have thought that I was the first of us both, which would give one another good advice of the good issue of our several undertakings; following your promise by your agreeable favour of July last. I expect since two or three months to know the particulars of the size and power of some Engines, which you was about erecting in that time, and which you expected to be completed in about four months after. I doubt not, but that she will have been completed and already set to work, but that your many occupations will have hindered you to fulfil your promise. I have now the pleasure of informing you that last Saturday we tried our Engine for the first time, having had no patience to wait any longer time, notwithstanding many parts of it were not fully completed, and our house water pump not yet giving water, so that we could make no use as of the water, which was by hand pumped up in the cistern, but which has been enough to let the Engine give about thirty strokes with two pumps which are fixed to the middle or great lever and which are 6 feet square, and the one 6 feet deep the other three feet; making the quantity of 320 cubic feet of water, which the Engine has raised at every stroke with the greatest ease of the world. I am able further to assure you that the boiler does his work very well, and that before and in the time of our working the Engine the steam was prodigious strong, and the consumption of fuel not extraordinary, not so much as commonly the Engines of the size as ours built about coal mines do consume. the working of the Engine was exceeding soft nice and easy, without making any noise at all; this first tryall has satisfied extremely all who are concerned with me in the success as well as our Engineer self. we will now do no more tryalls before all things are in due order, and that we can work with the eight pumps at once of which I hope in any time afterwards to give you no less favourable advice as I do now; In the meantime I hope that you will find an opportunity of fulfilling your promise and rejoice me with the agreeable news of your having succeeded completely in your undertakings, which is the ardent wish of

Dear Sir Your most ob: Humble Ser^t

J:D: Huichelbos van Liender

MB to JW 1776-07-10

AoS ref. MS 3782/12/76/113. Addressed Mr James Watt Engineer at Glasgow N Britain.

There is a tenuous link with HvL through the Falck reference; otherwise this letter may provide a glimpse of the early years of the B&W partnership.

The [Falck, 1776, p26,27] text referred to, reads:

(.....) the end of the lever to which the pump rods are suspended must be loaded with a sufficiency of weight to force down the pumps and to raise the piston in the cylinder, that weight consequently must be raised again by the power of the descending stroke of the engine, and naturally must deduct from the power (applied to the raising of the pump) by the whole amount of the weight appending: thus for example; suppose the descending stroke of the piston into the cylinder be computed fourteen tons, and the weight appending to the pump rods on the other end of the lever be about six tons (as it is in the engine to which this improvement is compared) the neat produce of power will but remain eight tons out of the fourteen. This is an impediment which most certainly is wished to be removed.

The “engine to which this improvement is compared” is the York Buildings atmospheric engine, which Falck describes earlier in his pamphlet, but only explicitly names on p.40.

A commonly used quantity to describe and assess these early atmospheric and Watt engines, is the “load on the piston”, i.e. the effective pressure differential over the piston during the working stroke, expressed in pounds per square inch or psi, but often mentioned as “pounds per inch”. For a perfect vacuum, the load of an atmospheric engine would be 14.7 psi, and this is the theoretical maximum attainable for such an engine. JW often used a conservative 7-7.5 psi for atmospheric engines. A value of 17, as MB derives, would indeed be preposterous and impossible.

Falck argues that the maximum force exerted by the steam piston is 14 tons or 31360 lbs; for a 49 in piston with 1886 sq.in surface area this amounts to a load of 16.6 psi, close enough to MB’s figure, and equally impossible.

The York Buildings engine is described in [Farey, 1827, p242-253]. The engine had two pumps in parallel, one lift pump and one (weight-driven) force pump, with a total pump rod load of c.12000 lb, which for an equal-beam engine would amount to a net steam piston load of 6.25 psi. Farey reports or assumes the vacuum at 8.75 psi, leaving a difference of 2.5 psi. Half of this, he reserves for the “counterweight” (as distinct from the weight driving the force pump), which would then be about 2360 lb or 1 ton; the remaining 1.25 psi provides another 2360 lb to overcome friction and provide acceleration.

Falck mentions the counterweight, but not its role in driving the force pump — he seems to regard this as solely for friction etc. On p.10 Falck writes “...in order to draw up the piston in the cylinder (to effect which the steam is not sufficient) and to press down the bucket in the pump, a considerable weight is added to the pump rods, which frequently amounts to near half of the power of the engine” He asserts this overweight to be 6 tons, i.e. more than twice Farey’s driver weight value. Still, when describing his own engine he does mention the lift/force tandem explicitly (p.34).

It remains unclear how Falck derived his 14 and 6 ton figures.

Soho 10th of July 1776

Dear S^t

Don’t attribute my long silence to a want of respect & youl be more kind than I deserve & yet not more than is due to my good intentions I have had this summer at the bottom of my garding (*Ed.Note: old form of garden*) a vast crop of Coaches & posh(?) Chaises I have fancied myself much hurried but perhaps it was only for want of health & spirits however I have some real evils & some bad health. The lunar Doctors prescribed for me lately 6 purges one bleeding 2 pukes(?) &c: apart of y^e purges I consented to & I think myself y^e better for em

I have this even^g recv^d your fav^r of y^e 3^d Ju^v & I also recv^d one other letter w^{ch} is not before me, by your first letter I was fearfull of Your returning alone & therefore I sent you D^f Falks pamphlet for a companion (Directed to D^f Hutton) At first sight of it I thought an illnated performance that might tend to do us mischief but after ye first fit of passion had subsided I (.....) it and its author as things of no consequence unless we made em so by taking notice of them.

Perhaps it might not be impolitical if you were to publish a paper in the Philosophical Transact^s with chiefly Elementary intimating that We have a variety of Engines invented very diff^t in their construction some where the piston is press^d upwards & without a great Beam others where there is a constant vacuum under y^e piston &c &c &c; & that you have annexed a drawing of one (.....) w^{ch} is erected at Bedworth & that it doth so & so wth such a quantity of Coals

You may compliment y^e York building Engine & say tis the best you have ever exam^d & that its Cylinder is

49 in^s & its load is 6 lb 1/10 upon y^e Inch which is = 5 Tuns 2 cwt. Then in a marginal note you may observe that D^f Falk in his pamphlet says its load is 14 Tuns & its Counterballance 6 Tuns wh^{ch} w^d be 17 pounds per Inch — an error of first magnitude

The Curve of Boiling points under diff^t pressures will do you honour if you think it prudent to publish it. I w^d explain y^e Engine & things but little further than most Philosophers may do by inspecting an Engine Intimate that great Mechanical difficulties have occurd but that we We have now conquerd them & renderd the Engine less liable to be out of order than a Comⁿ one. I think the best & most reputable advertisement w^d be a Paper in the Phlo^l Transactions

I most sincerely congratulate you upon the accomplishing a point so important to your future happiness as y^e consent of ——— and although I have added to the list of my bad habits by Jokeing upon Matrimony yet my dispositions & my judgment would lead me to marry again was I in your case. He that bangs or knocks out 's brains the devils in him if he feigns. I know you will be a happier Married Man than a single one & therefore it is Wisdom in you to Wed & if that could not be done without my coming to Scotland I certainly would come if it was as far again but I am so beset with difficulties that nothing less than the absolute loss of your life, or Wife, w^{ch} is virtually y^e same thing, could bring me. I need not point out the extra engagements which fall to my lot at this season of the Year. M^f Matthews who is our Mony Prvider is to be married about the end of this Month & the day following He & his bride with M^f Fothergill & his daughter set out to Brussells & thereby avoid the Ceremonies of Visiting the (*loss?*) of Fothergill, of Joseph Harrison (who is gone yesterday wth (*laugh?*) to London) of Matthew & yourself & M^f Scales head, at a time when the Mony changing requires additional attention when we are behind hand in our Button orders 16000 Gross when I have more real difficulties to grapple with than I hope ever to have in any other Year of my Life. I could mention other reasons but I will not let you partake of my plagues. Dam the Whole (.....) of Faulks, Heatleys, Hocrofts, &c &c they do us ill the service the can in Town & Country besides I no sooner mentiond your wishes to have me come to Scotland but my Wife vows she will come with me so that there is no making a flying visit. In respect to your request about y^e deed of partnership I will do all I can about it but you know our Lawyers are not punctual folks. As it is not yet drawn nor executed, suppose I get it drawn & send you a Coppy & write a letter with it urging the danger of sending y^e original & that I suppose a Copy may do as well in w^{ch} case y^e old Gentⁿ need not know but tis already executed. & then we can rectify the wording when you come up I see nothing in Your Missives but what is agreable to me & what I accept of & agree to. It is certainly right to have it executed an soon as you return although I am persuaded that you & I shall not differ whilst we live nor after we are dead, but our Executors may

I fear S^t Arch^d Hopes Engine will not be worth your attention as his Coals are so very Cheap. M^f Colevilles may. I have spoke to Wilkinson ab^t his Cylinder for Wilkinson is now in my House & we expect M^f Moor of the Adelphi tomorrow whose principle business is to see with his own Eyes whether what hath been said at their Society is true or false respecting y^e Engine

Our Copper Bottom hath plagued us very much by steam leaks & therefore I have had one cast (with its conducting pipe) all in one piece, since which the Engine doth not take more than 10 feet of steam & I hope tomorrow to reduce that quantity as we have just rec^d the new piston which shall be put in & at work tomorrow. Our Soho Engine never was in so good order as presently; Bloomsfield, & Willey are both well & I doubt not but Bow Engine will be better than any of 'em. I have had several letters upon Engine business & the particulars (.....) reserve to another opportunity. I will see after M^f Hamiltons goods in the morning. The Duke of Bucclough was here a few days ago & enquired after you

I desired our clerk M^f Pearson, some little while ago, to take up his wages Sixty pound p^t annum out of the Cash he keeps, weekly or as often as he pleased; & that I did not doubt but by his exactness & assiduity he would give me an opportunity of indulging myself with the pleasure of makeing him a small Compliment at the end of his Year over & above y^e agreed for wages; but to my surprise I recv^d the inclosed from him a few days ago which certainly tends to lessen the pleasure I should have had in making him any present. I wish to know if any thing passed between him & M^f Hamilton that could induce him to write such a letter. He never comes to work before breakfast His task is the Soho Books only; for he never writes a letter or doth any other business & therefore he is not a slave and as to the profound Mystery of Book keeping. Comⁿ sense & six weeks practice w^d accomplish it

I will conclude in my next for tis so late that I cant read what I have wrote

MB to Sir Joseph Yorke 1777-?

AoS ref. MS 3147/3/544/28. Docket: Copy of l^r to S^r Joseph York.

Copy (or rather draft) of the letter, undated, without greeting or ending. MB is seeking Sir Joseph's advice about aspects of the patent situation in Holland and asks for his protection (i.e. help) when it should be desired to apply for such a patent. The date of the letter is an educated guess: the last of the engines mentioned at the foot of the letter was erected in 1777, Yorke was ambassador in Holland until December 1780.

The symbol ∇ obviously stands for "water". Two performance figures apparently had to be looked up, but they were eventually not entered in the draft.

The possibility of drainage of the Haarlemmermeer, which would have been an immense and (if successful) prestigious undertaking, was obviously attractive for any ambitious entrepreneur. William Blakey also mentions it in [Brievens 33] as something that could be done by his engines, with considerably less caution than MB does here.

To S^r Joseph York

The knowledge I have of your Excellency's zeal to promote every British Interest, & of your disposition to patronize the arts, encourages me to take the liberty of writing to you at this time. I have undertaken, jointly with Mr Watt to carry into execution a very capital improvement of the Fire-Engine, for which improvement Mr Watt obtained an exclusive privilege for 25 years by an Act of Parliament passed in the year 1775. We have already erected several of these Engines and their success has fully answered our own Expectations & has somewhat exceeded the advantage we proposed to the Public, which was a saving of three fourths of the fuel usually consumed for fire Engines of the common sort, that is, the expence of keeping such Engines is reduced by our improvement to one quarter of what it was before.— I am inform'd that a cheap method of raising great quantities of ∇ is an object of considerable importance to the dutch and as the principles of our Engines has been given to the public in the Specification I am apprehensive lest the inventions should be carryd to Holland, to the injury of our own property, & probably to the discredit of the Engine, from the incapacity of the persons employd to execute well the mechanical part or from ignorance of the principles on which the superiority of our Engine chiefly depends.— I am therefore desirous of consulting your Excellency concerning the propriety of our taking out a patent to secure to our selves the privilege of our invention for Holland or rather for all the united Provinces if that can be done by one patent and if that proposal should be approved I shall employ an agent there, either a Merch^t or Lawyer, which ever may be thought most adviseable & beg leave to ask your Excel^y. protection in obtaining the patent if that should be necessary.

The draining of Harlem Meer has been often projected. How far it is practicable I have not sufficient information to judge but I am certain that no Machine hitherto invented is so likely as our Engine to produce so great an effect. To give your Excellency some Idea in a few words of its power we raised Hogsheads of water —— feet high at the expence of one Bushell or 84 lb of coals.

I shall be happy to find that your Excel^y. excuses this trouble & I am with the highest respect—

(Ed. Note: on verso of last page are some calculations of unclear purpose, plus the following list of six engines, the first one was set to work March 1776, the last one was erected 1777)

- 1 Bloomfield
- 2 Soho
- 1 Bedworth
- 1 Stratford
- 1 Wilkinson

MB to HvL 1778-08-29

AoS ref. MS 3147/3/81/44-45. Copy from Hist.Mus.Rdam.

The “programma” MB refers to, is undoubtedly the essay competition set on 11 August 1778 by the Batavian Society to find a solution for the problems with the pumps of the Rotterdam fire engine. It is a bit of a “putdown”, but quite in keeping with a strict approach to “proprietary knowledge” and its exploitation (see section The business model of the B&W Partnership). In the later correspondence JW does not rigidly adhere to MB’s adagium not to “engage in any discussions upon theory and principles” ! It may also be noted, that in letter 1776-07-10 MB suggested to JW to write a paper for the Philosophical Transactions about elementary and application aspects of the Watt engine family, apparently in response to [Falck, 1776] which was highly critical of the Watt inventions [1776-07-10].

MB’s style of writing is very precise, with carefully structured sentences and interpunction. In comparison JW’s (and HvL’s) sentences sometimes look a bit chaotic and rambling.

The efficiency guarantee offered is equivalent to 31.5 million ft.lb per cwt coals, that is a standard duty of 24 million ft.lb per bushel of 84 lb or, in modern terms, an overall efficiency of about 2.4 %.

M^r J.D. Huichelbos van Liender

Soho Aug^t 29 78

Sir/ I have received your favour several weeks ago and transmitted a copy to M^r Watt who has been several months past in Cornwall erecting 5 Engines. He has been so much engaged that he has left it to me to answer your letter. I have read the programma but as M^r Watt & I are engaged in the Fire Engine as a business or profession, we do not enter ourselves as candidates for honorary rewards, neither do we engage in any discussions upon theory or principles. But if you and your friends choose to employ us we will engage to raise 500,000 cubic feet of water one foot high, or half that number 2 feet high, or 100.000 cub.feet 5 feet high & so on proportionally, with one hundred weight of newcastle coals. If we engage to do that work with so little expence, you and your friends need not be sollicitous whether we use pumps or any other mode. But before we shall erect any engines in Holland, we must first obtain an exclusive privilege in that country, similar to that which we enjoy en (*sic*) England and if you can assist us in procuring that privilege, I doubt not but we shall be able to do the business you want to be done in a satisfactory manner, and I hope also that it may turn out to be of some benefit to yourself. That you may be enabled to compare our proposal with that which you may receive from others, I beg leave to recommend to you that you require them to say how many cubic feet of water they will undertake to raise with one hundred weight of coals, or with an equal expence. I give you many thanks for your good wishes to our undertakings, and I have the pleasure to say that every Engine which we have erected, does fully answer the expectations of ourselves and our Employers. — I am, Sir, your mo: obd^t h^{ble} serv^t M.B.

HvL to MB 1778-09-25

AoS ref. MS 3782/Gen.Corres.1778/208. Copy from [Tann, 1981] via R.Hills.

M^r M. Boulton

Rotterdam 25 Sept 1778

Sirs

I was favoured in due time by your Agreeable answer upon my letter to M^r James Watt, and saw with pleasure that gentleman constantly employed in erecting engines according his improved method, but it gave me some concern, that neither he nor you were in no manner Sollicitous for honorary rewards, the more as the desired solution and answer upon the question could have been composed by M^r Watt for diversion's sake, and in his leisure hours in th'approaching winter evenings, without doing him any harm, and where there was â prospect, that by obtaining the promised reward, his person and method would be more effectually recommended in his Country, than by all th'exclusive privileges you may have, besides this would never impede to obtain in this Country th'exclusive privilege, you seems to desire. In the contrary, it would greatly promote its obtaining, and must certainly be the best recommendation of any one's abilities in that sphere, and the preference he merites above all his competitors. These considerations I hope may alter yours and his resolution, and induce him to try his abilities in the discussion of this scheme. My friends and I are quite unable to employ your M^r Watt, we have no lands which want to be drained, all whatever we proposed ourselves to do had been nothing else than to demonstrate to people in general, that Fire Engines could be used in this Country to better purpose, than the common wind mills, whose defects and insufficiency were known and seen by us since many years. We never hath any other or special view of self interest, we expected not the least reward or profit, not even the reimburse of our expences. The glory of doing â Signal service, to our Country, was the only reward we aimed at, and those are the sentiments we stand in till this very moment, and as I hope we will never alter. We were offered an exclusive privilege for the common fire Engines, but we have declined it, and In the same time we have served other people. M^r Blakey should never have obtained th'exclusive privilege for his invention in this Country, if I had not given my formal consent to it, and I am ready to serve you and M^r Watt, where I can, and assist you in procuring th'exclusive privilege, if you think fit to obtain it; but to tell you the truth I can see no great advantage for you in it because the Dutch have no faith at all, they must see the thing with both their eyes, and then (when it is a new thing) they are with great difficulty persuaded to adopt it, and this is the Case with most nations

I am very respectfully,

Sir

Your m^t ob^t Hb^{le} Servant

J:D: Huichelbos van Liender

HvL to MB 1779-05-14

AoS ref. MS 3147/3/505/3. Docketed as 11 May. Copy from Hist.Mus.Rdam. Transcript by R.. Daalder.

MB had been to Rotterdam in April 1779, so he probably saw the 1776 atmospheric engine He also met Jan Hope in Amsterdam [1779-07-02]. This letter is mostly about the capacity/power of scoopwheel drainage windmills. The Rhenish or Rhineland linear measures are about 3.3% longer than the corresponding Imperial ones. For the square and cubic measures this is 6.7 and 10.2% respectively. The letter was damaged by the cutting of the seal, hence the incomplete PS; Blakey is the only possibility. Apparently his engine was not so much demolished, as dismantled, and the parts sent to Russia.

Rotterdam 14th May 1779

Sir

According the promise I have made you at your departure from this town I set myself down to give you a detail of what by the different calculations etc. in this country may be reckoned to be the true quantity of water raised by the windmills; and in order to give it you as compleatly as possible, I shall give you that quantity according to the opinion of several improvers of the windmills; according to a calculation we have made in setting out upon our undertaking the fire engine; and finally by what I have found the mills did in the tryalls against M^r Eckhard's improved mills; first of all I will inform you that the windmills and their use of raising water has been a constant object of speculation and meditation since thirty or forty years for people of every rank and condition, and that many have published treatises or discourses upon improvements found out by them, and many have sollicitated and obtained patents from the States in favour of their invention for a number of years; One of those improvers states the product of the common mills to be 1800 cubic feet at the height of four feet every minute, another at the same height 1360 cubic feet, a third says the quantity at four feet high is but 900 cubic feet, there is a great variation between those three calculations, which given for the mean quantity 1020 cubic feet in one minute at four feet height; An observation made by two eminent engineers for ascertaining the quantity water raised by one of the best windmills with a flight of 86 feet, the waterwheel turning round 14½ times every minute (which is certainly too much and requires very near a tempest) at the height of four feet, gave for the product 1330 cubic feet; the calculation we have made for finding the quantity of water raised by one of the windmills, is as follows.

The diameter of the waterwheel being 18 feet gives for its square	324 circular feet
of which must be deducted	<u>169 ditto feet</u>
being the square of 13 feet, the part of the wheel which do not pass through the water because the wheel hangs not deeper in the water than 2 1/2 feet; the residue is	155 circular feet
which being brought to square feet, by the known rule of proportion, gives for one foot breadth or thickness of the wheel	121 11/14 cubic feet
and the breadth or thickness being commonly 18 inches or 1½ feet the half of the above quantity being.....	<u>60 25/28</u>
must be added, and this gives for the whole	182 19/28 cubic feet
from this quantity must be deducted	<u>19 19/28 c: feet</u>

for the timber of the wheel which passes through the water, the neat circle of water brought up by the wheel by every turning of will be 163 cub: feet in case nothing was lost; and the wheel making 10 revolutions every minute, gives 1630 cub: feet, for its product and supposing one third of that quantity lost, the neat product will be 1087 cubic feet every minute four feet high, and this corresponds very near with the mean quantity found by me in calculating seven tryalls of one of the best common windmills against Mr. Eckhard's improved mill; for those tryalls was made for every one of the two mills a separate regular measured tight basin lined with deal boards, and having the length of 200 Rhenish rods or poles, and the breadth of 2 rods giving a surface of 400 square Rhenish rods, every rod being in length 12 rhenish foot, the surface or area of the basin is accordingly 57600 square feet, and 8294400 square inches, and every inch the water is lower in the basin by the mill, the quantity raised is equal to 4800 cubic feet, and the seven tryalls given the following product

No.1	Lowered the water in 112 minutes 5½ inches being	26400 cub: feet, gives	
	for every minute	235 5/7 cub: feet	
2. in	158 mins 13 inches ,,	62400 cub: ft is every minute	395 20/79 dt° dt°
3. ,,	125 dt° 9 dt° ,,	43200 dt° dt°	345 3/5 dt° dt°
4. ,,	61 3/4 dt° 14 dt° ,,	67200 dt° dt°	1101 49/61 dt° dt°
5. ,,	23 1/4 dt° 12 1/4 dt° ,,	58800 dt° dt°	1781 27/33 dt° dt°
6. ,,	34 1/2 dt° 13 dt° ,,	62400 dt° dt°	1808 24/69 dt° dt°
7. ,,	27 dt° 11 1/8 dt° ,,	53400 dt° dt°	1977 1/9 dt° dt°

the seven tryalls together

7642 c: ft

neglecting the fractions, gives for the mean quantity $1091 \frac{5}{7}$ cub: feet.

In those tryalls the waterwheel has made from $5\frac{1}{4}$ to 13 revolutions every minute; the result of all the foregoing calculations and tryalls gives for the neat mean product between 1000 And 1100 cub: feet every minute, which I doubt not or must be very near the truth, when the mill has to raise the water at the height of four feet, but if the difference from level to level of the two basins from which and to which the mill raises the water, is less than four feet , then the quantity raised will be more to a certain proportion; because the lesser the difference between the two levels, the easier the mill works; so in drainings when the second or another lower set off mills is newly constructed, and set to work, the difference of the level from which to which they raises the water, is in the beginning nothing, and increases by degrees to the common standard of four feet, by emptying the water out of the lake; and then another sett or range of mills is constructed, and so seven sets are constructed for emptying the water out of the Lake of Bleijswyck near this town, every set of four mills, in all 28 in number; 15 of those according M^r Eckhards invention, the 13 other ones of the common construction with vertical waterwheels. This draining is begun and finished in 6 years time, the extent or area of the drained ground will be about 7000 English acres. In the middle of January 1775 the water was lowered 18 inches in the Lake; in the month of September 1775 the water was lowered 30 inches more or 48 inches in all; in the middle of march following it was again raised and increased 2 inches, being then but at 46 inches under the summer's level, but in the month of October 1776 it was again lowered 12 inches or at 58 inches under the level and was at the same height in the middle of March 1777, and since that time the water has decreased more rapidly, and now but a small quantity remains in the lowest places, which are 16 feet 8 inches under the level of the River de Rotte, to which the water out of the lake must be raised. Last autumn great parts of the lands have been sowed with rapeseed, which stands now in full blossom, and gives a beautiful prospect; if this draining has been done by fire engines it could have been finished in one years time, because in winter time the mills rather seldom or rather never make any progress, the rainy season of October November and December pouring so much water into the lake that the mills are hardly able to keep it up on the same level, and in summertime the winds are commonly so foible, that the draining of the lake must be effected greatly by the Sun and dryness of the Air; so as I have plainly observed the draining finished mostly by the summers heat. If fire engines were employed for such a draining, they should be so constructed that in the beginning of it they could work a greater number of pumps than afterwards, according the decreasing height of the water in the lake, and what a great advantage would it then be to work constantly night and day for months together; in the case of the windmills they work for one two or three hours, and then again not in three days, sometimes not in three weeks; and strong winds are generally accompagned by heavy rains, which is another disadvantage; the expense of construction of those 28 new mills have run above 40000 £st. there is some prospect of another draining to be undertaken at about 6 or 7 English miles distance from this town; Plans and estimates of it are begun to be made out since manij months, its extent or area will be about 10000 English acres, and its circumference nearly circular or elliptical which is the most convenient and advantageous form, its depth as I believe in the lowest parts not above 11 or 12 feet, will require ten sets of three mills each or thirty in all; every 500 dutch mergens or 1000 English acres requiring a set of mills for every four feet height the water is to be raised.

I think now Sir to have very fully explained that matter to you, if any obscurity or doubt remains pray do not hesitate to ask more information. I am always very ready to impart all the knowledge I have gathered there about. And if you have finished the Parallel you begun here of the difference of consumption of fuell between our engine and one of the same size of your's construction upon various heights of raising water, and you will be so kind as sending me a copy of it, you shall sensibly oblige therewith

Sir

Your M^t ob^d Humble Servant

J: D: Huichelbos van Liender

P.S. (Blakey)'s engine at Amsterdam is begun to be demolished and (...)

(Ed.Note: Below the PS a number of calculations appear in another hand, probably Watt's. These have been reproduced on the next page.)

$\frac{28}{130}$
 $\frac{11}{110}$
 $\frac{56}{240}$

$\frac{1033}{1033}$
 $\frac{3099}{3099}$
 $\frac{10930}{10930}$
 $\frac{1067089}{1067089}$
 $\frac{3201267}{3201267}$
 $\frac{10670890}{10670890}$
 $\frac{1102302937}{1102302937}$

foot long measure 1000 vs square foot 106709 & a
 Cubick foot 1102,303

the English foot 1000 or ———— 12, 000
 Rhinland 9^o 1033 or ———— 12, 362
 Amsterdam ———— 11, 172

as 1000 : 62,5 : 1102,3

$\frac{55115}{22046}$
 $\frac{66130}{60,09375}$

all weights
 will of 42000 at 2000
 repairs annually 20 Lt 20 = 560
 2560

12000
 10001

144
 720

J.Hope to MB 1779-07-02

AoS ref. MS 3147/3/376/19

Boulton visited Holland in April/May 1779, probably mainly to find financiers for one or more of his enterprises; he would have met banker Jan Hope in that capacity, the latter would have broached the subject of a steam engine for irrigating his estate.

This letter was probably drafted in collaboration with Hope's engineering advisor R.L.Brouwer. There were two follow-up notes [1799-08-05] and [1799-08-06]. It was replied to by JW [1799-08-15]. Shortly after, Brouwer was making plans to erect a steam pumping engine under his own direction. This eventually became a very successful Newcomen-type engine, set to work in 1781 [vdPols & Verbruggen, 1996].

Brouwer wrote to HvL on 15 November 1799 [Brieven 154, see Brouwer summaries section] that he had written to W&B (as he calls B&W) and received a reply, which he found unsatisfactory; this quite likely refers to the (formally) Hope-B&W correspondence.

The decision to "go it alone" (possibly to avoid patent hassle) is also reflected in Brouwer's request to HvL to find out details, prices, parts manufacturing options in England without telling B&W.

Groenendaal 2 July 1779

Dear Sir

Since I had the pleasure of seeing you in this Country and the honour of your acquaintance I have very often considered of the application which could be made of Fire Engines to our water works, instead of windmills as we have now. Having an opportunity for it at a place near Haarlem, I have resolved to give the example for my own account there; if it would answer the purpose and not be too great an expence, since I have the desired effect with a windmill now, which has no other defect than the loss of time In great draughts, and which loss however is not very material: my Chief end being that of introducing your Fire Engines.

I have a Canal, which is 2400 feet long and 30 feet broad, seperated by a double, Brick Sluice, from the River from which my mill raises the water 5 foot high in to the Canal.

The mill is of wood erected upon a brick building adjoining the sluice of which you have a plan and section inclosed.

Thus you see Sir, that my mill raises 228000 Cubicq feet of water five foot high.

I should be much obliged to you if you would lett me know

1° Whether this building is sufficient, or can be made use of without any material additions of brickwork to erect in it the machinery for a fire Engine, that could raise the above mentioned quantity of water to the same height in the space of Eight days (which would be quick enough.)

2° To what price it would amount delivered in London.

3° How much time it would take to erect it here.

4° And the Expence of a single workman to come over with it, to whom I would give the assistance of my own Carpenter (who is very clever) and his men, besides my own presence to translate his directions.

A small sketch of the intended Engine would also be very acceptable.

I shall take the first opportunity of a friend's going over to transmit to you the Charts of the lake of Haarlem and the projects for draining it which were the subject of our Conversations

I am with very Great regard

Dear Sir:

Your Most Obedient Servant

J Hope

Please to direct to J:H. Esq^f
at Amsterdam

J.Hope to MB 1779-08-05

AoS ref. MS 3147/3/376/20

Follow-up of 1779-07-02, see notes there.

Amsterdam August 5th

Dear Sir

My worthy friend M^r Williams is so kind to take the present under his Care with the maps of the Haarlem-Lake, mentioned in my former letter of the 2^d July concerning the fire Engine whose contents I confirm, and will be much obliged to you for as speedy an Answer to it, as possible.

I am with great regard

Dear Sir

Your most ob^t and
most humble servant
J Hope

M.Boulton Esq^t at Birmingham

J.Hope to MB 1779-08-06

AoS ref. MS 3147/3/376/21

Second follow-up of 1779-07-02, see notes there.

Groenendael near Haerlem
August 6th 1779

Dear Sir

being returned here from a tour in the other provinces I have once more taken a Survey of my waters, by which I discovered that a mistake slip'd in the description which I sent you in my letter of the 2 July last, in which was mentioned that the water should be raised 5 foot whereas it is sufficient that it should be raised four feet only.

I thought proper to give you notice of this Circumstance As it may perhaps make a material difference in the Construction and regime of the works.

My friend M^r William going to England will forward to you the maps of the lake of Haarlem.

I am always with great regard

Sir

Your most obedient and
most humb^e servant
J Hope

JW to J.Hope 1779-08-15

AoS ref. MS 3147/3/81/426

JW's response to [1779-07-02] from J.Hope to MB.

B&W's copy of this letter was filed in a letter book which subsequently suffered heavy rain damage; in the 1790s it was decided to transcribe the letters into a new letter book. The handwriting is that of a scribe, and as some portions had become unreadable, the 1790s transcript has white spaces. In the present compilation these have been replaced by (.....) or, in a few cases, by an educated guess between ().

M^f Jn: Hope, Amsterdam
Sir

Birming^m August 15 1779

Your several obliging letters of the 6th July & 2nd August (*Ed. Note: in fact 2nd July and 6th August*) directed to my Partner M^f Boulton came duly to hand, and we should have done ourselves the honour of answering the first sooner if we had not been prevented by Mr Bouldons absence in London on business which still detains him there and does not permit us to consult fully together on the subject; but as we consider the setting out of our Engines in Holland under your auspices, as a matter of great importance. I would not longer delay giving you an answer and have therefore taken the liberty to offer you my thoughts on the subject, which I transmit to Mr Boulton that he may add what occurs to him. — You mention that your Canal of 2400 feet long & 30 feet wide, is 5 feet higher than the river from which it is separated by a brick sluice, the quantity of water to be raised you estimate at 228000 cubic feet & desire it to be raised in 8 days. — Now 228000 divided by 8 days, is 28,500 P^f day which divided by 12 hours is 2376 cubic feet P^f hour, divided by 60 minutes is 39 cubic feet each minute, and, supposing the engine to make only 10 strokes P^f minute, is nearly 4 cubic feet P^f stroke, which is the contents of a Pump 4 foot long in the stroke & 13 inches and 6/10 diam^f which would require a Cylinder of 6½ inches diameter to work it. Such an engine would be so trifling and its parts so small that they would be very subject to go out of order and would require very nice workmen to put them in order again and as it would have more friction than a larger, would neither give you the satisfaction you require, nor do our invention justice as we should be obliged to alter many of the parts to fit them to its size, besides it would not cost you £ 50 less than the (*large*) one.

If a Cylinder of 15 inches diam^f was employed it works a pump of 31 inches diam^f and 5 feet high which by a (*five*) feet stroke would deliver (.....) cubic feet — 220 per minute or 13200 per hour 158400 in the course of a natural day fill your canal and thereby (.....) abundance; for it would by no means consume proportionally with the other. Such an engine going at the rate of 10 strokes per minute (.....) our larger engines should should consume 12½ pounds best Newcastle coals (.....) as it would usually take about 17½ hours to raise the desired quantity it would consume (.....) in doing that business which is about 2-6/10 Winchester (*coal bushels as smaller*) Engines always consume more coals in proportion to larger ones (.....) of coals to make up the fire at beginning to work each day. (.....) should allow a quantity of coals equal to the above for these purposes or in all 5¼ Winchester coal Bushels for raising 228000 (*cubic?*) feet of water 5 feet high.

It is impossible to be precise but to the best of my judgement such an engine would cost about £ 200 Sterl^d independent of the House the Boiler setting the fixture of the pumps and other woodwork which must be done on the spot. We should put the Engine together here and provide the great Lever with all the cast iron, the hammered iron work, the cistern and the boiler with the pump and its piston and clack.

We should also provide a person to put it together in Holland. His charge would be about £ 31.10 besides his charges in coming and going and his board in Holland. The house you describe may be made to contain the Engine but the wall is not strong enough to support the lever which might be supported on wood it would be most most convenient for us to send the Engine to Hull from where it could easily pass to Holland. — My above estimate is made without any supposition of profit on our part and is what we suppose the Engine would actually cost us in materials and workmanship.

In your favour of the 6 of August you mention that the real height is only 4 feet nevertheless I would not chuse to make any alteration in the size of the pumps on that account as when the Engine works briskly the water cannot run away from it so fast as it is raised and therefore rises up in a bunch at its top which bunch will be at least one foot high.

I suppose M^f Boulton would mention to you that we do not undertake to erect engines in any foreign country unless they grant us an exclusive privilege for the sole constructing them in that country. Provided therefore that the states of the united provinces will grant us an exclusive privilege we will erect an Engine on which we will rest the vallidity of the privilege and in such case if you do us the favour of erecting such an Engine on your estate you may depend on being properly served and of paying no more for the engine than it

actually costs us. If it would not prove agreeable to you to erect such an Engine as I have described on these terms we will erect one at our own cost in any situation where (.....) of its answering there is a prospect of our being paid for the Engine and for our trouble — I must presume further to mention that without you were of opinion that our engines had a good chance of coming into general use in Holland it would not be our wish at present to bestow the expences and trouble which the introduction of such a machine into that country would cost us as we have very full employment but as that employment may not last always and as we owe our best endeavours for the good of mankind when it does not injure ourselves we are willing to (.....) the profits arising from our Engines to all who think them worthy of this regard (.....) to us who live by our employment.

I return you my unfeigned thanks for the trouble you have already taken and beg leave to subscribe myself with the utmost respect

Sir your most obed^t Servant
James Watt

HvL to J.de Luc 1783-12-19

AoS ref. MS 3147/3/505/4. Copy from Hist. Mus. Rdam. Transcript of French text by R. Daalder.

De Luc was in London at the time, where he resided almost permanently, in a position at the Royal Court.

“Ces hommes intelligents” in the preamble obviously refers to B&W in Birmingham. The main subjects (mostly in response to a letter from De Luc) are:

- *Thanks for sending engraved wood plates, apparently used for textile printing.*
- *Thanks for settling an account with an English firm.*
- *Thanks for details on three manufacturing sites.*
- *Reference to a (presumably Watt-)plagiarist. Who? Blakey (HvL knew him from his visits to Holland in the early 1770s, but he was hardly a Watt plagiarist)? Jabez Carter Hornblower (a wild guess, HvL had no reason to be contemptuous of him)? Perrier?*
- *Reference to a Watt letter (no date) about Bradley engine.*
- *Brouwer’s engine for Jan Hope, and reasons why this was not used as demonstration engine (instead of building a new one).*
- *Suggestion that B&W might build a demo engine in Holland at own expense, for patent and publicity.*
- *Reference to problems of Perrier firm (no details).*
- *Discussion of balloons - hot air and ‘air inflammable’ (hydrogen). First one in Holland made and launched in Rotterdam on 1783-12-01 (probably unmanned, disappeared without trace). Why are the English so far behind in this field?*
- *Reference to other inventions in France, particularly balloons.*

HvL’s estimate of £ 2000 for erecting a demo Watt engine was probably based on figures for the 1776 Rotterdam fire engine for which Hoogendijk had put up c.f 30000, which would be roughly £ 3000. Eventually, HvL’s ideas for sponsorship from B&W or their friends would founder, and the 1787 Watt engine for Blijdorp would again be funded by Hoogendijk (c.f 25000).

HvL does not name the polder he is at the time thinking of for this demo engine (R. Daalder thinks it may be the Cool or Kool polder). Eventually the Blijdorp polder was chosen, which was then served by a single windmill with 5½ foot lift [Bicker, 1800], see also [1785-06-03].

The tone of the letter is surprising in one respect: HvL gives the impression of urging De Luc to plead with B&W for his “demo engine” plan and its sponsoring, in a way which would suggest he lacks more direct access to B&W; by this time, however, HvL and JW had already corresponded quasi-directly about diverse matters; HvL was probably trying to use De Luc’s influence.

Monsieur,

Vous estes dans le cas à present d'employer votre bienveillance en m'excusant que je n'ai pas plustost repondu à l'honneur de votre tres obligeante et tres agreable lettre. Un voyage que j'ai fait dans le midi de la France et plusieurs autres occupations m'ont empeché, aussi l'hyver est mon vrai temps d'Etude et la saison quand je puisse le mieux m'engager dans des meditations suivies sur quelque sujet de reflexion; le contenu de votre lettre m'a pourtant tres souvent passé devant l'esprit et rien ne me seroit plus agreable que de pouvoir etre temoin oculaire des merveilles que ces hommes intelligens sont en estat d'operer à present. Je procede à vous repondre en ordre.— Vous remerciant premierement de votre attention en payant Mess^{rs} Kinlock & Hog. mes debourses, en suite me reconnoissant tres redevable des peines que vous vous estes donnés pour me procurer des planches de bois gravées. J'ai depuis eu le bonheur par un ami d'avoir plusieurs desseins pour des toiles imprimées faistes a Londres par une main tres habile qui ont données toute satisfaction. Je suis encore tres sensible à votre bonté en me donnant un detail si circonstancié de ce que vous avez vu et entendu à Birmingham, a Broseley et à Coalebrookdale quel plaisir n'aurois je pas goûté, si j'avois été de votre compagnie pendant ce voyage; Je conviens parfaitement que les hommes que vous me nommez sont de véritables genies. Le plagiaire dont vous me parlez je le connais bien. Il est habile mais trop vif, et même souvent etourdi. C'est depuis longtemps que je n'ai rien entendu de lui. Je ne scavois pas aussi que M. Watt avoit obtenu une patente pour une nouvelle invention, un exemplaire du bill de sa patente ou de son Avis au public, me feroit bien du plaisir;— J'ai été tout à fait stupefié, de ce que j'ai vu dans la copie de la lettre de M. Watt, ou il parle de la machine à Bradley. Il est tout à fait incroyable, qu'on ait pu produire une machine capable de faire parcourir un marteau de 800 livres l'espace de 600 pieds dans le temps d'une minute. Je n'ai pas l'idée d'une construction calculé pour faire un tel effet; c'est pousser les ressorts de la mechainique au dernier bout. J'admire aussi grandement l'Invention d'une machine à feu qui travaille aussi bien par le montant du piston du cylindre que par sa descente.— Il est certainement tres vrai que de telles gens pourroient faire infiniment du bien en notre pais aqueux, et quils meriteroient de grands encouragements; aussi rien ne seroit plus à mes souhaits que d'etre en estat de leur en pouvoir procurer, mais que puis je faire, moi simple particulier, je n'ai que ma voix pour precher la verité, et je

J'ai toujours prêché quand j'ai pu trouver des auditeurs. Si j'avois autant de biens comme un Mons^f Jean Hope, je ne prêcherois plus, je donnerois l'Exemple et une preuve pleinement convainquante, et sans qu'on puisse faire cela, on n'introduira jamais la machine à feu en ce Païs, car la foi est trop foible; Il faut des prodiges ou au moins des exemples, peut être que Mons^f Hope par son credit effectuera qu'on établisse une machine à feu pour la ville d'Amsterdam, mais elle sera à la maniere de Newcomen ou de la construction commune comme la sienne et construite par le même M^f R.L. Brouwer, qui a construit celle de M^f Hope et qui sans avoir jamais vu un autre machine à feu que celle de Rotterdam, et à l'aide de ce qu'en ont dit Desaguliers et Belidor, joint au peu de lumières que j'ai pu lui fournir, a construit une machine à feu tres digne de l'attention des curieux non seulement, mais même des Connoisseurs; je puis vous assurer que moi qui ai vu grand nombre de machines à feu dans differents Païs, et les ai vu avec attention, je suis persuadé quelle est faite, et travaille aussi bien, qu'une machine à feu d'un tel calibre, et d'une telle construction peut travailler, quelle est de plus d'une telle propreté que je n'ai jamais vu une qui en approche; cet homme qui certainement est tres Instruit est comme vous pouvez bien vous imaginer en cet article l'oracle de Mons^f Hope, Je n'ai jamais été en Estat de le convaincre de la superiorité des machines à feu construites suivant le systeme de M^f Watt, sur celles de la construction commune; n'obstant que je lui ai communiqué tout ce que j'ai jamais scu la dessus, et qu'il defere autrement beaucoup à mes avis, et qu'il m'a protesté plusieurs fois en presence de Mons^f Hope qu'il m'avoit des obligations essentielles pour les avis et les conseils que je lui avois donné pour la construction de la machine de M^f Hope; et c'est en cela que je chercherois la cause de l'indifference de M^f Hope pour les propositions de M^f Boulton; qui jamais ne trouvera d'appui de ce côté là. — Apres bien des reflexions je vois quil n'y a qu'un seul plan à adopter, et que je suis certain reussiroit bien, c'est que Mess^{rs} Watt & Boulton cherchent des amis ou participants, ou s'ils vouloient eux mêmes fournir ou debourser une somme d'environ 2000 £ St: je dix deux mille pour construire ici une Machine de Leur Invention de moyenne ou plustost petite grandeur, par exemple avec un cylindre de 28, 30 ou 32 pouces de diametre. Laquelle pourroit servir pour leur faire obtenir le privilege exclusif et en même temps donner une preuve decisive de la superiorité de ces Machines au dessus des moulins a vent en usage à present dans ce Païs. Une occasion excellente pour constater ce probleme, se rencontre tout pres de cette ville, Il y a un polder (c'est à dire district separé de tout autre, et tout à fait enclous en ses propres digues) lequel est tenu à sec par deux moulins, qui envoient l'eau de l'un à l'autre chaque moulin l'elevant à la hauteur de quatre pieds, par consequent l'eau est elevé a la hauteur de 8 pieds avant qu'il se decharge dans le Canal d'evacuation. Il y a par là le plus sur moyen qu'on puisse avoir pour calculer l'effet de ces moulins, c'est a dire scavoir le nombre de lignes ou de pouces d'eau, que ces moulins elevent dessus le terrain de ce district, en un temps donné, et pour la force connue du vent; et la Pompe à feu estant construite sur le mesme polder ou district; le plus ignorant sera aussi bien en estat que le premier scavant d'en faire la comparaison.— Je ferois avec plaisir toutes les demarches necessaires pour obtenir la permission de construire une machine à feu en cet endroit, J'aiderois autant que je pourrois, et que mon temps me le permettroit, pour faire avancer l'ouvrage et le faire executer en bonne ordre, sans vouloir etre recompense de mes peines en aucune façon, toute la gloire et le profit resteroit a ces Messieurs. Le Privilege exclusif en suivroit de soi même, et l'on pourroit prendre pour cela meme des precautions en même temps qu'on demanderoit la permission de faire construire la Machine; peutetre que les 2000 £ St: ne seroient pas toutes necessaires pour achever cette construction, c'est un calcul de ma façon, mais dont ces messrs. peuvent mieux juger que moi; Un Article seulement dois je leur faire observer, c'est qu'un fondement sur pilatis seroit inevitable, et qu'on doit calculer à environ sur 150 ou 160 £St: pour cet article. Sans une preuve de cette nature; il est impossible d'introduire en ce Païs l'usage de ces machines, mais un plan sur ce pied la pourroit certainement bien reussir. Les Etats ne s'engageront jamais d'Avance avec quique ce soit. Tout ce que nous avons pu obtenir, quand nous entreprenames notre grande pompe à feu, c'estoit une franchise de l'impot sur les matieres necessaires pour la construction du batiment, et sur la matiere combustible. Peutetre que je pourrois encore obtenir la mesme faveur, en le demandant en mon nom.— Que ces Messieurs se donnent la peine de reflechir murement sur le plan que je viens de tracer, quand ils sont sur de leur fait, une telle experience leur vaudroit bien la peine de l'entreprendre; pour obtenir un privilege exclusif en Hollande, ils auroient toujours besoin d'un modele grand ou petit. Et même ayant le privilege exclusif, ils n'avanceroient encore rien sans une preuve demonstrative; et comparable; et personne n'a plus d'Interest de donner cette epreuve que ces Mess^{rs} Ils auront des Avantages que tout autre ne rencontreroit pas toujours, toutes les difficultés que des Etrangers peuvent rencontrer d'Avance seront applanées, la Machine et tout son Attirail leur restera en propre, en tout cas, Il n'y auroit que les fraix de construction et les autres depenses accessoires de perdues. La Pompe à feu de M^f Hope ne peut jusqu'ici servir pour d'autre preuve que pour celle qu'il est possible de lever un grand volume d'eau à une hauteur mediocre au moment que l'on veut, mais elle ne peut servir pour faire la comparaison entre elle et un moulin à vent. La situation de l'endroit ou elle est construite ne pouvant servir à cela; Les deux moulins à vent à present en train sur le district en question, commencent devenir vieux, et exigeront quelque temps de grandes depenses pour les retablir, ce qui pourroit plustost faire prendre la resolution de les abandonner, en cas qu'on construeroit un substitut preferable. Des moulins du Calibre de ces deux moulins cousteront à present nouvellement construites 1700 £St: chaque moulin. En cas que ces Mess^{rs} se resoudrent à suivre ce parti, je leur offre mes services estant

prete a y mettre tout le zele possible pour faire reussir l'entreprise, sans aucun autre motif que le bien de ma Patrie et leur avantage.— Je vois que Mess^{rs} Perrier par une mauvaise oeconomie se sont conduites bien à travers dans la construction de la machine à Paris. Je connois par experience le mal, au quel on s'expose en voulant construire apres des desseins des machines de nouvelle invention et pas assez connus.—

J'ai à present parcouru les principaux articles de votre obligeante lettre; mais je ne puis pas cesser de m'entretenir avec vous, sans vous avoir parle de la celebre nouvelle Invention des boules Aërostaticques, dont on raisonne à present du matin au soir, Invention qui à fait des progress si rapides, et Laquelle pas encore cinq mois passé, et soit traité en fable. C'est en cette ville que la premiere de toute de la Hollande à été fabriqué et laché, estant faite dans la figure d'un ellipse, ayant un axe de 16(?) pieds et l'autre de 15, construite de taffetas vernissés, remplie d'air inflammable, elle à été laché le premier de ce mois, et jusqu'aujourd'hui on n'en a pas eu des nouvelles. Un autre fait a la Haye de toile peint et de figure ronde, ayant un diametre de 34 pieds, et une hauteur de 40 pieds, à été lachée en l'air la semaine passée apres avoir remplie avec de l'air rarefié, par de la paille brulante, dans le temps de onze minutes, suivant la methode de Montgolfier, mais l'ouverture d'enbas, par laquelle on l'avoit remplie restant ouverte et l'air dilaté, du dedans, s'estant bientost refroidi, le chateau Aerien, apres avoir été poussé par le vent à quelque distance du lieu ou il s'estoit elevé, tendoit au centre de la terre, comme toutes les autres matieres graves, apres avoir été monté à environ une hauteur de 200 pieds. J'ai été pour le voir, il faisait un singulier spectacle. Mais tout cela n'est rien en comparaison des si renommées voyageurs Aëriens Charles & Robert à Paris, qui ont été à la Hauteur de plus de 9000 pieds; Que vos fameuses experiences pour mesurer la hauteur des montagnes par le moyen du barometre, seront à present de Service, pour leur guider dans leurs courses, et leur faire scavoir à quelle distance ils sont de la terre. Il me surprend bien fort, que les Anglois sont encore si tranquilles sur ce sujet que je n'ai jusque present appris d'aucune boule Aërostaticque laché en ce Royaume, que des deux seules envoyées en l'air par Le Roy et M^e Priestley, qui estoient petites et seulement un badinage; Seroit ce que la nation est jalouse que les francois sont tombées les premiers sur cette Idée ingenieuse; Il faut quelle s'evetue pour attraper aussi une parti de cette gloire, et que ce sont les Anglois qui passent les premiers de la mer entre Douvres et Calais. Il ne faut pas que les francais restent seuls maitres de l'air, cet element doit etre aussi libre que celui de l'eau, et que les mers sont à present.— Il semble que les francais sont à present en train des nouvelles inventions , on fera en peu de jours à Paris l'essay d'une autre nouvelle decouverte, non moins singuliere que celle des ballons Aerostaticques, scavoir de courir sur l'eau avec une vitesse infiniment plus grande que celle d'un cheval gallopat à toute bride. La souscription de 200 Louis, ouverte pour cela, s'est remplie bientost, et l'Inventeur à laché, qu'il pensoit de remplir sa promesse par le moyen de patins elasticques.— Le temps nous apprendra si cela est si praticable que de voyager en l'air, ce qui à un an d'ici auroit paru aussi problematicque.— Je finirai ici ma longue Epître, que j'espere vous donnera quelque sujet de me gratifier d'une reponse, et apres vous avoir retourné les compliments de Mess^{rs} Hogendijk et Bikker, j'ai l'honneur d'etre avec la plus parfaite estime,

Monsieur

Votre tres h. & tres obeissant Serviteur

J:D: Huichelbos van Liender

Rotterdam le 19 Decembre 1783

(at the bottom, in another hand: Huichelbos van Liender - Rotterdam 19 Dec. 1783 - To Mr. J.A. De Luc)

(English translation)

Sir,

You have now an opportunity to use your benevolence in excusing me for not replying earlier to the honour of your obliging and very agreeable letter. I have been prevented from doing so by a journey I have been making to the South of France and by several other activities. Also, winter is my true season for studies , when I can best engage in thought about some subject worthy of reflexion. The subject matter of your letter has, nevertheless, often been on my mind, and nothing could be more agreeable to me than to be able to witness the wonders which these intelligent men are working nowadays. I will now respond to your letter in the proper order.

First of all, I want to thank you for your kindness in settling my expense account with Messrs. Kinlock & Hog. Further, I am much in your debt for the trouble you have taken to procure engraved woodblocks for me. I have since had the good luck of getting, through a friend, several designs for printed cloth, made in London by a very skilful hand, and being very satisfactory. Furthermore, I am very grateful for your goodness in describing to me in such great detail what you have seen and heard in Birmingham, Broseley and Coalbrookdale. How I would have enjoyed accompanying you on that journey. I fully acknowledge that the men you mention are true geniuses. You mention a plagiarist; I know him well. He is skilful, but too temperamental, often even rash. I had not heard from him for a long time. I did not know, either, that Mr. Watt had obtained a patent for a new

invention. It would give me great pleasure to have a copy of his patent bill, or of his public announcement. I was quite astounded from what I read in the copy of Mr. Watt's letter, where he speaks of the Bradley engine. It is quite unbelievable that an engine has been constructed, capable of making an 800 pound weight travel a distance of 600 feet in a single minute. I have no idea what sort of design could produce such an effect; this is certainly pushing the resources of engineering to their very limits. I also admire greatly the invention of a fire engine which works equally well with ascending or descending piston. Truly, such men could do an infinite amount of good in our watery country, and they most certainly merit substantial encouragement. Also, I would wish nothing better than being in a position to support them, but what can I, simple citizen, do? I have nothing but my voice to preach the truth, which I have always done wherever I could find an audience. If I had the wealth of a Mr. John Hope, I would no longer preach, but I would provide an example and perform fully convincing tests. Without doing that, the fire engine will never be introduced in this country, as there is too little faith. We would need a miracle, or at least demonstrations; maybe Mr. Hope could, through his influence, cause a fire engine to be established in Amsterdam, but it would then be an engine of the Newcomen type, or the common construction, and built by the same Mr. R.L. Brouwer who built Mr. Hope's own engine. This gentleman has, without having seen any other fire engine than the one in Rotterdam, with the help of the writings of Desaguliers and Belidor on the subject, plus what little light I have been able to furnish, built an engine worthy of the attention of the curious, but no less of the knowledgeable. I can assure you that I, having seen many fire engines in various countries, and looked at them attentively, am convinced that this engine is built as well, and works as well, as any fire engine of such a size and design may do, and that she is so neat and well-kept that I have never seen one that comes near. This man, who is certainly very knowledgeable is, as you can imagine, Mr. Hope's oracle in this respect. I have never succeeded in convincing him of the superiority of the fire engines constructed on Mr. Watt's system over the common engines. This is notwithstanding my communicating to him everything I have ever known on the subject, and notwithstanding the fact that he often follows my advice in other matters, and that he has on several occasions said in the presence of Mr. Hope that he is in my debt for essential advice I have given him with regard to Mr. Hope's engine. This is where I seek the cause for the indifferent attitude of Mr. Hope towards the proposals of Mr. Boulton, who can never hope to find support from that quarter.

After ample reflection, I see that there is only one way forward, which I am certain would succeed well, which is that Messrs. Watt & Boulton look for friends or participants, or maybe they would themselves put up a sum of about 2000 £st; in words two thousand for erecting here an engine of their invention, of medium or even small size, for instance with a cylinder of 28, 30 or 32 inches diameter. This could serve to get them an exclusive privilege, and at the same time prove decisively the superiority of these engines over the windmills currently used in this country. An excellent opportunity to address this problem exists very near this town. There is a polder (that is an area separated from all others and completely enclosed by its own dikes) which is kept drained by two windmills which feed the water to each other, each mill lifting it four feet before it is discharged to the drainage canal. This provides the best opportunity one could have for calculating the power of those mills, that is how many lines or inches of water these mills lift from this area in a given time, and for a known wind force. If the fire pump is built on the same polder or area, the most ignorant as well as the wisest person could make the comparison.

I would be pleased to take all the necessary steps to obtain permission for erecting a fire engine at that location. I would help as much as I can and my time permits, to push the work ahead and to have it properly executed, without wanting any reward for my efforts, all the glory and the profit would remain with these Gentlemen. The exclusive Privilege would follow naturally within a short time, and preliminary steps to that end could be taken at the same time when requesting permission to build the engine. Maybe not all of 2000 £st. would be needed to complete this structure, it is just an estimate by myself, and these gentlemen can assess it much better than I can. Only one matter I must draw their attention to, which is that a foundation on piles would be inevitable; providing this would cost about 150 to 160 £st. Without a demonstration along these lines it is impossible to introduce these engines in this country, but a plan such as this one might very well succeed. The States would never get involved in advance with anything whatsoever. When we undertook the building of our great fire pump, all we were able to obtain was tax freedom for the building materials and for the fuel. Maybe I could once again obtain the same favour if I applied in my own name.

I would hope that these Gentlemen will take the trouble to consider the plan which I just outlined. If they are certain of their case, such an experiment would well be worth undertaking; for the purpose of obtaining an exclusive privilege in Holland a large or small model would be required anyway. And even if they had the exclusive privilege, this would not be of any benefit to them without demonstrative and comparative proof, and no one has more interest in providing that than these Gentlemen themselves. They would have advantages which others do not always have, as all difficulties which foreigners could encounter would have been moved out of the way beforehand, the engine and all its outfit would remain their property anyway, only the cost of erecting and attendant costs would be lost. Mr. Hope's fire pump can to date only serve to prove that it is possible to lift a large quantity of water over a medium height at any desired moment, but it cannot serve for

comparison with a windmill. Conditions in the region where it stands would not permit that. The two windmills presently serving the area I mentioned are getting old, and at some time they will require costly repairs, which might result in a decision to scrap them and build a proper substitute. Windmills of the same size would cost 1700 £st. each. If these Gentlemen were to decide to follow this plan, I offer them my services and I am ready to pursue this with all possible diligence to make the enterprise successful, with no other motive than the good of my Country and their advantage. I know from experience the ills that may result if one attempts to construct engines from drawings without enough knowledge.—

I have now covered the principal parts of your esteemed letter, but I cannot stop this discourse with you, without mentioning the famous new invention of the aerostatic balloons, of which people talk day and night, an invention which has made such fabulous progress, in less than five months. In this town [Rotterdam] the first one in all of Holland has been made and launched. It was of elliptical shape with one axis of 16 (?) feet, the other of 15, built of varnished taffeta, filled with inflammable air. She was launched on the first of this month and to date nothing has been seen or heard about her. Another one was made in The Hague, of varnished linen and circular, of 34 feet diameter, and 40 feet tall, launched last week after filling it with rarefied air in eleven minutes by way of burning straw using the Montgolfier method. The bottom aperture, via which it was filled, was however left open and, the dilated air inside rapidly cooling, the airborne castle, after having been driven some distance from its takeoff point by the wind, was again drawn to the centre of the earth, as all heavy matter will, after having ascended to a height of about 200 feet. I went to watch, and it was a remarkable sight. But all this is nothing compared to the famous air travellers Charles & Robert of Paris, who have been at a height of more than 9000 feet. How useful do your famous experiments, to measure the height of mountains using a barometer, come in now to guide them in their travels and to let them know how far they are above the earth. I am quite surprised, that the English are keeping so quiet about this subject, so that I have not heard to date about any aerostatic balloon being launched in that Kingdom apart from just two which were sent up into the air by the King and Mr. Priestley. These were small, though, and just a joke. The nation should be jealous of the French being the first to stumble upon this ingenious idea. It should put itself out to catch part of this glory, and the English should be the first to cross the sea between Dover and Calais. The French should not remain the only masters of the air, that element should be as the water, and as the seas are at present.—

It seems that the French are busy with new inventions, in Paris another new discovery, no less remarkable than that of the aerostatic balloon, will soon be tested, to wit running on water at a speed infinitely greater than a horse galloping on a long rein. The subscription of 200 Louis offered for that purpose was soon filled, and the inventor has let on that he intends to fulfil his promise using flexible sliders or skates.— Time will tell whether this will be as practicable as air travel, which itself would have seemed just as problematic a year ago.—

I will now conclude my long letter, which I hope will give you occasion to favour me with a response, and after having returned the compliments of Messrs. Hoogendijk and Bikker, I have the honour to be, with fullest esteem,

Sir

Your very h: & very obedient servant,

J:D: Huichelbos van Liender

Rotterdam the 19th December 1783

HvL to J.de Luc 1785-01-30

AoS ref. MS 3147/3/505/5. Copy from Hist.Mus.Rdam. Transcript of French text by R..Daalder.

At the time, de Luc was living in London (ref. to Blackfriars/Albion Mills project)

Much of this letter is a rerun of the letter HvL wrote more than a year earlier [1783-12-19], but with an added note of urgency regarding the central theme of arranging demonstration trials with a Watt engine. In the meantime, Steven Hoogendijk (founder of the Batavian Society, 87 years old now) had put up the money (f 25,000) for the project, as apparently no other sponsorship could be found. Again: why should HvL have to approach B&W via De Luc ? Was De Luc very influential ? Anyway, he forwarded the letter to B&W, and JW responded directly to HvL with [1785-03-29].

It is interesting to note, that HvL has a contingency plan with an atmospheric engine, again citing the Hope engine at Heemstede as a shining example. Or is this a teaser to make B&W more forthcoming? The polder for the demo engine is again not mentioned by name.

The Essay Competition (Programme) which HvL mentions has not yet been identified.

Monsieur

Le sujet qui me fait jouir du plaisir de m'entretenir par cette lettre avec vous, c'est encore notre ancien topique LA MACHINE à FEU. Ai je besoin d'une apologie pour la liberté que je prends d'interrompre vos occupations? Je ne le crois pas, surtout quand je vous dis, que le temps approche qu'on fera encore un Essai complet de cette machine superbe en Hollande, en comparaison contre un ou deux moulins à vent. Un capital est fixé par un vrai Patriôte pour faire cette epreuve interessante en plein ordre, et ce sera principalement sous ma direction et celui de Directeurs de La Societé Batave que ce projet s'exécutera, dont je me promets beaucoup de bien pour ce País. c'est encore un mystere pour le public, et nous ne prenons que des mesures praeparatoires; mais je n'ai voulu passer outre ou fixer un plan absolu, sans vous consulter d'avance et soit sil ny aurait pas moyen d'introduire à present l'Invention de M^r Watt, et de lui procurer en même temps le privilege exclusif pour son invention; Il me semble que ce sera une bonne occasion pour lui & ses Associés de faire connaitre leur machine Ici, sans que cela leur coutera quelque chose. Voici un plan suivant Lequel je suis d'opinion que nous pourrions convenir ensemble pour arriver à un but commun. Le notre qui est la gloire et l'Avantage de la Patrie, sera d'avoir la machine la plus complete, et qui aura le plus de superiorité possible sur les machines en usage à present, les moulins à vent; Le leur de constater autant possible l'utilité de leur invention et la preference que l'usage general de leur machine meriteroit en Hollande ce qui ne pourrait jamais se manifester sans le grand experiment que nous avons en vue, et qui sans le pouvoir dont nous sommes munis à present ne s'exécuteroit jamais, nous avons ainsi besoin l'un de l'autre; c'est pour cela que je propose que ces Messieurs feront un plan en concurrence avec moi pour etablir une de leurs machines dans un endroit que je trouverai convenable, et du calibre que nous trouverons requis, qu'ils en feront un plan en parfait ordre et feront faire toutes les principales parties sous leur inspection en Angleterre, que nous leur payerons au prix Courant de la Manufacture, et comme si nous etions en Angleterre, qu'ils nous donneront toutes les instructions necessaires pour mettre ces pieces ensemble, ou nous envoient (si cela ne cousteroit pas trop) quelqu'un pour diriger cela, et que nous ne leur payerons rien de plus, mais que nous nous obligerions de leur faire obtenir le privilege exclusif pour leur Invention. Le Polder ou l'endroit entouré de ses digues propres, que nous avons en vue pour faire ce grand experiment se trouve tout pres de cette ville, et extremement bien calculé pour cette epreuve decisive. Il est à present servi ou tenu à sec par deux moulins à vent, qui ensemble elevent l'eau à la hauteur d'environ 6 pieds du rin, et qui suivant la calculation que j'en ai faite, doivent elever par chaque revolution de leurs roues à palettes un volume d'eau de 130 pieds cubes à la hauteur d'environ 6 pieds, dans la supposition qu'il n'y à pas le moindre dechet d'eau, ce qui n'est pas le cas, au contraire, le dechet est considerable, mais le plus sur sera de calculer comme s'il n'y avoit point, ou presque point de dechet, et de construire une machine à feu, qui sera capable d'elever par chaque coup de piston une telle masse d'eau à la même hauteur. La Machine exigera son coup de piston du coté de la pompe ou des pompes à eau de la longueur d'environ six pieds, et qu'elle pourra donner 10 coups par minute. En cas que nous ne pourrions pas agréer avec Mess^{rs} Watt & Boulton, nous nous bornerons à faire une machine à feu de la construction commune, suivant les principes de Newcomen, de laquelle construction nous sommes parfaitement au fait et bien instruits; temoin la jolie machine à feu, construite pres de Haerlem, et qui est parfait en son genre. Le Polder que nous avons en vue pour en faire le theatre de notre operation, est extremement bien calculé en tous points, pour faire cette experience capitale, dont Il n'y à point d'exemple, et les plus ignorants comme les plus scavants, seront en estat de juger laquelle des deux machines hydrauliques merite la preference, ou est en estat de delivrer le plus d'eau dans le même temps, ou sera capable de tenir le terrain sec avec le plus de certitude. Je ne puis pas douter que vous n'approuverez le plan, que je viens de tracer, et que vos Amis ne l'accepteront, parceque l'occasion qui se presente est certainement unique en son genre, et comme il ne sera pas possible d'en rencontrer ailleurs; n'est ce pas un vray Patriote qui se resout à depenser son argent d'une manière si noble et si peu commune? C'est encore le fondateur de La Societé Batave qui veut donner ce nouvel temoignage de son amour pour la Patrie et les

sciences. J'ose ainsi me flatter que vous ne me refuserez pas votre assistance pour seconder des vues si louables.

J'ai appris de Mademoiselle Maffei, qui â passé chez nous en son voyage de Londres a Amsterdam, que Mess^{rs} vos fils sont allés directement d'Amsterdam á Londres. Il m'a chagriné que je n'ai pas été en estat de faire plus de plaisir au (.....) a son passage par ici. J'espere qu'á une autre occasion je rencontrerai mieux.

Vous m'obligerez de me marquer comment cette entreprise pres du pont de Blackfryards reussit, scavoir de ces moulins â moudre des grains avec des meules dont les roués sont mués par la force de dilatation de la vapeur d'eau bouillante. Je n'en trouve plus rien dans les papiers publicqs.

Je vous envoie par cette occasion la traduction en Anglois du dernier Programme de La Societé Batave, qu'on prendra soin de faire inserer dans le Monthly Review. Si vous avez l'occasion de l'envoyer á votre ami M^r Priestley á Birmingham pour le faire inserer en quelque brochure periodicque publicé en cette partie de l'Angleterre, ce qui seroit un bon moyen de le repandre encore d'avantage, vous me feriez plaisir, et vous obligeriez la Societé. J'y joins encore les questions que la Societé Batave publie pour conte de la Societé de Batavia, comme aussi un Programme extraordinaire, pour lequel on promet un prix distingué, â cause que la solution de ce probleme est d'une si grande importance pour le País, on â pour cela mis un dicours d'eclaircissement pour faire mieux comprendre l'Idée de la question, et meme on ij propose deux moyens de la resoudre que l'on assujettit au jugement de ceux qui veulent penser â ce sujet, et on laisse la liberté de proposer des autres moyens en cas qu'on juge de les connaitre.— Voila encore un Francois qui â le premier avec sa machine Aerostatique franchi le Pas de Calais. C'est singulier que les Anglois restent si en arriere en cet article. Je lis dans le Journal Encyclopaedicque du premier Janvier dernier que le Docteur Priestley a, dit on, découvert un nouveau moyen de faire de l'air inflammable, infiniment moins dispendieux que le premier. On ajoute que cette nouvelle preparation ne coute que le vingtieme de la depense ancienne. Si cela est vray, les Anglois meriteront encore quelque chose de ce coté la. Vous m'obligerez de me dire ce qui en est, comme aussi de me favoriser avec une prompte reponse s'il est possible , en attendant de laquelle j'ai l'honneur d'etre le plus parfaitement

Monsieur
Votre tres humble & tres
obeissant serviteur
J:D: Huichelbos van Liender

Rotterdam, le 30. Janvier 1785

(note on reverse, in a different hand) Mr. Van Liender to Mr. De Luc - Jan. 30 1785

(English translation)

Sir,

The subject which it pleases me to entertain with this letter to you, is again our old topic of THE FIRE ENGINE. Do I need to make any apology for the liberty I am taking to interrupt your work ? I do not think so, particularly if I tell you that the time is drawing near, when another full-scale trial of this superb machine will be made in Holland, comparing it to one or two windmills. A capital sum has been put up for this interesting experiment [Ed.Note: "en plein ordre" is probably a standing business expression, which I have not been able to trace]. The project, of which I anticipate much good for this Country, will be executed under the Direction of myself and the Directors of the Batavian Society. It is still hidden from the public, and we are as yet only making preparations, but I would not go further, nor decide on a fixed plan, without consulting you first to see if there would be any possibility to introduce Mr. Watt's invention now, at the same time procuring for him the exclusive privilege for his invention. It seems to me, that this is a good opportunity for him and his associates to make their engine known here, without any cost to them. In my opinion we could agree to follow this scheme together, to attain a common goal. Ours is the glory and the benefit of the Country, and for that we would have the most complete engine possible, which would be maximally superior to the machines currently in use, the windmills. Theirs would be to establish as clearly as possible the usefulness of their invention, and the preference which it merits for general use in Holland. This could never be attained without the great experiment which we have in mind. Without the means available to us at the moment this would never come to pass, so we need each other. For this reason I propose that these Gentlemen cooperate with me in making a plan to install one of their engines at a suitable location which I will find, and of the size required, that they will make a complete design, and that they will have the principal parts made in England under their direction, that we pay them the current manufacturing price as if we were in England, that they will give us all necessary instructions to assemble these parts, or send over (if that would not cost too much) someone to direct that, and that we would not pay anything else, but that we would undertake to procure for them the exclusive privilege for their Invention.

The Polder, or area enclosed within its own dikes, which we have in mind to perform this great experiment, is

situated very near this town, and is extremely well suited to this decisive trial. It is currently served, or kept drained, by two windmills, which together lift the water about 6 Rhineland feet and which, according to calculations I have made, should raise a water volume of 130 cubic feet 6 feet high, assuming no loss at all. The latter is not the case, on the contrary the losses are considerable but it will be safer to calculate as if there were none, or almost none, and to construct a fire engine which will raise a similar quantity to a similar height. The engine would have a stroke on the pump side of about six feet and would be capable of doing 10 strokes per minute. In case we could not come to an agreement with Messrs. Watt & Boulton, we would limit ourselves to building a fire engine of the common plan, following the principles of Newcomen, with the design of which we are fully acquainted and about which we are well informed, witness the lovely fire engine built near Haerlem, which is perfect in its way.

The Polder which we have our eyes on as a stage for our trial is in all respects eminently suited for performing this large-scale trial, for which there is no example, and both the stupidest and the wisest will be in a position to judge which of the two water-raising devices is to be preferred, or which can deliver the most water in the same time, or which is capable of keeping the grounds dry with the most certainty. I do not doubt that you approve of this scheme, which I have outlined, and that your friends will accept it, because the opportunity presenting itself is certainly unique of its kind, and will not be found anywhere else. Is not he a true Patriot, who decides to spend his money in such noble and unusual fashion? Once again it is the founder of the Batavian Society who wants to give this new testimony of his love for his Country and for science. I thus dare flatter myself with the thought that you will not refuse your support for such laudable ideas.

I learned from Miss Maffei, who stopped to see us on her way from London to Amsterdam, that your sons have gone directly from Amsterdam to Londen. I was disappointed that I have not been able to (.....). I hope that I will fare better at another occasion.

I would much appreciate news on your part about the fortunes of the enterprise near Blackfriars Bridge, these grain mills where the wheels of the stones are turned by the expansion of the vapour of boiling water. I have seen nothing about this in the public papers.

I enclose the English translation of the latest Essay Competition set by the Batavian Society, which will be published in the Monthly Review. If you should find an opportunity to send it to your friend Mr. Priestley in Birmingham to have it published in some or other periodical published in this part of England, which would be a welcome further means of disseminating it, you would do me a great favour and the Society would be much obliged to you. I have added the questions which the Batavian Society is publishing on behalf of the Society of Batavia, and also a special Subject, for which a distinguished Prize is offered. Because the solution to this problem is of such great importance to the country, an explanatory discussion has been added, to clarify the idea behind the question, and even two ways to solve it are presented, which are subject to the judgement of those who want to think about the subject, and they are left free to propose other means in case they think they know of any.

And here again it is a Frenchman who has been the first to cross the Channel in his aerostatic machine. It is peculiar that the English stay behind on this subject. I read in the Journal Encyclopaedique of January the first, that Dr. Priestley has, as they say, discovered a new way for making inflammable air, which is infinitely less costly than the earlier one. It is added, that the new method costs only one-twentieth of the old one. If that is true, the English do have some merit in this field. I would be much obliged if you could tell me more, as I would be if you were to send me a prompt reply if possible, and looking forward to that I have the honor of fully being,

Sir

Your most humble & very obedient servant

J:D: Huichelbos van Liender

JW to HvL 1785-03-29

AoS ref. MS 3147/3/85/106-107. Copy from Hist.Mus.Rdam. Transcript by R. Daalder.

B&W accept HvL's proposal [1785-01-30 to De Luc] in principle, but before an agreement can be concluded a number of details need to be cleared up.

M^r Huichelbos van Liender

Birm^m March 29th 1785

Sir,

Your letter of the 30th Jan^y which Mr De Luc was so kind as to put into my hands should have been answered sooner, but I was obliged to make a long stay in London, where I was too much agitated with various matters, to be able to give your proposition the due consideration. Since my return home I have been much indisposed with a bad cold & a feverish disorder, from which latter I am just recovered, and my partner M^r Boulton remains still in London confined by a sprained leg.

We approve in general of the proposition you have made us and if you understand it in the same light we do have no doubt but we shall agree with you. You propose that we should furnish you with Drawings and directions for erecting a steam Engine capable of raising 130 cubic feet of water 6 feet high p^t stroke and of making 10 strokes p^t minute, and that we should also provide, at your expence, the cast iron work & such parts of the hammered iron work as we shall judge necessary to send from England, and this without our charging any other profit than what may arise to us as manufacturers at the prices we commonly charge these goods to our customers here, that is that we should receive no premium for the use of the invention or for our skill & trouble.

On your part you promise to erect such an Engine at your own cost on a Polder near the city of Rotterdam, and to pay all the expences incurred thereby — and also that you will oblige yourselves to procure us an exclusive privilege for the use of our invention.

As we are ignorant of the nature of such exclusive privileges in your country, we wish to have an answer to the following queries.

1. Whether the patent, or privilege, is meant to be for all the United provinces or only for the province of Holland.

2d. In what manner must the invention be explained in the privilege to secure against evasions, I suppose you know that in England we give in a separate writing called a specification, wherein the invention is explained & the principles on which it proceeds and in which its novelty consists are set forth, so that any person making another machine which acts on the same principles however different it may be in form is precluded; for instance suppose a man was the first inventor of spinning flax, but the machine he used was a distaff (quenouille) and he described the nature or principle of his invention to consist in the pulling and gradually a few fibres of flax and twisting them together by the whirling or rotative motion of a spindle which motion was communicated to it by twirling the spindle between the fingers, or otherwise as might be found convenient, such patent would be exclusive against spinning by a wheel because the wheel in so far as regards the twisting acts on the same principle. Yet the spinning wheel & the distaff differ toto coelo in form. Now our invention consisting entirely in the application of certain philosophical principles, which may be applied to Engines of 100 different forms, if the principle cannot be secured the patent is of no avail.

3. Is it understood that the privilege is to be granted as free of all expence to us ?

4th. Whether drainage will not be required in other provinces besides Holland, & if so whether to any great extent ?

We have had so much opposition, to our Engines, to combat in this country & still have, whenever we attempt to open a new field, that it is with a considerable degree of reluctance, that we can bring ourselves again to lye under the disagreeable necessity of struggling with the prejudices of mankind, particularly as your country^{mm} have shewn a rooted aversion to Fire Engines in general. Yet if our doubts receive satisfactory answers, our confidence in your & other patriotic & enlightened Gentlemens exertions together with the known merit of our Engines, (which we expect will speak loudly for themselves,) will probably determine us to accept your proposals; though under the load of business which presses upon us from every quarter of this country, and which increases daily, the bestowing the labour time and attention, which will be necessary to erect such an Engine as you want, without any prospect of immediate reward, is perhaps not perfectly consistent with prudence, but tends more to indulge the love of fame and an ambition of doing all the good we can in the world, to which we are not a little prompted by the example of your truly patriotic society.

If the quantity of water you require is to be raised by a pump it must be 63 inches in diameter, and the cylinder if 6 feet stroke must be, (or ought to be to work in the most advantageous manner) about 37 inches diameter, or if 8 feet stroke 32 inches dia^t and the consumption of coal by such engine should be from 1¼ bushel to 2 bushels of good Newcastle coal, measured by the heaped Winchester coal bushel which weighs commonly about 84 lb avoirdupoise, but of Scotch or free burning coals the consumption would probably be from 140 to

160 pounds weight per hour at 10 strokes p^r minute, & this supposing the engine to be kept in good order and the manner of firing well understood, otherwise an ignorant fireman may easily con(*sume*) more. I have in the above calculated upon the supposition of your using a pump, and I am not certain that we cannot serve you better by a rotative engine applied to a wat(*erwheel?*), but that must be the subject of future deliberation and (*I even*) think that I have found a better method than a water(*wheel*) which I mean soon to submit to experiment. These (.....) will come best when we have settled the first points, but in the mean time we will be obliged to you for your opinion of the quantity of water lost by water wheels, that is the quantity they raise less than they ought to do by calculation.

We hold ourselves much obliged to you for the preference which you have so obligingly given us in this business and the attention which you have always paid to us.

M^r Boulton desires to join in compliments to you (and) I will be obliged to you to remember me to my old friend M^r Ainslie.

I remain, with much Esteem

Dear Sir,

Your most Obed^t

& most humble serv^t

James Watt

HvL to JW 1785-06-03

AoS ref. MS 3147/3/505/6. Docket: Explanation of proposals. Copy from Hist.Mus.Rdam. Transcript by R. Daalder.

There have been problems with the (Cool?) polder envisaged earlier, now switched to Blijdorp.

M^r James Watt
at Birmingham

Rotterdam 3th of June 1785

Sir

Very readily acknowledging the receipt in due time of your agreeable favour of 29th March last, I shall proceed to answer it accordingly, having duly considered its contents with the Gentleman concerned with me in th'undertaking; Being fully persuaded that our sentiments on both sides are of the most candid kind, and that our views are noble and most laudable, It was a great satisfaction to me that you did approve in general the proposition I have made, being certain we understand it in the same light and that therefore there was no doubt of our agreeing together; You have very well stated the two terms of my proposition upon which I shall now enlarge and more fully explain them, in the first place telling you that by further inspection and more mature deliberation we have so many inconveniences and hindrances, in the Polder near this town, we had first in view for making the Theatre of our operations, that we have resolved to abandon it and to chuse rather a neighbouring one for that purpose, which is at a little more distance from town, but in other respects enjoys many advantages, which compensate fully that disadvantage; This polder has an extent or superficial surface of something more than 700 English acres, and is kept dry by one wind watermill, raising the water at the utmost to the height of six feet, giving by every revolution of its waterwheel according our common way of calculating 196 Cubicq feet, and supposing 5½ revolutions per minute as a medium; because the great circumference of the waterwheel makes its revolutions slower; the product per minute will be 1078 Cubicq feet; and this the quantity of th'engine ought to be capable of raising per minute at the height of six feet; And an Engine planned according your improved principles, and able to perform these desiderata in due order, you shall take all the necessary trouble to plan and have constructed as far as possible under your eye and care and give us the necessary instructions by writing and drawing how to make its foundation (which certainly ought to be a piled one) to know its Dimensions, because we know very well how to make it of a sufficient strength and solidity; and all its parts which are to be made in England you will take care to send us from thence in the most convenient way, either by Bristol or by London, and we shall pay for them according the common current prices of those things in your Country. And you shall in due course given us the needfull directions and instructions to put its several parts together and set it to work, for which we shall not be obliged to pay anijthing extraordinarij. But in consideration of your trouble and for the use of your Invention, we promise and engage to incur all th'Expences necessary on th'Erection of the said fire Engine, and moreover to take all the necessary and commonly employed steps and measures to sollicit and procure you an exclusive privilege for the use of your Invention in the Province of Holland for a limited time of fifteen years. You will undoubtedly very well conceive that we are utterly unable unable to engage ourselves for th'Event. We can only engage to sollicit this favour from the States in the way and mode it is customary to do it, and which as far as we know, till now; was never refused, but as the granting of a favour depends from the goodwill of those who are the masters of granting it; we can no farther bind ourselves as to do all what lies in our power to obtain that favour, and to that end we will and readily oblige ourselves.— And shall now procede to give you the desired elucidations of your several queries; The Privilege we judge only will be wanted for the Province of Holland, because that province stands, most and nearly only in need of Hydraulic Engines, th'use of them in the other Provinces being so inconsiderable, that would not be worth the trouble, th'obtaining of the Privilege would subject to.

The mode of securing the Privilege of any Invention to the Inventor of it in this Countrij is certainly founded upon the same principles as In England, and therefore the real grounds and distinctive caracter of th'Invention ought to be explained as full as possible in the specification laid over by the demand for it, and the Philosophical principles which are the basis of the Invention are the characteristicq definitions of its merit and to which alone th'advantages of the privilege is granted; everyone is necessarily excluded, who should employ the same principles, notwithstanding the form of their application differed widely from that of the original Inventor; we have understood that th'expences of obtaining the Privilege should be incurred by you but If that would be a hinderance of our agreeing together we shall rather give up that point. No drainage of any consideration as far as we know; will be wanted in any of the other six Provinces.— I know very well what oppositions your Engines have met with in your Countrij and so it alwaijs has been with every new and good improvement; should any man ever believe that the first windmill in Holland, which was made to turn round for catching the wind (all th'others then standing fixt for a certain wind) was violently opposed and ridiculised; — I know what opposition and the so common jealousy in mankind may effect but this fires my

mind and makes me more intent to go on, and I find more and more that no good of any consequence can be effected than by perseverance. No example (at least in Holland) exist of particular Persons spending so much money and giving themselves so much trouble for the public good than th'undertakers of the first fire Engine ever erected in this country, and perseverance alone will make that so much money will not have been spend in vain, which certainlij would have been the case if by opposition and ridicule we should have been deterred. I could give you a whole history what this now last undertaking in its Embryo already has occasioned; All th'authoritij of the whole Heemraadschap of Schieland (who are now very willing to promote our undertaking) is not able to permove the stubborn mind of an old farmer of which we want â small piece of ground to erect th'Engine upon, and which we will pay for largely. and th'uncertainty in which we have been kept by this old fellow during some months has been the reason of my differing to answer your favour sooner; we shall now request the Town Magistrate for leave to construct the fire Engine upon a part of the public road, the same being broad enough in that part for the purpose, but we had rather a piece of ground from a field, which we could surround by a good ditch. Another very substantial farmer in the same polder is very inclined to help us with â piece of ground but his land is not so well situated for the purpose as the spot we have chosen, and every other consideration must make room for that of â proper situation.— I am of opinion that we must begin with making use of a pump to raise the water, being the most known and simple method, and if this tryall answers in any degree, we can afterwards try another method by application of a waterwheel to a rotative Engine. I shall with sincere pleasure learn the result of your further experiments about â better method than â waterwheel for raising the water to a small height.— The Quantitij lost by our common waterwheels as far as I have been able to ascertain it by experiments, is when they make â mean number of revolutions per minute (which in one mill is five, in another six, in a third seven, and in a fourth eight) about one third of the calculated quantity, they ought to raise, and when their revolutions are more in number per minute, the Loss is still greater, and increases more and more in proportion the quicker their motion is, so that by the velocitij of the revolutions of the wheel great part of the raised water is thrown backwards over the wheel.— A Cylinder of 37 English Inches will do just well, because that will make it 36 Inches rhymland measure, and that is th'utmost diameter of the Cylinder may be according the terms of the Investment. the length of the stroke in the water pump or waterpumps (if one was thought of to large a diameter) ought to be of six feet or more, because the water is to be lifted at that height.

Nothing will be more agreable to than to receive your final consent and agreement with mine explained propositions, and that all impediment of beginning soon with this laudable undertaking may he removed, not doubting or our joined endeavours may prove useful and honourable for all who are concerned in it. I beg my best respects to M^r Boulton as likewise your old friend M^r Enslie has prayed me to return you his; and remain with due regard,

Sir,

Your m^t ob^t humble servant
J:D: Huichelbos van Liender

HvL to JW 1785-08-04

AoS ref. MS 3147/3/505/7. Copy from Hist.Mus.Rdam. Transcript by R. Daalder.

Day unreadable on damaged original; 4th inferred from JW's reply of 1785-09-04

M^r James Watt
at Birmingham

Rotterdam (4)th of August 1785

Dear Sir

It was the 3th of June that I wrote you last and answered fully your esteemed favour of 29th March. being till now without your replij, It persuades me you have fully acquiesced in all what I have proposed at that time; and as we have now obtained a spot of ground fully answerable to our purpose, and all other obstacles are quite removed, we are able to go on freely with our undertaking. Therefore in the name of the Directors of the Batavian Society and my Own, I beg you will be so kind as as to send me as soon as possible a plan of th'Engine and building, to the end that we may go on with making the foundation, and drive the piles for supporting the Capital walls; and make moreover all other necessarij preparations to put th'engine together next spring; — th'ensuing or next winter will serve you for having cast the several pieces wanted for its construction. You will observe that the Cylinder's diameter ought not to exceede 36 inches Rhijnland measure, as I have told you before; If you judge a lesser one will suffice, it will be the more agreable. I never before spoke anything about the boiler, but as we intend to have a copper one, it will be made here, you only will give us its dimensions and what form it ought to have. In Expectation of hearing soon from you I remain with due esteem.

Dear Sir

Your m^t obedient humble Servant
J:D: Huichelbos van Liender

JW to HvL 1785-09-04

AoS ref. MS 3147/3/85/209-210. Copy from Hist.Mus.Rdam. Transcript by R. Daalder.

The experiences in France referred to would be the events told in [Muirhead, 1858 pp 265-267], concerning Mr. Perrier.

The dimensions eventually agreed upon are: steam cylinder 34", pump barrel 55", equal strokes 7'.

M^r van Liender

Birmhm Sep. 4th 1785

Dear Sir,

We are favoured with your obliging letter of the 4th Augst (.....) giving an answer to your favour of the 3^d June

However the fact is this, at the time it came to hand we were both in London, Mr Boulton attesting to settle a new system for the coppertrade of this country which has been so lamentably managed by the 11 or 12 old coppercomp:s that the mines in which we are greatly interested were on the verge of ruin, & some going to give up, as all would soon have done. This occupies him so intirely as to prevent me from having an opportunity of having a deliberate consultation with him on the subject. I am myself engaged in giving directions at the various Engines which are now erecting in London and in attending the House of Lords, lending my poor assistance to our brethern, the manufacturers of Great Britain, to oppose these infernal propositions by which our ministry, for some reasons known only to themselves, proposed to sell our birthright, that is our trade and manufacture, to the Irish for a mess of pottage (*Ed.Note: for a pittance*); which propositions, thank God, met the fate they deserved. This and other business detained me in London for some time after M^r B. left it. When I returned I found an accumulation of business which had fallen behind by my absence which you may easily conceive, when you know that we have had 20 Engines to erect this year & many of them on new constructions and that the whole of the Engineer part of the business passes through my hands. M^r B. was also so much engaged with business, in which I am not concerned and both of us with people coming here on our mutual business that I had only one very short conversation with him before he was called away to Cornwall where he now is, this conversation being interrupted was not conclusive, which with the necessary attention to the immediate objects in hand & the frequent interruptions from my own habitual bad health & the hope of knowing more of M^r B's sentiments has made me delay answering you till now.

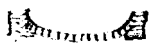
The only objection that occurred to us as worth stating against your proposal is that you cannot undertake that the privilege will be granted by the States as you can only apply to them as suitors, the force of which we allow, but on the other side we think that you will allow that as men of business we should appear in a very ridiculous light, if after we have performed on our part what we undertake, the States should, either from the instigations of the enemies of fire engines, or from other causes, in which politicks may come in for a part, refuse to grant the desired privilege. You may say that in such case we shall not suffer any great loss, nevertheless we actualy should because the number of Engines in a year we can make is limited, both by the necessary portion of my time and attention, as well as of that of our principal draughts and workmen which each Engine takes; and by the time it would occupy of one of our best workmen in putting it together. Of such workmen we have very few, and can by means procure no more except by the slow process of learning other(?) subjects which subjects are not often to be met with, and as the delays and trouble attending the execution of engines abroad are more than double what they are to those in this country it might naturally prevent our making two engines here and consequently deprive us of the profits arising from them. This argument is the more forceful as we have always more demands for engines than we find it convenient (.....). We also feel ourselves very much hurt by the treatment we met with in France, where they granted us an Arret de Conseil for the exclusive use of our engines, and as soon as they got us to erect some for them told us the Arret was of no validity & even insisted on our giving up the names of the ministers who granted it & the friends who solicited it, that the granting it might be brought as a crime against them. They have gone farther they have refused to pay us one part of the sum which was stipulated as a premium on the engines we did make for them. This however we have still hope of obtaining. We do not pretend to be so unjust as to say that the States of Holland would imitate the arbitrary Government of France, but it certainly should be a lesson to us to act with all honourable caution in similar transactions.

You see then the only difficulty we make and we hope some way be found of removing it, would the states on application at present grant no provisional assurances, that they would grant such a privilege on our fulfilling our part? We have a sincere confidence in your honour & I hope we may say in your friendship, and as a friend we hope you will advise us for the best, and leave nothing loose which can be made fast. In this hope I shall in a few days set about a plan and section of the foundations of the house and send them to you that you may lose no more time, and you will please to remark that the same foundation which would serve our engine would serve a common one, so that you will in any case have made an advance in your undertaking.

The quantity of water, 1078 cubic feet, English, p^r minute, at 10 strokes p^r minute would require a pump

note in margin see at bottom of letter

of 49½, (say 50) english inches in diam^t with 8 feet stroke, which would require a cyl^t of 29½ but say 30 inches in dia^t, loaded to 8 7/10 lb an sq^{te} inch which is as much as is advisable with such a wide pump as they are worse to work than narrower columns of the same statical weight. If the engine is made with a 6 feet stroke the pump must be 57½ inches dia:r & the cylinder 33¾ or 34 inches dia^t.

The advantage of the 8 feet stroke is that it would burn rather fewer coals in doing the same work, and of the 6 feet stroke that the house would be 4 feet lower than for the 8 feet stroke, which I think is of some consequence in your instable foundation; add to this that the pump being wider will afford better water way in the bucket and clacks. You will please observe that the depth or height the water is to be raised will have no connection with the length of the stroke only will immerse the bottom of the pump so much farther under the surface of the low water as the stroke is longer. The following will be near about the depth for a 6 feet stroke from the surface of the water above to the top of the working barrel: 2 feet; Length of D^o., 7 feet 9 inches; the pedestal or foot on which it stands about 2 feet; the whole depth from the surface of the water above to the top of the platform 11 feet 9 inches which will be almost 12 feet or 6 feet under the surface of the low water. An eight feet stroke in the pump would go down 2 feet lower; As such pitt may be difficult to make and to support in soft ground I am inclined to prefer the 6 feet stroke. The house will require to be 12 feet wide and 14 or 15 feet long within, the side walls 3 feet thick to the surface of the ground, and the lever wall 4 feet 6 inches thick at the foundation for about 2 feet high, to come in to 4 feet, which thickness should carry to the surface of the ground, or rather to the level of the bottom of the cylinder, which we commonly fix at, or about, the level of the natural ground, that is above the level of the upper water. I am afraid that for security you must carry down the lever wall foundations as low as the bottom of the well, however that shall be considered of. We have built some Engines lately on similar foundations & have thrown inverted arches  under them to distribute the pressure more equally which seems to answer. I shall be glad to know the dimensions & quality of your bricks, also their prices, and that of oak and fir timber & plank pr.cubic foot that we may regulate accordingly in substituting one for the other.

Now my dear Sir I beg of you to consider of some method of putting us on a plan of certainty so that in the case of our proving victorious in the conflict with the natural impediments, as I have no doubt we shall be, we may not be conquered by moral ones. I beg the favour of you to remember me to Mr. Enslie and to believe me to remain with sincere Esteem

Dear Sir

Your Obliged humble serv^t
James Watt

The new machine I propose instead of a pump will suffer the fewer deductions the faster it goes, is capable of being easily adjusted to different heights & with the same power will raise quantities of water proportional to the heights; I have not yet tried, but have no doubt of its success.

(note in margin on previous page)

We hope that it is understood that a workman must be sent from thence, at the expence of our Employers, to put the machinery of the Engine together, when the house and beam with the iron work are ready which will not take him above 6 weeks or two months if he finds matters in tolerable readiness & meets no accidental hindrances.

HvL to JW 1785-10-04

AoS ref. MS 3147/3/505/8. Stamped OC 8. Copy from Hist.Mus.Rdam. Transcript by R. Daalder.

The two drawings mentioned have not been located.

Acc. to [1785-10-07], 4 Oct 1785 fell on a Tuesday (which date could thus be used as a reference point).

M^r James Watt
Birmingham

Rotterdam 4th of October 1785

Dear Sir

Upon my return from a five week's course through the Country of Liege, the Provinces of Luxembourg, Lorraine, Bar & Champagne to Paris, & from that Capital by the way of Brussels here, I found your very agreeable & obliging favour of the 4th of September. Its contents have been duly considered in the several assemblies the Directors of the Bat: Societij and I have held for that purpose, and to the end that we might give you all the satisfaction we could devise of, with obtaining th'exclusive privilege for your invention. I have been at Delvt, the Pensionary of which city being the permanent President of the Colledge appointed by the States for the new inventions; and I have exposed to that minister all the circumstances of the case, and th'arguments you have adduced, as likewise th'expedient you did propose. And he has given me his word to procure you an exclusive privilege in a few weeks, if you can resolve to reside here for some time and deliver to the States a drawing and description of your invention; but If it was utterly impossible for you or Mr.Boulton to come over here for that space of time, you should be obliged to name any other person here, in whose name the patent would be granted, because the States cannot grant such a privilege to any man residing at the time of granting the privilege in a foreign country. In that case I have thought if it was not advisable for you to demand it in the name of M^r Enslie, or if M^r Boulton, who I believe is acquainted with M^r Thomas Littledale here, who is as well as M^r Enslie a very creditable merchant of this place, could think fit to sollicit that gentleman to step forth in your behalf, and you do not run the least risk by having it granted in the name of one of those two gentlemen, who are incapable to do you, or any body else the least injustice. but if you could spare some few weeks and come over here, it would greatly facilitate th'operation. We could prepare the request before, and as soon as you arrived here with your description and the necessary drawings relating thereto, it could be delivered in, and as the Pensionary has promised me to make all possible dispatch, you should have it secured to you in a short time. Of this you will consider at your leisure, and impart to me the result in consequence; although the sooner it could be effected now we have mentioned something of the matter, the better and easier in my opinion it would succeed, and I in particular hope it will suit you to pay a visit to this country. It is morally impossible that a treatment as you have met with in France can ever befallen you in this Country. When at Paris I took a ride to Chaillot to see the fire Engine there, but could not obtain admittance, because they were busij to bring a second pump in order. I was likewise at Mr Perier's house, and was told th'undertaking did answer now exceeding well; and that five fire engines, all of your construction, were now erecting in Burgundij for a coal work; One Cylinder and many pipes I saw laying there. Mr Wilkenson has been at Paris some time before me, and was now gone to Geneva.— I have considered your reasoning about a six and eight feet stroke a very commendable circumstance is that of burning fewer coals militating for the eight feet stroke, which should make me prefer that above the six feet stroke. If no other objections are to be found against it, than that the house would be four feet higher, and the pitt two feet deeper; by some experiments we have made, I should think that the more or less width of the pump will not contribute in making the waterway in the buckets or clacks better, it may certainly well be kept for a general rule to have the waterway as roomy as possible it may be.— I have very well comprehended that the length of the stroke has no connection with the height the water is to be raised, because you intend to let your bucket go always under the surface of the water; but to the end that for the sequel we may surely understand one another, the best will be to convene in the beginning of the real meaning of the terms we may make use of; by instance when you speak of the Working barrel you understand thereby the main pump If I am right, by the Water above you understand certainly what we call th'outerwater or Schiewater, by the platform you mean (I think) what we call the stortvloer, or the floor whereupon the raised water is evacuated; two feet more or less depth of the pit will do no harm, the whole spot must be well dammed of, and kept dry by hand mills during the time the foundations are laid, and part of the walls built up; I have taken notice of the thickness the severall walls ought to be, but we are of opinion that for giving more strength to the building in general, the walls ought to be built up sloping, drawing the building in more and more in raising it higher, likewise as all our high mills are built for strengths cause; all the walls foundations ought certainly to be carried down as low, or nearly so, as the bottom of the pitt or well. we can make the floor of the foundation firm enough that I think we will not want to employ inverted arches.— We have already bored the ground and found the wellsand at the depth of 49, say 50 feet, so that we shall want

piles of about 40 feet length, to drive under the foundations. The dimensions of our bricks is 7 inches length and 3 inches broad and 1½ inch thick; their quality is very good, their prices as likewise those of oak and other timber, I shall give you hereafter. I send you herewith a plan of the spot whereupon th'engine is to be erected, as likewise The profile of the different grounds and waters, by which you will more easily conceive an orderly plan of the whole.

You have had with you the young M^r Bicker Son to the Director and first Secretary of the Batavian Society; who was greatly pleased with the Civilities you have offered him, of which his father has begged me to acknowledge his obligation.

I shall now expect by the first opportunity the plan and section of the house, that we may prepare the necessary piles to drove under it;

M^r Enslie joins readily his compliments to mine, and believe me to remain with every esteem,

Dear Sir

Your m^t ob^t & h: serv^t

J:D: Huichelbos van Liender

HvL to JW 1785-10-07

AoS ref. MS 3147/3/505/9. Docketed as 4 Oct. Stamped OC 11. Copy from Hist.Mus.Rdam. Transcript by R. Daalder.

The "celebrated countryman" would be Joseph Priestley, see also [1786-10-13]

M^r James Watt
Birmingham

Rotterdam 7th of October 1785

Dear Sir

Last thuesday I had the pleasure of writing you and answered your favour of the 4th of August (*Ed.Note: probably September meant*) and being somewhat confined in my time I was obliged to leave several Questions for a following letter; one Question of those is, what height the house nearly shall have. I comprehend that the more or Less length of the stroke shall make some difference, but no more than the difference of the stroke is, which difference then shall be of two feet.

Another question is if the Cylinder employed here by th'Erection of the first Engine, can be of any service for this new construction, either for an outer Cylinder or for a working barrel. Its dimensions are 52 English inches diameter, and nine feet length. There is likewise a house water pump of about 50 feet length of 10 inches working barrell. If you think one or other can serve, we should prepare matters to remove 'em; a third Question of some consequence is if the bucket in the mean pump or working barrell must never raise above the surface of the low polder water, in this case th'engine's bucket gives a full peal (*Ed.Note: spelling unmistakable, meaning clear from context, but word not found with this meaning in dictionaries*) in the first moment it begun to work, but if in the Contrary the bucket raises equal in height with the surface of the high or Schiewater, then the two or three first strokes of th'Engine will not give a full bucket, and should not therefore the best way be to have the bucket's raise determined at the half between the high and low or the Schie and Polderwater. I hope now to hear soon from you, and to receive your opinion upon those questions. We are now ready to go on as soon as we have the drawing of the foundation; I beg your pardon for including this letter for your so much celebrated countryman from the now President Director of the Batavian Society the reverend Doctor Nozeman.

I remain with sincere regard

Dear Sir

Your mt: obt: H.Servt.

J:D: Huichelbos van Liender

JW to HvL 1785-10-11

AoS ref. MS 3147/3/85/229-231. Copy from Hist.Mus.Rdam. Transcript by R. Daalder.

JW refers to a HvL letter of 1st instant, which would be [1785-10-01], but no such letter has been found in the AoS; the content is mainly a response to [1785-10-04] and [1785-10-07] (which latter had not been received when JW started this letter), plus a lot of new material. The reference is probably in error, and a letter [1785-10-01 never existed].

The 5 drawings and the "small plan" have not been located.

M^r Van Liender

Birm^m Oct^r 11th 1785

Dear Sir,

I am favoured with yours of the 1st instant (*Ed.Note: probably erroneous, see above*), & before I received it had made the plans of the Engine house and boiler seating with the situation of the well & since then have added a small plan to shew how I would situate the Engine in the polder if there be no objection I don't foresee, but of that I leave you master as well as of many things to be mentioned in the latter part of this letter.


I hold myself much obliged to you for the steps you have taken in the affair of the privilege which appear to be the proper ones. As I much doubt whether it will be possible for Mr. B. or myself to leave England this season, my voice should be given for taking out the privilege out in Mr. Enslie's name, and as I suppose it is assignable as they are here in England he can assign it to us at convenience, of his honour I agree with you there can be no doubt; but on this head I must consult with Mr. Boulton who is now in Cornwall, but must be home early in November. If you think there is any risque of competitors or of trouble being created to us by delay I shall be obliged to you to advise me on receipt of this as it will taken some time to make out the specification and I am obliged to go for London this week which will prevent my doing anything in it before my return or perhaps before I can receive your answer. A Mr. Eckhardt from your country who is now in London, selling an invention, has made some proposals to us for engines to drive some of his waterwheels at Amsterdam but we have hitherto put him off and shall do, as we should not like to encounter with two difficulties at once. Besides we know not whether any confidence can be put in his promises. Now I must trouble you with some queries. What is the form of a petition or requête to the states for a patent? In what manner must a specification be drawn so as to be valid?

If you could send us a copy of the specification of some mechanical invention it would be obliging, and also how the law decides in those matters. Whether the same patent or privilege can cover all the varieties of Steam Engines which may be made on the new principles? Whether in case of describing several varieties it will be necessary to make models of them all, or to use them all in order to make the patent valid? or whether making one sort to illustrate the principle, will be sufficient? Whether the specification is given in after the patent is granted, as is the case here, or if it must be given in per advance? In what court & in what manner the cause is tried in the case of the infringement of a patent. Whether your patents in any wise regulate the patentees demands on the users of his invention, or if he & they are left to make the best bargain they can as is the case here? And last though not least what benefits are likely to accrue from a patent for such an invention, provided it can be brought into use? You know that in this country our profits arise from $\frac{1}{3}$ of the the savings in fuel which our engines make when compared with those of the common construction which is paid us monthly, quarterly or annually according to the particular agreements. Now as there are no common engines in Holland and we cannot pretend to compare with wind mills we shall want a standard of comparison, and consequently a reasonable demand on our part may be thought too much. In cases of rotative engines driving mills we have fixed our premium in this country at £ 5 annually for each horses power the engine is equal to & in London we have £ 6-6 pr. horse.

Since I wrote to you I considered fully the affair of the 6 feet & 8 feet stroke and have determined in favour of the former, because the differences of the resistance of the water in the same quantity coming in the same time through the valves of a 50 inch which corresponds to the 8 feet stroke as does through the valves of a 58 inch which corresponds to the 6 feet stroke, will occasion a greater loss of power then there would be gain by lengthening the stroke in the cyl^r unless the 8 feet stroke was made to work a six feet stroke in the pump which we frequently practice, but that also is attended with inconveniences so that on the whole I prefer the simple 6 feet stroke & the engine house is drawn for it accordingly. A 58 inch pump with a 6 feet stroke will give by calculation 110 English cubic feet pr. stroke which are equal to a little more than 100 Rhyland cubic feet & by 10 strokes would give 1000 of the latter pr. minute which is what you desired. But upon calculating the resistance of the water in passing through the clacks (valves) & bucket or piston I find it to be equal in the 58 inch pump to $\frac{1}{4}$ of the whole power necessary to lift the water & in the 50 inch pump to more than $\frac{1}{2}$ of that power, supposing the strokes to be made by each in the same time. Therefore I think the 34 inch

cylinder which I proposed to work the 58 will prove rather of the least, now whether shall I increase the cylinder or diminish the pump, I am inclined to the latter, because I think the the pump large enough for a first experiment and because by diminishing it a little, say 2 or 3 inches, in dia^t the engine will work lighter & easier & will by making a stroke more p^t minute raise the same quantity of water, besides we have patterns &c ready prepared for the nozles or regulator boxes of a 34 inch cyl^t by using which some time and money may be saved; but it shall be as you please. The working barrel means that part of a pump in which the piston works. The Bucket means the piston of the pump. The clack means the soupage or the assemblage of fixed valves, through which the water passes. By valve I mean one of these moveable lids or doors which is also called the fly part of a clack, as the other is called the beating part or fixed part. By the water above I mean the upper water or the surface the water is to be raised to. By a platform is meant any strong floor of planks & timber, or of stones or bricks on which any heavy body is supported. I spoke of the floor on which the pumps are to stand. Other cramp words (*Ed. Note: words difficult to pronounce or understand—OED*) must be explained as they occur.

No.1 is a section of the engine house in the direction of the working beam or Grand balancier. Engine houses being square cannot well be built with the walls leaning inwards but we always diminish them in thickness as is done in the section. It was drawn for our bricks before your letter arrived but I have marked in blue the thicknesses in Rhymland inches which I think will correspond to your bricks, and have increased the thicknesses of the side and back walls a little. The lever wall was strong enough, we have never had any of our engine houses crack or give way, and I think we have built some on as bad foundations as yours. C.C.C. represents the floor of the cellar under the cylr. platform & under the condensor cistern, this cistern being placed in the space D. This floor need not be built to that height solid with bricks, but Walls 18 inches thick may be built comprehending the space DD,DD in no.3 & the rest may be filled up with clay or sand, but the whole internal part of the house had better be left empty to the foundations until more complete drawings are sent you. The platform on which the cylr. stands must also be left unbuilt until the house is finished, but holes must be left in the walls for the ends of the beams which support it.

I have put iron lintels over the front door because arches tend to split the wall and wood decays. The cylinder beams are to be about 48 inches asunder, but should have some play in their holes laterally, so that they may be moved 2 or 3 inches farther from or nearer to one another. They may be laid loosely in their places when the house is built up to them, their Iron mounting can be put on afterwards. They should be of Dantzich fir timber, just above these beams there should be 3 sets of thin Iron bars built in the wall to keep it from splitting and a course of short bars across them as shown in nos. 1 & 4, & there ought to be another set of bars immediately under the opening for the worlking beam. The spring beams of Dantzich or other good fir may be built in fact in their places when the wall comes up to them. They should be of one piece from end to end & may have a temporary support for the outer end till the pit head frame is erected. There need be no iron built in the side or back walls except two bars going back about 10 or 12 feet in each side wall to connect them with the lever wall, one on the level of the cylinder beams and another just above the top of the windows in the side walls. The window upon the same side with the boiler must be made down to the floor, to admit the steam pipe from the boiler. In no. 1 I have drawn the situation of the pump in the well and the Lander or trough fixt upon it which carries away the water which is raised. This Lander I propose to make very large, in order to prevent the water rising in it during the stroke and thereby loading the engine needlessly. This Lander must not rest at all on the walls of the well, but on the pump only otherwise the motion of the pump which there is no preventing would tear it off from its Joint and cause it to leak. The thickness & height of the walls of the well and the channel which brings the water to it I leave to your judgement. The perpend. line EE shews the thickness I proposed for them except just in the point where they are in contact with the engine house. The pump is to be placed on a cross  of cast iron supported on a cross of the best oak timber, and under that must be driven as many piles as you can conveniently for there is scarce any such thing as making foundations solid enough to resist the the shock of shutting the clack, though I shall do all I can to lessen that shock yet it will prove very considerable. In no. 3 you will observe I propose a sluice or gates to keep the well dry when any repairs are wanted about the bottom of the pumps, but I do not like the way in which it is drawn, as the uprights will stop too much of the waterway. If some better method is not thought of the passage in the brick work must be made so much wider as to allow 8 feet wide clear water way. The beams GG which serve to steady the pump in the well must have some play in this place as shown at HH, thus they maybe withdrawn to let in the pumps, and wedged close upto it afterwards, therefore the cavity they lye in must have a slight lintel over it, and a strong crooked piece of oak must be built in the wall under them, say a piece of 12 inches deep reaching from J to J (no. 3). The clack of the pump is to be fixed on the top of it and made in a particular manner which shall be hereafter described. In no. 3 you have the foundation of the boyler seating & of the chimney, which should be carried up independent of the house. In no. 5 you have plan of boyler seating level with the bottom of the flues & in no. 2 section of the boyler & seating through the centre line of the ashpit. The boyler seating should be built no higher than X X until further directions are given. No.6 is a general plan of the whole to shew, what appears to me to be the best way of receiving and giving out the water. If you chuse to place the engine nearer the road or to place it in any other manner I can have no objection, but I think it

should draw its water from the best source and that the main Ditch should even be widened at the place to avoid hurtful currents. I am quite exhausted & can add no more at present, but if anything is not well understood please to write to me.

While writing the above (Oct^r 12) I am favoured with yours of the 7th in ans^r thereto, any difference in the length of the stroke makes rather more than twice the difference in the height of the house, and the whole difference in the depth of the well.

As to the old cyl^r, we now use no outer cyl^r but a slight case which is more commodious & not costly. As to using it for a pump I can say little without an accurate drawing of it with all its flanches &c., and as the bucket & clack must be accurately fitted to the pump, I would in this first experiment recommend a new one, the other can be used afterwards in some other erection. If you chuse to use it in this I recommend the lessening the cylinder to suit it instead of lengthening the stroke, and I suppose it will then be large enough to drain the polders in question. As to the question about the proper situation of the bucket in the pump. As it is drawn the bucket will give full water the second stroke, & in all time coming when there is water in the trough above will give water the first stroke — Pray you have any iron founder who can execute large iron work such as a clack for a 56 inch pump of a very difficult figure?

I remain with due esteem

Dear Sir

Your Obd^t humble serv^t

JW

HvL to JW 1785-11-29

AoS ref. MS 3147/3/505/10. Copy from Hist.Mus.Rdam. Transcript by R. Daalder.

HvL's proposed plan has not been located.

Apart from the request for the Privilege to the States of the Province Holland, a separate request was sent to the Rotterdam City Corporation, which held one of the important seats in the States.

M^r James Watt
at Birmingham

Rotterdam 29th of November 1785

Dear Sir

I was in due course favoured with your esteemed letter of 11th October last, accompanied by five drawings for our intended Steam Engine. One and other have been the subject of many conversations and reflexions, but not withstanding they are very accurate, and your description gives a good explanation of 'em, there are still some points, upon which we wish to have your further advice and consent, before we venture to go on with fixing a complete plan for the foundations; because when once planned and commenced, it is not very easy to alter it, and notwithstanding you say that for the general situation you leave us matter, we prefer rather to give you first our opinion and ask your advice, because we can do so now without any detriment having not yet received the piles for the foundation, and the season being so stormy and uncertain, that it would be very difficult to proceede. and first with regard to the small plan you send for the site of th'Engine in the polder, we have some objections and alterations in view, which you will conceive by inspecting the drawing of it, which we have let made and include herein. you will see that we would like to make the pump pit square, and the walls straight, because it is much more easij to make the foundation watertight, and to built the walls up, when that form is employed as when a round or octagon is chosen. The foundations of the pump well ought to be quite surrounded by (what we call) damplanken (*Ed.Note: =sheet piling*), which can be joined much thighter against a square as around a circle, and without being driven in good order and well joined to another, it would be impossible to make the pump well thight and able to empty it when wanted. It will give us no difficultij to make a sluice door of about 12 feet width, very thight; you will see that we have contrived to give as much room as possible to receive the water in the pumpwell; the situation of the Engine house etc. upon the spot must very near be as you have planned it, we think it very well faisable and adviseable to built the walls up leaning one to another and keep the space within just as the given dimensions require; it certainly will increase th'Expences of the foundation, but must absolutelij contribute to the whole strength of the building; we have taken notice of the alterations you have made in the dimensions, after having received the dimensions of our bricks; in the front or mean (*Ed.Note:main*) whall of our Engine house here is a chain arch of seven feet high, which has never had the least tendency to splitting; If a chain arch is taken I think there is no danger of splitting. we have not been able to distinguish rightlij the meaning of the drawing no. 1 & 4 in regard to the 3 sets of iron bars built in the wall to keep it from splitting and a course of short bars across them. If these are meant only to be laid down in the wall between the layers of bricks, we d'ont see any utility in them. The lander or receiver of the raised water must certainly be made as capacious as possible and therefore we are of opinion that it ought not to rest upon the pump, If there is no possibilitij to prevent the motion of the pump (of which you will permit that we doubt greatly, and that we think to be able to fix it unmovable) we must contrive anij other method; by which we will be able to extend this Lander always as occasion will require, because I have seen in the 36 Inch pump of Mr. Jan Hope near Haerlem that with a stroke of five feet length the water raises nine inches upon the stroke, notwithstanding the Lander is eight feet wide, and all the raised water runs out of the Lander after every stroke; the pump may be fastened to the piles and flooring made under it, our pumps of 72 inches diameter, made of wood, and fastened in the floor here, have never shaken the floor, nor does the 36 Inches pump mentioned above, nor the four 40 Inches Iron and wooden pumps at th'Engine constructed in the moors near Duynkerken, who all four are likewise fastened in the upper floor or platform. There is at Amsterdam an Iron foundery where I believe that the Clack for the 56 inch pump could be cast, but where so manij pieces of this engine will be cast with you, I think it will be better to have it likewise cast under your inspection. I proceed now to propose some questions, which we wish to have answered for giving us a clearer idea of some circumstances in the drawings you have send us. Viz¹

1st Question. Would it not be better to join the beams G in drawing no. 1 & 3 for staedying the pump, just against the same, instead of laying them against the moulding, which would give more firmness to the pump, and would it not be better to inclose the ends of the beams were laying in the wall in wood or in hewn stone whereby they may be faster wedged in ? 2nd Question. If there is absolutely wanted a door in the front or main

wall, a window certainly there ought to be. If a door is wanted, a chain arch we think would be preferable above a square opening! See drawing no. 4: 3th Question: The drawings no. 1 & no. 6 do not agree about the platform or Lander. 4th question. Is two feet opening under the pump's bottom roomy enough for a sufficient quick supply of water, for feeding the pump, where the iron and wooden cross take off so much of the waterway: drawing no. 1. 5th question. Will not a staircase be wanted to mount the Engine house? draw. no. 4. 6th Question. May the bottom of the Ashpit not be laid one foot higher, or the boiler wall raised one foot higher? to the end that we should never be plagued with the polderwater in the ashpit, drawing no. 1. 7th Question. Where is the damperplate properly to be placed? The drawings no. 2,3 & 5 do not enough elucidate this. 8th question. It will certainly be very easy to take the clack and piston from and out of the pump? or there must be made another opening in the Lander (or stortvloer) to empty the pit or pumpwell, and go down under it. 9th question. The outlet or outrun (we call it het buyten waeterloop) of the raised water, must be laid as deep as the platform or stortvloer, and this will be $5\frac{1}{4}$ feet below the Schiedike; this will require it to be of a great strength to contain such a body of water. 10th question. Will there not be wanted a dam and grate to hinder the pumpwell being filled in a short time with mud, because the foundation will be four feet lower than the bottom of the main ditch? Your answer upon those queries will be received with much pleasure.

Seeing by what you wrote me in your last letter, the little appearance there was, that you or M^r Boulton should come over to reside some weeks in this Country, we have been advised by the Pensionarij of Delvt, to ask the patent for your Invention in the name of the Directors of the Batavian Society, and of J:D:Huichelbos van Liender, but in behoof of M^r James Watt of Birmingham, which is expressed in clear terms in the requête; This measure we have thought will answer all our ends, and make you quite master when the privilege is granted, and empower us to act for you in case of anyone daring to infringe your right, and we hope, that the States of Holland shall grant in that manner, this our requête shall be presented this week to the States, so that you will be kind as to prepare meanwhile a description in case (as I believe) it will be required, as a condition sine qua non; I doubt not or this arrangement will fully please you. We have likewise presented a requête to the Council of this town, praying them to bring our requête by their Deputies in the Assembly of the States, and to patronize it there with all their power, which is granted. There is not the least danger of any competitor as yet, but by securing the privilege to you as soon as possible, this necessary step and condition on our side we have wished to fulfill as soon as opportunity offered.

If you will not involve yourself in difficulties, don't meddle in any way with M^r Eckhardt. He is a fine talker but no dependance at all upon his proposals. His waterwheel is quite condemned in this Country, and where it has been employed in watermills, they are now altered again to the former method of standing wheels;— I go now over to answer your queries the form of a petition to the States you will now nearly conceive by the principal tenets I have told you already; we have further set forth in it, that we wished to state a clear demonstration and proof of the Excellence of the fire Engines in general and of its newest improvement in particular, but that for to have the benefit of this last qualification, we were obliged to have recourse to their High Mightin^{ess} because the inventor of this last improvement Mr. James Watt of Birmingham did not like to serve us with it, without being granted in Holland an exclusive Privilege for a certain number of years, as likewise he enjoyed in England, but that he has so much confidence in our honour and the Candour of our Society, that he should permit us to ask that Privilege in our name, and that we do pray and ask it in our name, but never would reap the benefit of it ourselves, and so forth.— The specification of your invention I suppose ought to be a clear demonstration of the principles upon which your invention is founded, by instance a principal difference between your invention and Newcomens method, is that you do not use a cold water jet for condensing the steam; but by using another method keep your cylinder always as hot as possible, every Engine acting upon the same principles, let its form and construction be what it will, is covered by your privilege; I have a copy of the bill by which your privilege in England is granted, and the same specification you have made there, will in my opinion hold good here likewise, and there is, as I suppose, not the least danger of anyone trying in this Country to erect or construct any Steam Engine; If the several varieties you describe in your specification are deduced from the same principles, it will not be wanted to make models of them all. The Exclusive privilege leaves the Patentee wholly master of his terms.

Your last, but not your least (as you express yourself) query is, what benefits are likely to accrue from a patent for such an invention; I am utterly incapable to answer this question as I should wish to do, all what I with certainty can say upon this head is that you may depend, that I in my particular will do all what lies in my power to procure you all the benefit it is possible to reap from it, and that will mostly depend from the issue our undertaking will have and how the Engine will turn out in opposition to the mill; but when we are so far advanced, as that Steam Engines of your Invention came to be demanded, the terms would then very easily be arranged, and undoubtedly not without reasonable benefit for the Inventor. This I am sure you would wholly in such a case leave to my care; what you say about rotative Engines driving mills, will be an object of consideration, when we have some more leisure as now. I acquiesce wholly in your determination of the length of the stroke, and let us fix it invariably upon an equal six feet stroke, as likewise we may fix upon a 34 Inch Cylinder and a pump of about 55 or 56 Inches. now I believe I have touched upon every material point of your

interesting letter, and may well conclude this long epistle with wishing you a good health, remaining always with every esteem

Dear Sir

Your most ob^d Humble Serv^t
J:D:Huichelbos van Liender

P.S. What a particular kind of paper is it! whereupon you write your letters, I like it very much.

JW to HvL 1785-12-10

AoS ref. MS 3147/3/85/252-253. Copy from Hist. Mus. Rdam. Transcript by R. Daalder.

M^r van Liender

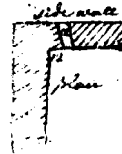
Birmingham Dec^r 10th 1785

Dear Sir

Two days ago I was favoured with yours of the 29th. I have no objection to making the pump well square, but I think you have confined it rather too much in its dimensions at bottom, say you were to make it 1 foot wider & if you judge that the walls require so much slope make it also 1 foot wider at top. If the house were round it would answer very well to make the walls lean to one another, but being square I should apprehend that if they leaned inwards more than half their own thickness at top, without your mortar was exceeding good, they would be apt to bend inwards in the middle of each wall; but as I have never seen any walls built in that manner, nor indeed have never found any occasion for it, I am no proper judge. I must therefore leave it entirely to you, only requesting that the same space may be left within the walls that I have drawn, and that the lever wall may be built perpendicular in the inside also that you will send me a plan of the house with the enlarged dimensions if they affect the distance from the center of the boiler to the cylinder, that the steam pipe may be accommodated to it. In relation to the door in the lever wall, it is made of that height for the more convenient placing of the pipes for receiving the cold water and returning the overplus, and when the engine is finished we build up part of it by a thin wall, and convert it into a window. On examining the drawings I find that the bottom or threshold of that door should be as low as the level of the Schiewater & if 6 inches lower so much the better, because the cistern which stands in the inside has its top within one foot of the line of the floor, and must vent its waste or overflowing water out at the said door, but the top of the door must go up as high as is drawn, otherwise it will be very dark about the working gear & front of the cylinder.

I do not understand what is meant by a chain arch, but I object to all arches in lever walls. The method I have drawn I have always found sufficient only we have commonly used wooden lintels in place of the cast iron ones, but wood rots sooner or later and betrays its trust. I shall however before you can build send you a drawing of another method of executing it with Iron Lintels, surmounted by an arch which cannot spur against the walls. As to the thin Iron bars laid between the courses of bricks to keep the wall from splitting we have found them very serviceable, and I expect they would be so in your case, your bricks being so short. We lay it down for a rule never to build wood into a wall where it can be avoided.— I do not say that it is impossible to fix a wide pump fast, only that I have never seen (*one*) that was so, tho I have seen them set on a rock. But scarce any of (*the*) large pumps in this country are less than 20 feet high, and generally move (...?). If you think that you can make the pump immovable, I am willing (....) you rest the lander on the walls, and if any bad consequence should (arise) from their not moving equally, I know of a remedy. The pump you mention at Harlem probably raised the water so much higher than the pump (.....) the lander was not deep enough below the top of the pump, but all pu(*m*ps) will do it more or less. I believe however that I have given quite w(*a*ter) way enough in the passage to the Schie water, but that passage should (*have*) a tight gate or sluice upon it to keep out the Schiewater when any (.....) is repairing about

in the drawing that there must be an opening in the side wall boiler, to let the water out of the cistern occasionally, and part of the house as low as the water in the polders will ever inches distant from the inside of the lever wall, and it should feet high, to be built up close afterwards, when the proper



the pump or lander. It was forgotten which is on the same (level) with the also to let the water out of the lower permit. This opening should be 18 be about 12 inches wide and 2 or 3 pipes are fixed in it. It is meant that the bottom of this opening should be at least as low as the polder water. In order to avoid the boiler seating this opening must go through the wall a little slanting (see margin). To question 1st: the beam G may be made to absolutely approach or touch the pump, & the holes they lye in were in my last directed to be lined with wood.

2d ansd. on other page. 3d N^o. 6 was not drawn with accuracy, as you well square the lander may be so too. 4th I apprehend that 2 feet pump will readily supply it with water, but if you chuse to make it 6 be better. 5th the stair will be made within the engine (*house?*)



to be sent. 6th the boiler seating cannot be raised any hig(*her*) without raising the whole building as much, but the ash pit would do (....) though it were not so deep by one foot, but had better be built as drawn & may be filled up if found inconvenient. 7th particular directions about the damper will be given in the particular drawings, in the mean time the boiler seating should be carried up no higher than the level of the fire Gr(*ate*) until the boiler is finished and the engine putting together. 8th the clack wi(*ll*) be fixed on the top of the pump instead of its bottom & will be always eas(*y*) to come at & great part of the water raised by the pump will be discharged laterally, the clack being lifted off, the piston will be easily got at, nevertheless there should be a pump to lay the pump well dry when repairs or cleansing are wanted. 9th The outlet of the water into the Schie

or the continuation of the lander should be made as deep as drawn or proportionally wider otherwise it will cause the water to heap up in the lander. 10th A grate will be very proper in the channel which leads the water to the pump to prevent sticks &c being sucked up, and the Gate being shut when the engine is not at work will prevent the gathering of mud, for it will not deposit while the engine works.— In the part of a front view which you have sent you have drawn a wall plate across the upper part of the opening for the working beam which cannot be permitted because that place will be occupied by the King post of the working beam, therefore the house must be built with two gable ends as originally drawn, but if you chuse, the walls on each side of the opening for the beam need be built in bricks no higher than you have drawn & the remainder may be made up with wood in that end of the house, but you will understand all these matters better when you have the complete drawings, meanwhile it will be best to think of no alterations in the engine part, as it will be creating double labour to all parties.

We are much obliged to you for the steps which you have taken in the affair of the privilege. It seems to me that the requête is more properly presented in the name of the Batavian Society than in that of a private person, as it will give you more weight & serve to shew what you are doing for your country. I shall as soon as I can attend to the specification, in which I will make some alterations from that in the Act of Parliament, as we have some improvements since for which we have separate patents.

I had lately the honour of a visit of M^r Camper formerly professor at Franeker, to whom on account of his excellent character for probity &c I took the opportunity of mentioning what we were about in holland requesting him in case of need to join his interest, to yours which he promised to do but feared we should meet with some opposition from a great man who is a friend of M^r Eckhardts (of the latter he gave the same caution that you do) M^r C^r I fancy is now on his return to Holland, & either belies God Almighty's hand writing in his countenance, or will act a friendly part in the affair. He seems to me to be a person who would do honour to any country, from his knowledge, benevolence & agreeable manners.— My friend M^r Boulton is not yet come home but expected next week, and as I have therefore had no opportunity of consulting him properly, you see I have taken much upon me in going so far upon my own opinion but I hope it will turn out for good to all parties, and he will not fly back from what I have done.— I have learned lately, that the same (*spirit*) which prompted the manufacturers of this town to solicit an Act of Parl^t last session against the exportation of tools, is to be expected in procuring a law against the exportation of Engines, and against any Patentees exercising their businesses in foreign countries; But the scheme seems too wrongheaded to be carried out into execution, and we shall exert ourselves to counteract it, even on the principle of such an act being essentially hurtfull to this country. If such a law should be made it will blow up our scheme, for certainly we should not like to be obnoxious even if we could do the thing with safety. I shall write again in a week or two & if I learn any more I shall inform you. Meanwhile I remain with sincere esteem D^r Sir, Your Obliged serv^t James Watt

The paper I write on is called vellum paper, if you like it shall send you some from London

HvL to JW 1785-12-30

AoS ref. MS 3147/3/505/11. Copy from Hist.Mus.Rdam. Transcript by R. Daalder.

M^r James Watt
Birmingham

Rotterdam 30th December 1785

Dear Sir

About a fortnight ago I was duly favoured with your esteemed answer of 10th Instant, which has so far given us the needfull Illucidations, that we are able to go on now very well, and I should not have been obliged to trouble you again with this letter was it not that our Architect, thinking to receive back his drawing, has not taken the precaution of keeping a copy of the same; which obliges me now to desire you of sending me that drawing by return of post. I shall take care to send you a copy of it, if you have no leisure to have a copy made of it before you return it.

Our request is presented to the States and given over to the considerations of the Committee of New Inventions, and I have this day a letter from the Pensionary of Delvt, with promise to give th'affair all possible dispatch.— It is impossible or M^r Boulton will fully approve all what we have done, and I am persuaded it is impossible to act more candidly as we have done or to taken better steps, to the end that everyone of us may obtain, what he is aiming at, and it has greatly th'approbation of everyone who is made acquainted with it; so as I see Professor Camper has likewise given his approbation of it, that verij able man is already returned through Holland to Friesland; you have done very well to acquaint him with our undertaking, because he deserves certainly every attention; being one of the most ingenious men this Country ever produced. I am not afraid that any opposition from any friend of M^r Eckhard will be made a against our endeavours of obtaining the privilege, of which I hope soon to give you a desired account. Meanwhile I remain very sincerely and making you the compliments of the season am

Dear Sir

Your m^t ob^t h: Serv^t

J:D:Huichelbos van Liender

Priviledge (Dutch) 1786-01-12a

Copied from [Doorman, 1940]. Dutch National Archive ref. 3.01.04.01 fol.1751

The document (like many other documents in the same Volume of States of Holland Resolutions in the National Archive) illustrates an interesting practice. A Request should apparently be worded in such a way that the States need do no more to grant it, than to “interchange” the address at the top and the signatures at the bottom of the Request, add the decision, plus maybe a few very minor changes in the wording. Thus the document is the Request by HvL and Bicker, with notes by Clotterbooke of the Secretariat, plus a note about 18 guilders stamp duty. Two effects of this procedure (apart from being economical) are, that the resolution is not restricted to the decision, but contains all the many (often grovelling) petitioners’ arguments for it, and it makes well-nigh impossible any later objections to the wording.

The Privilege stipulates, that a plan plus description be deposited with the States’ Secretarial Office. HvL and JW discuss this in [1786-03-27; 1786-05-31]; at the end of the latter HvL mentions having received it, so it must have been deposited in the Hague early June; a search in the National Archives has not produced this document. The transcript was made from the copy in the AoS and filed as [1786-05].

HvL and B&W had agreed to enter into a contract, to ensure that the Batavian Society would transfer all the revenues from the Privilege to B&W. This Contract of Cession is [1786-11-08].

HvL is mentioned separately from the Directors: he became a Director three months later.

Octrooi verleend aan de Directeuren van het Bataafsch Genootschap der Proefondervindelijke Wijsbegeerte te Rotterdam tot het opregten van een vuur of stoommachine naar de uitvinding van James Watt.—

12 January 1786.—

De Staaten van Holland & West Friesland
doen te weeten

Alzoo Ons te kennen is gegeven by Directeuren van het Bataevsch genootschap der proevondervindelyke wysbegeerte te Rotterdam, benevens Jan Daniel Huichelbos van Liender lid consultant van het voorsz. genootschap, dat Steven Hogendyk, burger en inwoonder van gem. stad Rotterdam en lid consultant van het reeds genoemde genootschap, nu tien a elf jaaren geleeden, met medewerking van eenige andere personen, zig zeer veel moeyte gegeven en een aanmerkelyke somme uitgeschooten had om te Rotterdam voorsz. een vuur of stoommachine op te rechten, dienende om water op te brengen, even gelyk de gewoone wind watermolens, met oogmerk om door de werking van deze machine een ieder te overtuigen dat dezelve verre te prefereeren ware boven de gewoone wind watermolens, en dus de daarby belang hebbende te engageeren om zich voortaan van zodanige stoommachines te bedienen, dat de oprigting van deze machines egter niet volkomen aan het zo evengemeld oogmerk had beantwoord, ‘t welk in ‘t byzonder moest toegeschreven worden aan derzelve plaatsinge, dewyl deeze plaatsing niet gedoogd dat de put voor de pompen geschikt, uitgegraven wierde, tot die diepte welke er noodzaakelyk vereischt zoude worden om het groot vermogen van dezelve boven de gewoone wind watermolens, met de proeven dus op een ontegenzeggelyke wyze aan te toonen, dat men wel is waar door uitrekeningen dit groote vermogen deezer machine klaar kon betogen edoch dat voor een bewys van dien aart slegts een zeer gering aantal van menschen vatbaar was, en dat voornamelyk zy die het grootste nut van den invoer deezer machines zouden hebben, juist diegeenen zyn welke niet door bewyzen op het papier, maar door de daad moesten overtuigd worden.

Dat voorn. Steeven Hogendyk het een en ander bezeffende, en teffens overtuigd van welk een oneindig nut de invoer van voorsz. machimes zoude weezen, daar dezelve niet slechts door hun onbepaald vermogen, veel meer water opbragten en hetzelfde hooger opvoerden dan de gewoone wind watermolens, maar bovendien (hetgeen een aller uitmuntendts voorrecht was) ook ten allen tyden werken konden, dienvolgens te raade was geworden, on te zynen kosten een nieuwe vuur of stoommachine te doen bouwen en dezelve zodanig te plaatsen dat men de kragt en het vermogen van dezelve kon beproeven tegen een gewoone wind watermolen.

Dat hy Steeven Hogendyk daartoe te eerder was overgegaan, omdat men sedert het opregten van de hier vorengemelde vuur of stoommachine aanmerkelyke verbeteringen omtrent deeze machines in Engeland had uitgevonden en men dus in staat konde zyn de proev te neemen met des te grooter hoop van succes.

Dat hy Steeven Hogendyk, thans reeds bereikt hebbende den ouderdom van agt en tagtig jaaren en nogtans yverig genoeg om alles by te brengen wat tot nut van zyn vaderland konde dienen, zich egter buiten staat bevond om in persoon een werk van dien aart te onderneemen, en dus de uitvoering van dien toevertrouwde en opgedragen had aan de suppl^{ten}, welke zeer gaarne dien last op zich genomen hadden, en zelfs met vermaak, daar zy geen oogenblik twyfelden of het werk zou volkomen beantwoorden aan het edelmoedig

oogmerk van voorn. Steeven Hoogendyk.

Dat de suppl^{ten} dan ook reeds zo verre gevorderd waaren, dat zy in een polder naar by de stad Rotterdam en tot het doelwit volmaakt geschikt, hadden bekoomen een stuk land, en de permissie om op dit land een stoommachine op te richten, en gevolgelyk spoedig met de opbouwing van dezelve zouden kunnen voortgaan, indien zy daarin niet verhinderd wierden door een zwaarigheid welke allen door de gunstige tusschenkomst van Ons konde opgeheven worden. dat de gem. zwaarigheid dat James Watt, wonende te Birmingham in Engeland en uitvinder van de nieuwe en met veel grooter vermogen dan de vorige werkende stoommachines niet goetvond aen de suppl. zodanige machine van zyn uitvindinge te leveren, ten waare hy zeeker was daardoor geen schade te zullen hebben, dewyl hy in zyn vaderland een uitsluitend privilegie had, om geduurende eenige jaaren stoommachines van zyne uitvinding op te rigten, dat voorn. James Watt egter redelyk genoeg was om zig op de deugd en goede trouw van de suppl. te verlaten, en geneegen was om hun het voorsz. stoomwerktuig te bezorgen indien de suppl. van Ons voor zig konden verkrygen een gelyk Octroy en privilegie als hy James Watt in Engeland had geobtineerd, voor een getal van vyftien jaaren. Dat de suppl. om deeze redenen zig in de noodzaakelykheid bevonden om ons te adieeren en eerbiedig te verzoeken dat het ons mogte behagen aan de suppl. (schoon zy daarby geen eigen belang hoegenaamd bedoelden) gunstig te verleenen octroy en een uitsluitend privilegie, om geduurende een aantal van jaaren als wy zouden goetvinden, alleen binnen deeze Provincie vuur of stoommachines te mogen maaken, na de uitvinding van James Watt hier voren genoemd, en daarvan aan de suppl. te doen expedieeren brieven in communi forma.

Zoo is 't dat Wy de zaake en 't verzoek voorsz. overgemerkt hebbende, en na ingenoomen consiederatien en advies van de Heeren Onze Gecommitteerden tot de zaaken van de nieuwe inventiën, geneegen weezende, ter beede van de Suppl. uit Onze regte weetenschap, souveraine magt en autoriteit, de suppl. hebben geoctroyeerd, zo als wy dezelve ocroyeeren by deezen, om, geduurende de tyd van vyftien eerstkomende en agtereen volgende jaaren de voorsz. vuur of stoommachines, naar de uitvinding van James Watt, met seclusie van alle anderen, alleen te mogen maaken of doen maaken, met interdictie aan elk en een iegelyk, om dezelve op eenigerhande wyze na te maaken of elders nagemaakt zynde binnen deze provincie te brengen of te doen inbrengen, alles op een boete van tien duizend guldens by de contraventeurs te verbeuren, mits de suppl. gehouden zullen zyn om, alvorens dit Ons octroy aan hen werde uitgegeven ter Onzer secretary over te leveren en te depositeeren, een nette en accurate afteekening en descriptie van hetzelfde werktuig.

En gelasten wy een ieder die het aangaan zal zich naar deezen te reguleeren.

Gedaan in den Haage onder Onzen grooten zeegele etc. den 12 January 1786.

Geteekend	}	P: Van Bleiswijk
		Naamens de Staaten
		C: Clotterbooke

Priviledge (English) 1786-01-12b

Copy from Hist.Mus.Rdam.

The English translation (by Enslie) of the Privilege (Patent) [1786-01-12], granted by the States of Holland & West Friesland, sent to Watt with [1786-03-10]; see also [1786-03-27; 1786-11-27].

For further notes see preceding Dutch version.

Priviledge Granted to the Directors of the Batavian Society of Experimental Philosophy at Rotterdam to Erect a Fire or Steam Engine according to the Plan of James Watt Esq^r.— 12 January 1786.—

=====
The States of Holland & West Friezeland
hereby give notice

Whereas we are informed by the Directors of the Batavian Society for Experimental Philosophy at Rotterdam, as likewise by Jan Daniel Huichelbos Van Liender consulting Member of Said Society that Steven Hoogendijk Burgher & Inhabitant of the above mentioned City of Rotterdam & consulting Member of the above Society, had with the Joint concurrence of several other Persons Ten or Eleven Years ago, taken a great deal of Trouble & expended a considerable Sum of money, to Erect at Rotterdam aforement^d a Fire or Steam Engine for the Purpose of raising Water in the same manner as the ordinary Wind Water Mills; with a view to convince every one by the Working of this Engine that it is preferable to the ordinary Wind Water Mills & thus to Engage those whom it may concern to make use of such Steam Engines for the future but that the Erection of this Engine had not Perfectly an(s)werd the end abovementioned, which must principally be ascribed to its situation which prevented the wells made for the Pumps from being dug to that depth which was absolutely necessarij to show by Proof & thus incontestably the great Power it Possesses above the ordinary Wind Water Mills.—

that it is indeed true that this great superiority might be demonstrated by calculations; but that a proof of this nature, could be understood by very few People, & that Particularly those who will be the most benefitted by this Engine are the persons who could not be convinced by Proofs upon Paper but only by the fact itself.—

That the aforement^d. Steven Hoogendijk comprehending this & being besides convinced of the great Utility that would result to the Country from the Introduction of these Engines {not only by reason of their unlimited Power in raising Water in a greater quantity & higher than the ordinary Wind Water Mills but of their being also able (which is a very capital advantage) to work at all times} Was inclined to Erect a new Fire or Steam Engine at his own expence & to Place it in such a situation that it's force & powers could be tried against an ordinary Wind Water Mill.—

That the above Steven Hoogendijk had the sooner taken this resolution because since the Erection of the former Engine considerable improvements had been made upon it in England & thus the Experiment might now be made with the greater hope of Success.—

That he Steven Hoogendijk having allready reached the Age of Eighty Eight Years, though zealous enough to contribute everything in his Power to whatever might prove of Utility to his Countrey found himself not in a condition to undertake in Person work of this nature, & therefore Intrusted the Petitioners with the Execution of it, & had delivered it over to them, who had very willingly taken this charge upon themselves; & even with Peculiar pleasure, as they had not the least doubt of the Work fully answering the generous View of the aforementioned Steven Hoogendijk.—

That the Petitioners were allready so far advanced as to have procured a Piece of Ground in a district near the City of Rotterdam, completely adapted to the Said purpose. & liberty to Erect a Steam Engine thereon, & consequently would be able to proceed to the erection of it without loss of time, if they were not prevented by one difficulty, which could alone be removed by our gracious Interposition; that the said difficulty consisted in this, that James Watt Esq^r. living at Birmingham in England & Inventor of the new Steam Engines (which work with much greater power than the former ones) did not think proper to furnish the Petitioners with such an Engine of his invention unless he was certain that he would not be a sufferer in so doing as he in his native Country an exclusive priviledge to be the Sole Erector of the Steam Engines of his Invention for a certain number of years.—

That the said James Watt Esq^r. nevertheless placing full confidence in the honour of the Petitioners was inclined to furnish them with a Steam Engine as abovementioned, if the Petitioners could procure from us a like Patent & Priviledge as he James Watt Esq^r. had procured in England for the term of Fifteen Years.—

That the Petitioners for these reasons found themselves under the Necessity of applying to us & repectfully beseeching us that we would be Pleased to grant them (though they had not therein the least View to their own advantage) a Patent & Exclusive Priviledge to be the Sole Erectors of Fire or Steam Engines according to the

invention of the aforesaid James Watt Esq^r. in this Province alone for such a number of years as we might think proper, & to grant the Petitioners Letters Patent in the usual form for this Purpose.—

Therefore, we having duly weighed this affair, & the aforesaid Request & having consulted with the Gentlemen in our Committee in Affairs relating to new Inventions; & being inclined to Comply with the Request of the Petitioners have by our full Knowledge, sovereign Power, & Authority, granted them the sole Priviledge (as we grant it them by these Presents) to Erect during the Term of Fifteen succeeding Years, Fire or Steam Engines according to the Invention of James Watt Esq^r. & we do hereby exclude all other persons from erecting them, or getting them erected.— & we likewise prohibit the Imitation of them by any person in any manner whatsoever; or in case of their being Imitated in any other Place, we forbid the importation of them in this Province.— all on a Penalty of Ten Thousand Guilders, to be forfeited by all such as shall act contrary to the tenoier (*Ed.note: =tenor*) of this Resolution.— on Condition that the Petitioners shall be bound to furnish & deposit a neat & accurate Plan & description of the above Engine at our Secretary's office, before the delivery of this our Patent.—

We order all Persons whom it may concern to regulate themselves according to this resolution.—

Done in the Hague under our great Seal annexed to this on the twelfth of January in the Year of our Lord & Saviour One Thousand Seven Hundred & Eighty Six

Signed	}	P: Van Bleiswijk
		by Order of the States
		C: Clotterbooke

HvL to JW 1786-01-13a

AoS ref. MS 3147/3/505/12. Docketed as 30 Jan. Copy from Hist.Mus.Rdam. Transcript by R. Daalder.

Dear Sir

The 30th of last month I have wrote you, desiring to return me the drawing made by our Architect here, to which I further refer; these serving principally to acquaint you that I have received this morning a letter from the Pensionarij of Delvt that yesterday afternoon in th'Assembly of their Noble & High Mightin^s our demand for an exclusive privilege in your favour is allowed, and that a penalty of ten thousand guilders is inflicted upon any person or persons who dare to infringe it. The Act of it, dressed in due form, will be delivered us as soon as we are able to given in a drawing and description of th'Invention; so that you will be so kind as to let me have these desiderata as soon as you possibly can that we maij finish this transaction, and give you an acknowledgement that we never intend to make use of this Privilege, as to your advantage onlij, of which you will send me a scheme, how you would like to have it. I wish you heartily Joij with this speedy success; The Pensionary has been so kind as to consult me before upon the principal terms, how I wish to have them stipulated; I beg the favour that now our undertaking may be furthered on your side, that it may be the means of giving you profit in its consequences, and to us glory, which and the real advantage of our Country, is all what we are aiming at. I remain with every regard.

Dear Sir

Your m^t ob: H: Serv^t
J:D:Huichelbos van Liender

Rotterdam 13th January 1786

JW to HvL 1786-02-05

AoS ref. MS 3147/3/85/26.

M^r Van Liender

Birmingham Feb^y 5th 1786

Dear Sir

Your obliging letter (*Ed.Note: probably [1786-01-13a]*) came to hand in my absence at London from whence I returned on Monday last so much indisposed with a cold & a feverish disorder that I have not since been able to do any business not even to write letters. I am now a little better but still extremely languid. I sent you on my going to London the drawing furnished by your Architect & also a copy of it with what I judge to be the necessary alterations. As soon as health permits I will send you the description of the Engine which is wanted to complete the patent & shall take the necessary steps for the forwarding the Engine (*Ed.Note: i.e. engine drawings*), at present I do not feel myself capable of either, but hope I soon will be. In the mean time I wish to know whether the specification should not be regularly drawn upon paper or Parchment & acknowledged by me before a Master in Chancery as is customary here in which case a recitat should be prefixed mentioning the title & date of the patent the stile of which you should furnish by a literal translation in English of similar instruments or deeds in your country. If I am able to get it copied I shall sent such recital as it is used here inclosed in this letter, which will better explain the matter than any thing I can say — with sincere thanks for your good offices I remain Dear Sir

Your obliged friend James Watt

Copy Recital of Specification of a patent for Ireland

Whereas his Most Excellent Majesty King George the Third, by his letters Patent under the great Seal of Ireland, bearing date at Dublin the 28th day of June in the 22^d year of his reign did give and grant to me James Watt my Executors Administrators & assigns, his Especial Licence full power sole privilege & authority that I the said J W my ex^{ts} adm^{ts} & assigns should & lawfully might during the term of years therein after expressed make, use, exercise & vend within his Mag^{ty} Kingdom of Ireland my new invented Steam or Fire Engines Applicable to the raising raising water giving motion to Mills & other mechanical purposes. In which said lttres pat^t is contained a proviso obliging me the said J W. by an instrument in writing under my hand and seal to cause a particular description of such Steam or Fire Engines to be enrolled in his Majesties high court of Chancery in his said kingdom of Ireland within six calendar months next after after (*sic*) the date of the said letters patent as in & by the s^d lttres pat^t relation being therewith (.....) may more fully & at large appear.

Now know ye that in compliance with the said proviso I the s^d J W. do hereby declare that the nature of my s^d invention & the manner in w^{ch} the same is to be performed is particularly described & ascertained in manner & form following, that is to say &c

You see what will be wanted first the proper letter from their high Mightinesses (*Ed.Note: i.e. the States of Holland*), 2^d the title and date of the patent, 3^d the proper form of the recital in English, 4th whether executing the same before 2 witnesses will be sufficient or if must be acknowledged before a master in Chanc^y, 5th whether the writing & drawing must be on parch^t or if paper will do as the latter might be most convenient, & may be in my own handwriting & consequently more authentic.

Excuse the badness of the scrawl which is the best I can make at present

Adieu Yours J.W.

HvL to JW 1786-03-10

AoS ref. MS 3147/3/505/13. Docket: Covering Patent and 13 Mar. Copy from Hist.Mus.Rdam. Transcript by R. Daalder.

The translated Privilege, sent with this letter, has been filed under its own date as [1786-01-12b].

M^r James Watt
at Birmingham

Rotterdam 10th of March 1786

Dear Sir

I was duly favoured with both your agreeable letters of 13th January and 5th last month, and shall now procede to answer them more fully. By the first I received back the desired drawing, and your explanation of it, as likewise a drawing to acquaint us with your meaning, by which I see you prefer the building to be made with two gable ends, instead of the roof ending in one top as we should have preferred, we shall follow your direction in this.— I find that I have had no leisure sufficient to answer great part of your letter of 10th December last, which I shall do now first; by the chain Arch we understand an arch drawn by the form, which an iron link chain of a sufficient length takes, when hung up against a flatt wall or board, and whose ends are opened to that width you wish to have your arch at the bottom. And such a one of seven feet width at bottom we have made in the mean wall of th'Engine house here and it has kept always perfectly well. Such an Arch is certainly the Strongest of all, and will never spur, if well abutted as in a Lever wall it is.— because we make bold to fix the pump immoveable we intend to build up the walls of the pump well of a sufficient height above the Lander to keep the raised water, and fix the floor of the Lander or through very steady in those walls, which will be better as to make a wall or bac of boards.— Undoubtedly there is wanted a good sluice gate at end of the through, to keep out the Schiewaeter, when wanted. The upperside or top of the floor, whereupon the pump will stand, shall be laid 13 feet under the Schiewaeter or Schiepeyl, that is to say the lowest water in the Schie.— I do not conceive what hindrance a wall plate across the upper part of the opening, wherein the working beam is laid, may be, because this wall plate is so far above the working beam, and I do not see, wherefore such great an opening there is wanted. What you understand by the kings post of the working beam, I do not conceive; not remembering to have seen any where any construction above the beam; because we now will go on in a short time to drive the piles and lay the floor and foundation upon them, we wish to know in what manner the Iron cross is to be fixed or made steady upon the wooden cross, and if the wooden ring must be fixed upon the iron cross, and the pump put above ? or if the wooden ring must be fastened around the pump ? and if (as we intend to built the walls of the pump pit up as high as the raised water will require) this wooden ring is wanted in that case ?

According the plan made of the foundation 177 or 180 piles of 45 feet length. and of 12 or 13 inches diameter at the thickest end, will be driven under it with a ram of at least 1000 lb, and a general floor of fir beams covered with fir boards of 4 inches thick, will be laid from one end to another under the whole construction, and another floor in the pump pit of oaken beams, filled up with strong masonry between them, and covered with an oaken floor of 2 inches thick, laid upon the fir floor and fastened well with iron bolts to it, and surrounded at the four sides with damplanks of 16 feet length and 4 inches thick, well swallowtailed together and able to keep out all surrounding water, and so made as all the floors and foundations of our sea and river sluices are laid .

I now proceed to answer your last favour of 5th february, which to mij sensible grief, made me acquainted with your indisposition, which I sincerely hope and flatter myself may at this time be totally removed; I saw with pleasure your intention of sending me the description of the Engine, and that you should take the necessary steps for the forwarding our Engine. And you did wish to know, whether the specification should not be drawn upon parchment, but this is not wanted; neatly written upon a good paper will sufficiently do, nor an acknowledgement before a master in Chancery will be wanted, but your common signature and apposition of your seal, and likewise that of two witnesses will be satisfactory.— For your government I send you herewith a translation of th'original patent which the States have been so kind as to have delivered us, notwithstanding the condition on our side is not yet fulfilled. Our mutual good friend M^r Enslie has been so kind as to translate it for me, which will enable you to put such an introduction before the description as you do think proper, no accepted form for such an instrument being adopted here.— I doubt not or the general stile and contents of this patent will greatly please you. It is absolutely impossible to act more open and candidly, as this whole transaction has been executed.

As the description and drawing or drawings will be to heavy to be send by post you could send them to Rodger Hog Esq^r Banker folks ordinary court S^t Nicolas Lane Lombard Street London, to be forwarded by that gentleman to me because that gentleman having family connections here, has many opportunities of sending such parcells with trusty persons over.

I expect now soon to hear from you and that you enjoy a good health being in th'interim with every consideration.

Dear Sir

Your m^r ob: H^e Servant
J:D:Huichelbos van Liender

JW to HvL 1786-03-27

AoS ref. MS 3147/3/86/4-5. Copy from Hist.Mus.Rdam. Transcript by R. Daalder.

M^r Van Liender

Birmingham Mar: 27th 1786

Dear Sir,

I am duely favoured with your obliging letter of the 10th Covering Translations of the Patent which does M^r Ainslie credit in point of language. I reserve what I have to say more on this head to the latter part of this letter.— What you call a Chain Arch we commonly call by the name of Catenarian Arch, w^{ch} I should have found out if I had not been led astray by your saying it had no lateral thrust or spur, which it certainly has, in common with all arches of what form soever they be, on which head I refer you to Belidors science des Ingenieurs, & indeed to all other books in w^{ch} the principles of arches are treated upon mathematica. That the spur of your former arch has never been sensible is owing to the goodness of your bricks & mortar. However an arch in that place cannot easily be constructed, as the ends of the cylinder beams which rest there would cut it in pieces. But if you have any objection to the iron lintels you may put in place of them solid wooden lintels of oak 8 inches deep & filling all the space from the outside to the inside of the wall, and in some measure to relieve these lintels from the weight of the wall you may build above this place where the course of iron bars is marked, what we call a blind arch, that is simply some bricks disposed in the wall in the form of an arch but filled up solid within, down to the lintels. The form of this arch is not material, as the thrust will be counteracted by the course of bars. In relation to the building up the sides of the lander in bricks, I cannot advise you to it, being fearful it may be cracked and become leaking. Therefore I hope you will acquit me if it sh^d do so. In regard to the wall plate, we have for many years been used to make our working beams with what we call a King post, i.e. an upright piece of wood about 6 or 7 feet high placed on the back of the Beam right above the gud(*geon*) or axis, from the top of wch. post there comes iron diagonal stays to each end of the beam, which serve to keep it from bending, which without making the Beam enormously big we could not otherwise prevent & should never have our arches preserve their form through the whole stroke. (a) is the King post. However if you prefer it I shall send you dimensions of a beam that will do without a king post, but even then it will not be so good.



I approve very much of your proposal in regard to the foundation, to which there can be no objection except the great Expence it will ammount to. The wooden Ring is to be screwed to the Bottom Flanch of the pump by a few screws & armed with iron in those parts where it rests on the iron cross. The use of it is to allow the wall to turn gently by the figure of its inside & to reserve room for a clack if we should find that the best place for it, which I expect will not be the case. The iron cross may be lett into the wooden cross about an inch which with the weight of the pump will be sufficient to make it steady, and the wooden cross may be bolted or pinned down to the floor, and all this may be reserved until you come to fix the pump.

I have now made out the specifications all to the engrossing or writing out, fair, which I intend to do on unstamped parchment, that substance being more durable than paper & fitter to be laid up in a publick office. I have also got the drawing finished on parchment to accompany the writing. Both which have taken much time as I found it necessary to enter farther into the matter than I at first expected. The writing is 18 pages in folio, but I think will be easily comprised on 3 skins of parchment. The time which these things have taken both from me and from our principal draughtsman has obliged me to delay the drawings for your engine, which would otherwise have been finished, but I shall take care to have them done in time, particularly as the late very severe frosts must have delayed your operations. I have not been able yet to think of the proper form of a deed of assignation of the patent to us, which seems difficult, as your patents do not use the words executors, administrators & Assigns, but I suppose nevertheless it is customary to assign them, & shall turn my thought on some proper form.— M^r Boulton is now at London. We have just got our Great Albion Corn Mill to work. I have yet learnt no particulars except that it goes very well. I much obliged to you for your kind concern about my health which is now much better, though I am far from being well nor am capable of much application, w^{ch} considering the quantity of work which we have before us is a disagreeable circumstance, but must be submitted to.

With thanks to the Directors of the Batavian Society & comp^s to M^r Ainslie I remain Dear Sir
Your Obliged Friend, & humble servant
James Watt

JW's patent specification 1786-05

AoS ref. MS 3147/2/26.

The document in the AoS is probably the final draft, the original or fair copy for the States of Holland and West Friezeland may be in the Dutch National Archive, but a fairly thorough search by archivist R. Guleij has failed to locate it. The document is undated, but from related correspondence [1786-05-31; 1786-07-03] it must have been finalized in May, hence the transcript being given the date 1786-05.

The drawings mentioned in the text have not been found in the AoS.

The document is discussed in the correspondence, see e.g. [1786-02-05].

The manuscript has some corrections, in what appears to be JW's hand, so it is probably the final draft of the document. These corrections have been incorporated in the transcript without identifying them. It is also likely that the references to the figures were initially left open, and were filled in at the proof reading stage.

JW planned to have the fair copy for the States written on parchment [1786-03-27].

The Privilege [1786-01-12a+b], for which this specification was made, mentions Watt's patent in England in rather general terms, and Watt exploits this by not only referring to his main Patent, the separate condenser, extended in the 15th year of the reign of George III (= 1775 AD), but also to a host of other devices and inventions, suggesting (but not claiming outright) that these are also within the terms of the Privilege.

To all to whom these Presents shall come, I James Watt of Birmingham in the County of Warwick, engineer **send greeting. Whereas Steven Hoogendyk** of the City of Rotterdam Esquire being desirous of erecting at his own costs and charges, in or near the said City of Rotterdam, A Fire or Steam Engine to be applied to the draining of certain Polders or Meadows in order that the effects of the same might be compared with the Wind Watermills commonly used for that Purpose, having no other View in the said erection, than the benefit and advantage of his Country. And on account of his great Age having committed the care of seeing the same properly executed to the Directors of the **Batavian Society of Experimental Philosophy** at the City of Rotterdam aforesaid, in conjunction with **Jan Daniel Huichelbos van Liender**, Esquire consulting member of the said Society;

And whereas the said Gentlemen having confidence in the superior powers of the new **Fire or Steam Engines** by me invented did, through the said Jan Daniel Huichelbos van Liender apply to me, the said James Watt in conjunction with **Mathew Boulton** of **Soho**, in the County of Stafford Engineer (who by virtue of an agreement with me is interested in the said invention, and in the business of constructing the said new Fire or Steam Engines, which we carry on in Partnership under the **Firm of Boulton and Watt**) requesting our advice and assistance in furnishing proper plans and drawings, in procuring proper materials, and otherwise furthering the said Work.— We upon our part highly approved of the Generous and Patriotic design of the said Steven Hoogendyk and were inclined to further the same; Yet as by an Act of the **Parliament of Great Britain** made and passed in the Fifteenth Year of the Reign of his present **Majesty King George the third**, the sole privilege of constructing and vending the said Engines, throughout the British Dominions was vested in me the said James Watt and my Executors Administrators and Assigns for the term of Twenty Five Years from the time of passing the said Act; As the demand for these Engines in this Country is very considerable and increasing and as we having no exclusive Privelege in the Province of **Holland and West Friezeland** could not hinder other People imitating any Engine which we might erect in that Province and thereby we might eventually receive no reward for our Labour and Experience. We therefore considered that, consistently with a reasonable degree of attention to our own interest, we could not comply with the request of the said Gentlemen unless they could procure an exclusive Privelege which should secure to us the said James Watt and Mathew Boulton the benefits which might fairly accrue to us from the introduction of these new Steam Engines into use in the said Province, Where we are persuaded they will prove of Great Publick Utility.— And whereas the said directors of the Batavian Society and the said Jan Daniel Huichelbos van Liender, being convinced of the propriety of our reasoning, in consequence thereof did by their Petition most respectfully beseech the **Noble, Great and Mighty Lords the States of Holland and West Friezeland**, that they would be pleased to grant unto the said Petitioners (alho they had not therein the least view to their own private Advantage, but proposing the same to be used only for the Benefit and Advantage of us the said James Watt and Mathew Boulton and our legal representatives) a Patent and exclusive Privelege to be the sole Erectors of Steam or Fire Engines according to the invention of me the said James Watt in the said Province of Holland and West Friezeland, And whereas the aforesaid **Noble, Great and Mighty Lords** having been most graciously pleased to grant unto the said Petitioners their **Letters Patent** in the usual form bearing date at the Hague the Twelvth day of January in the Year of our **Lord and Saviour** One thousand and Seven hundred and Eighty Six, granting to the said Petitioners the sole priverlege of erecting the said Engines in the said Province for the term of fifteen Years next to come, and enjoining the said Petitioners to furnish a neat and accurate Plan and Description of the said

Engines to be deposited in their Secretarys Office; In Order therefore to enable the said Petitioners to comply with the aforesaid injunction, I have (with the advice and consent of my aforesaid Partner) drawn up, in the English Language the following description of my said new invented Steam Engines and have accompanied the same with drawings of several applications of the Principles on which they proceed, and I request that the said Jan Daniel Huichelbos van Liender will procure the same to be translated into the Dutch Language if need be, and for greater authenticity to deposit this Original along with the Copy in the proper Office.—

Now know ye that my said New invented Steam or Fire Engines are described in Manner following.

First — The principal part of the said new Steam Engines is a Vessel called the Steam Vessel wherein the powers of Steam are exerted to work the Engine This Vessel is commonly called the Cylinder both in these new Engines & in the Engines of Newcomens construction, but in the latter it differs in several particulars from those I use. I generally make it of a Cylindrical form; but also occasionally make it in the form of a hollow parallelepipedon, a Prism of any number of Sides or otherwise, so that it (the Steam Vessel) shall be of one uniform or regular dimension or diameter from one end to the other, which is absolutely necessary, in order that the Piston may everywhere fit it exactly. The said Steam Vessel is, excepting some proper apperture or appertures for admitting and letting out the Steam, permanently shut at one end by a plate of metal or other material, which, whether placed at the upper or lower end of the Steam Vessel, I denominate the bottom of the said Steam Vessel, because in its common situation it is fix'd upon the lower end of the said Cylinder or Steam Vessel; and when I work the said Engines by the elastic force of steam in place of the atmosphere, I also shut the other end of the said Steam Vessel, with a Lid or Cover which may be taken off at pleasure & in which there is a hole or holes through which the Piston Rod or Rods slide, in such a manner as to permit no steam to issue nor air to enter and I admit the Steam to enter above the Piston through a pipe in the side of the Steam Vessel.—

Secondly. Within the said Steam Vessel I place a Diaphragm or Piston capable of moving or sliding easily from one end of the Steam Vessel to the other, although at the same time it will not permit either Steam or Air to pass by it; And in order the more perfectly to make the said Piston capable of sliding easily, and to keep it tight, I surround its circumference with a collar of Hemp, Flax, or any other proper substance well beat together in its place which from time to time I soak with Tallow, Oil, Wax or Grease of any kind, which substances I use in place of Water (which latter fluid only is employed to keep the Pistons of the common Steam or Fire Engines Air and Steam tight). This Piston has a Rod or Rods fixed to it, by means of which it acts upon, or pulls up or down one end of the Working Beam of the Engine; or by other Means pulls up the Columns of water to be raised, or acts upon such other Machinery as the Engine may be required to work. When the Engine is at work I keep the Steam Vessels and their Covers or Lids, and Bottoms, or as much of them as possible as nearly as may be of the same degree of Heat with the Steam which works the Engines; This I perform by surrounding them with a Case containing Steam or other hot matter and by enclosing them in a Case or Cases of such Substances as transmit heat slowly such as Wool, Hair, Wood or the like.

Thirdly. In most cases I employ the Elastic power of the Steam to act upon the Piston and to force it upwards or downwards, in place of the Weight of the Atmosphere (which latter alone has been and is still employed for that purpose in common Steam Engines); But in some cases I employ the weight of the Atmosphere to act upon the Piston in place of the Steam.—

Fourthly. In order that the elastic force of the Steam or the weight of the Atmosphere may exert their Power upon the Pistons, it is necessary that there should be a Vacuum or Space exhausted of Air and Steam or other vapour on the reverse side of the Piston, or in the opposite end of the Steam Vessel to that which contains the Steam or Air. To produce this Vacuum at commencing the Motion of the Engine I admit Steam into the part of the Steam Vessel where the Vacuum is required to be produced and thereby expel the Air and other Fluids by blowing them out at a valve in or nearly in the same manner as is done in common Steam Engines; I then open a Passage from the Steam Vessel into another Vessel previously exhausted of Air and other Fluids, and kept always as cold when at work as can conveniently be done, which Vessel I call a Condenser; The Steam rushes into this Vessel by its elastic expansion, and is there immediately condensed, or reduced to water by coming into contact with a Jet or Stream of cold Water, or by being brought into Contact with sufficiently large surfaces or quantities of other cold Bodies. In common Steam Engines this operation of condensation is now, and has always been performed, by injecting cold Water into that part of the Steam Vessel itself, wherein the Steam is employed to counteract the Weight of the Atmosphere, and to facilitate the ascent of the Piston: And the Steam Vessel of the common Steam Engines being cooled by the said injection, destroys much Steam the next time it is required to be filled with it. This I avoid by condensing it in a separate Vessel or Place. When the

Vacuum is thus produced or effected, in the Engines of my invention, the elastic force of the Steam or the weight of the Air in the upper part of the Steam Vessel (or on the reverse side of the Piston to that where the Vacuum is) presses the Piston into the Vacuum, and thereby overcomes the weight of the Water to be raised, or the resistance of the other Machinery to be wrought by the Engine; and in order to restore the equilibrium, and to facilitate the Ascent of the Piston, I admit Steam again into the lower or Vacuum part of the Steam Vessel, and proceed as has been before recited. In some cases I never admit Steam into the lower end of the Steam Vessel except to be condensed, but in order to facilitate the Ascent of the Piston, after the Steam has pressed the Piston to the bottom of the Steam Vessel, or to the end of its Stroke, I let the said steam run off into the Condenser or into the lower end of the Steam Vessel, where I condense it with cold Water or other cold Bodies in the same manner as in the Condenser, taking care to prevent the Piston or sides of the Steam Vessel from being wetted or cooled by the said injection or cold matter, and thus the part of the Steam Vessel which is above the Piston being exhausted of Steam as well and equally with that part of the Steam Vessel which is below the Piston, or in other words, there being an equal degree of Vacuum above and below the Piston, The said Piston can be pulled upwards by any power which is greater than its own weight and friction. And in this case the cold produced by the injection is not so prejudicial as in the common Steam Engine, because the injection water does not touch the Piston or sides of the Steam Vessel, and the Steam does not enter the cold Part of the Steam Vessel of this species of the new Engine, until it has exerted its powers in working the said Engine, and is required to be condensed, And no cold water or other cold matter is suffered to enter that part of the Steam Vessel wherein the Steam exerts its powers.—

Fifthly. As quantities of Air and other uncondensable fluids enter the Cylinder and Condensers along with the Steam and with the injection Water, and also by other means, and as such fluids would accumulate and impede the working of the Engine, I extract or draw them, together with the injection water & condensed Steam, out of the said Engine, or out of the Condensers by means of Pumps wrought by the Engines themselves or otherwise, or I extract the said fluids from the Steam Vessels or Condensers by other mechanical means.—

Sixthly. In some cases I place the Steam Vessels erect, and the Piston Rods go through holes in their Covers or Lids, and the upper ends of the said Rods are attached or suspended by Chains or otherwise to one end of a strong Lever which is supported by & moveable upon and Axis or Gudgeon fixed near its middle or in some proper part of its length, or the said Rods are suspended or attached to, or otherwise connected with a Wheel or Wheels, moveable upon its or their Axis, centre or Gudgeon and to the other or opposite ends of the said Levers or opposite sides of the same Wheels the Pump Rods or other machinery to be wrought by the said Engines are suspended or attached or otherwise connected, and the said Levers, Wheels or combinations of Levers and Wheels are denominated Working Beams, and are so constructed that when the Pistons of the Engines descend, the Pump Rods are pulled upwards by the contrary Motions of the opposite ends of the Levers or sides of the Wheels.— In other cases I place the Cylinders inverted, so that the Piston Rods go downwards, and thereby can act immediately upon the Pump Rods or other Machinery, without the intervention of Levers or Wheels, and in other cases I lay the said Cylinders horizontally or inclined as the case may require but the two latter methods can seldom be used to advantage.—

Seventhly. Where great powers are required, I make a Vacuum in the Steam Vessel above & below the Piston alternately, and by employing the Steam to act in that end of the Steam Vessel which is not exhausted, I cause the Piston to act equally powerfully in its ascent & in its descent, so that the action upon the Pumpwork or other Machinery is not interrupted during the ascent of the said Piston, whereby I obtain a double power, which in many cases is very useful.—

Eighthly. Where continued Rotative or Circular motions are required, the Steam Vessels may be made in the form of hollow Cylinders, or in the form of other regular hollow bodies, having in the center or axis of such Vessels a Shaft or Axle extending through one or both their ends, and the ends of these Vessels must be shut or closed with smooth Plates which have proper apertures for the axle to pass through. Within the said Steam Vessel there must be fixed to the said Axle a Piston, Plate or diaphragm, extending from the Axle to the circular circumference of the Steam Vessel, and from one end of the Steam Vessel to the other. The said Piston must be made Steam tight by surrounding the parts which fit to the circumference & ends of the Steam Vessel with Hemp or other soft Substances soaked in Grease, Oil or Wax, or by means of Springs made of Steel or other elastic or pliable Materials. And to the circumference of the Steam Vessel I fix one or more Valves which occasionally shut or close the Space between the axle and the circumference, and which open either by turning upon a hinge, or by a sliding Motion like a drawer, so that they may open, draw back, or be removed when the Piston comes to them and thereby suffer it to pass by the place where they were, and so begin a fresh Revolution in the same direction. Or I make one or more Divisions or Septa fixed to the circumference of the Steam Vessel and extending to the Axle, and I fix one or more Valves to the Axle, which are capable of folding down and applying themselves to the Axle and of forming a part or parts of its circumference, so that they can thereby pass by the fixed divisions or Septa, and when they have passed such divisions they are raised up again by springs or otherwise so as to perform the Office of a Piston or Pistons. On each side of the said fixed divisions or Valves there must be made proper Channels Apertures or Pipes for receiving and discharging the

Steam, and proper Condensers and Air Pumps must also be fitted to the same.

These modes of applying the principles are exemplified in Fig 5 — & Fig 6 of the annexed drawings, where in both **A.A.** represents the circumference of the Steam Vessels **B.** in Fig. 5. the Valve and **C.** the Piston. In Fig 6 **C.C.** the valves which perform the office of Pistons & **D.D.** the fixed Septa or divisions; and in both **E.** the passages to admit the Steam and **F.F.** the passages which convey it to the condenser and **G.G.** the Axles.

Ninthly. In other cases the Steam Vessels may be made in the form of hollow Rings or circular Channels, mounted on horizontal axles like the Wheels of a Water Mill see the annexed drawing Fig. 7 within which Channels are placed a number of valves that suffer any body to go through the Channel in one direction only, In these Steam Vessels are placed Weights solid or fluid, so fitted to them, as entirely to fill up a part or portion of their channels, yet capable of moving freely in them. When the Steam is admitted in these Engines between these Weights and the Valves it acts equally on both so as to raise the weight to one side of the Wheel and by its reaction on the Valves successively to give a circular Motion to the Wheel. The Valves opening in the direction in which they are pressed by the weight, but not in the contrary one; As the Steam Vessel turns round it is supplied with Steam from the Boiler through the Axis of the said Wheel, and through Pipes leading from thence to the circumference or hollow Channel, and the Steam which has performed its Office is let off in like Manner into Condensers or into the open Air.

These Methods of producing circular or rotative motions I have practised, and have therefore thought it proper to describe them as being of my invention, and I could in like manner add many More, but as they only consist in different modes of applying the same principles, the varieties of which are infinite, and the methods of producing circular Motions from reciprocating Engines which I am about to describe answer much better in practice, than any of those wherein the circular motion is obtained from the immediate action of the Steam I forbear to enlarge any further on this head.—

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tenthly

Tenth. I produce continued rotative or Circular Motions by annexing to any Steam Engine, whether made according to Newcomens or the common construction, or according to these my new invented Constructions, or according to any other Construction, by which a Piston or any other solid body is made to move up and down or to and fro by the Action of the Engine, Certain Mechanical Contrivances which give a Circular or Rotative Motion to Wheels or other things. As these mechanical Contrivances admit of great Variety I shall describe only such of them as I have found the most useful.

1. I produce the said circular Motion from any vibrating or reciprocating Steam Engine by suspending from, or attaching to the Piston Rod or Working Beam or other moving part of the said Engine, a Rod or Spear, which connects the said Piston Rod or Working Beam (or great Lever) with a bended Lever or Crank fixed upon the end of a Shaft or Axle (or with a Pin fixed in any part of a face or side of a Wheel or otherwise shaped body fixed upon the end of the said Axle or Shaft) see the drawing Fig 8. When the Engine commences its stroke the said pin **A.** is a little on one side the straight line **B.G.** which passes through the Centre **C.** of the Wheel or Axle to the place **B.** where the connecting Rod **D.** is joined or attached to the Piston Rod or Working Beam so that when the Action of the Engine draws the said Pin (**A.**) towards the point **B.** as the pin can move in no other than a circular line because of its connection with the Axle or Shaft, it causes the Crank or Wheel to which it is fixed to revolve on the said Axis or Centre untill the said Pin has made half a revolution and the Engine has completed its stroke in one direction, and the circular motion of the said Wheel or Crank (**A.C.**) is continued during the return of the Engine by the descent of a weight fixed to the said Wheel or Crank (**A.C.**) or to some other Wheel fixed on the same shaft or placed on the working beam (at the end **B.**) or by the weight of the connecting Rod itself, or if the Engine be a double one of that kind which act both in the ascent and descent of the Piston, the motion is continued by the returning force of the Engine.

2. I produce continued circular motions by employing a reciprocating Steam Engine to pull upwards or press downwards by means of a Connecting Rod or otherwise a circular, or otherwise shaped Wheel **B.** see drawing Fig 3. furnished with Teeth of its external or internal Circumference which Wheel **B.** is fixed to or upon the connecting Rod **Z.** so that the wheel cannot turn round or revolve on its own Centre or Axis, and the teeth of Wheel **B.** are engaged or locked into the teeth formed on the external or internal Circumference of another Wheel **A.** which is fixed on the end of a Shaft or Axis, and the Wheel **B.** which is fixed to the connecting Rod is confined by a link or Strap of Metal reaching from its Axis to the Axis of the Wheel **A.** or is otherwise so constructed that the Wheel **B.** cannot recede from the Wheel **A.** but that the teeth shall always continue engaged in one another, And as the Wheel **B.** cannot turn upon its own Axis or Centre, when it is pulled upwards or downwards by the Engine it revolves in a circular manner round the other Wheel **A.** and by the action of the teeth causes the Wheel **A.** to revolve on its Axis, and the Motion is continued during the return of the Engine by a Weight placed upon the working beam at **Y.**, or by the Weight of the connecting Rod itself, or by the returning Power of the Engine if a double one; And from the Nature of this Method when the Wheels **A** & **B** act upon the external circumferences of each other, and have equal numbers of teeth, the Wheel **A.**— which is fixed upon the Axis makes two Revolutions for each Stroke of the Engine

3rd I Produce continued circular Motions by causing a reciprocating Steam Engine to pull or press a

friction Wheel or Wheels against the sloping section of a Cylinder cut obliquely to its Axis or against the side of a Wheel fixed obliquely upon its Axis see drawing Fig 9. or by causing the said Engine to pull, push or press a friction Wheel or Wheels against the external or internal Circumference of a Wheel or Wheels fixed upon an Axis or Axles which do not pass through the Centers of the said Wheels see drawing Fig 10. which contrivances operate nearly in the manner that has been described.

In order to equalize and regulate more effectually any or all of these Rotative Motions, I fix to or upon the primary Rotative Axle or upon some other Axle connected therewith a heavy Wheel or Fly (see Fig 3. lett^r. C Fig 8. lett^r. F & Fig 10. lett^r. K.) of as large a diameter or size as may be convenient which receives and gives back the Momentum, Power or Velocity communicated by the Engine, at such times respectively as may be necessary, and renders the Motion nearly uniform. I have delineated all these rotative Motions, according to the scales of feet marked upon the several drawings in parts of English inches, but I make them larger or smaller, and vary the proportion, Shape and Position of the several Parts as their uses may Require.—

Eleventh In some cases I cause the Piston Rods, the Pump Rods and other reciprocating Parts of these Engines to move up and down or to and fro in Perpendicular or other Straight lines, by means of Arches and Chains as is practised in the Common Fire or Steam Engines, but in cases wherein the Working Beams or other parts of the Engines are wanted to be acted upon by pushing as well as by pulling, or both in the ascent and descent of the Pistons, I perform the same on different principles. First by forming the Arch head of the Working beam into a toothed sector of a circle, and fixing a toothed right lined Rack to the top of the Piston Rod, the teeth of which being engaged in those of the Sector on the beam act upon and give motion to it. The second Principle upon which I derive a perpendicular or straight lined Motion from an Angular or Circular one consists in forming certain combinations of Levers moving upon Centers, wherein the deviation from right lines in the moving end of some of these levers is compensated by similar deviations, but in opposite directions of one end of other levers; This principle admits of much Variety in its Application. I shall exemplify two of the best Methods Fig 3^d. (s.t.u.v.x) represents one of these Methods X. is one end of the working beam W. the Wall or Support on which it rests U.V. the spring beams. s.r.t a Lever or bar of Iron called the regulating Radius moveable about the center or Axis s. (which is fixed to the spring beam) and also about the Axis or Center t. which is connected with, or is a part of the bar or Rod tu. called the parallel bar, which bar (tu.) is capable of moving a few inches endways towards or from the center or Axis of the working beam by a small portion of a circular Motion of the lower ends of the coupling bars or Links Xu. & vt. by which it is suspended from or connected with the working beam. (It is to be noted that there is a similar parallel bar, Link and regulating Radius on the other side of the Beam) The Piston Rod or other part which is to receive the perpendicular Motion is fastened by the Joint pin or Axis u. to the link Xu. which connects it with the working beam. The same Joint Pin also connects the end of the Piston Rod with the parallel bars. Now as the joints or Centers X. & v. of the links Xu & vt. describe portions of Circles round the center of the Working beam; and the end of the regulating Radius describes a portion of a Circle round the Axis or center s. the convexities of these circles lying in opposite directions mutually tend to correct the deviations from a right line and produce a perpendicular Motion in the end u. of the parallel bars which is connected with the top of the Piston Rod. A second method of putting this principle in practise is delineated in Fig 11. AA. is the working beam of the Engine B.C. the Piston Rod or pump Rod D.E. one of two bars of Iron or Wood connected by joints at D. & B. with the working beam A & with the top of the Piston Rod respectively, and at E. by a joint to an angling bar or regulatory Radius E F. the other end of which is connected with the Wall of the House or some other form of support by a joint at F. on which as a center the Radius E F. is moveable. When the working beam is put in Motion the joint D. describes the Arc G D H. and the joint E. describes the Arc I E K. on the center F. and the convexities of these two Arcs being in opposite directions compensate for each others Variations from straight line so that the joint B. at the top of the Piston Rod which lies between these convexities ascends in a perpendicular or straight line. Both these methods of producing a straight or perpendicular Motion from a circular one are laid down in their true proportions for Cylinders whose Diameters are twenty inches, and the length of whose stroke is four feet, for other sizes the dimensions are easily found by Geometry.—

The third principle on which I derive a perpendicular Motion from an angular or circular Motion is delineated in Fig 12. and consists in guiding the top of the Piston Rod or pump Rod perpendicularly by means of a piece of Wood or Iron A. sliding in a groove made in an upright B. firmly fixed to some part of the Machine so as to be higher than the working beam C.C. and in the direction of the required Motion; and by connecting the end of the working beam with the top of the piston Rod or pump Rod A D. or with the sliding piece A by means of a bar or bars of Iron A E. having joints at each end.

The pricked lines shew the quantity of Angular Motion of the working beam.

Twelfth - In place of the sliding Valves, regulators or Cocks used in the common Steam Engines to admit or shut out the Steam, I use circular or other shaped Valves whose edges are made in the form of a short frustrum of a cone, sphere, pyramid or other tapering figure, which are accurately fitted onto apertures of the same figures so as to be Steam and Air tight and are pulled upwards or downwards when wanted to be opened, which is effected by means of Spindles passing through the sides of the Boxes containing the regulators, having

levers on the inside which act upon the Stems of the Valves either by means of toothed Racks and Sectors, or simple joints, and to the same Spindles are fixed on the outside of the regulator boxes or Nozzles certain levers which are acted upon by machinery wrought by the Engines and similar to that used in the common Steam Engines for the same Purpose.

One of these regulator boxes with two Valves one opening upwards and the other downwards is represented in Fig 13. in which **A.** is the pipe or opening which admits the Steam from the boiler, **B.** the passage into the Cylinder, **D.** the Spindle, **E.** the inside lever or toothed sector. **F.** the Rack on the stem of the Valve. **G.** The Valve which opens upwards. **H.** a Valve that opens downwards which is kept shut when wanted by a Catch on the outside and forced open by the pressure of the Steam when this Catch is disengaged. **I.** The pipe which conveys the Steam to the Condenser.—

Thirteenth - To supply the Engines with Steam I employ either Round Boilers, such as have been commonly used for other Steam Engines, or Boilers in the form of an Oblong Square Chest, with a semicylindric cover or top, with a tube or tubes of a square or cylindric form passing through them in their longest directions. In these Boilers the Fire is made near one end of them, the flame passes along under the Boiler to the other end, where it ascends and then passes horizontally through the Tube, which is surrounded with water upon all sides. It is then conveyed in a flue quite round the outside of the Boiler, to the Chimney which is placed near one end of the Boiler—

In order for the more perfectly understanding what I have herein set forth relating to the reciprocating Steam Engines of my invention I have delineated what I call a single Engine (which works by the force of the Steam, only in the descent of the Piston) in Fig 1 & 2. and a double Engine (which is acted upon by the force of Steam both in the ascent and descent of the Piston) in Fig 3.& 4. The single Engine is represented as applied to the working a Pump, and the double Engine as applied to the turning a Wheel by means of the Rotative Motion Article tenth, method second ————— In the single Engine the method of working is as follows—(see Figs 1 & 2^d..

The Condenser **k.** being previously exhausted of Air, Water, and Steam, the Piston **b.** being at the top of the Cylinder. the Regulator or valve at **C** being shut, and the regulators or valves at **d.** & **e.** being opened, the Steam issues out of the Cylinder by the regulator Valve **e.** and passes into the condensing Vessel **1k.** where it meets the jet of the injection which condenses it (the steam) into Water and leaves the Cylinder exhausted. A Vacuum being thus produced under the Piston, the Steam from the Boiler enters by the pipe **f.** and the regulating valve **d** and presses on the Piston by its elasticity (which ought to be always something greater than the pressure of the atmosphere) The Piston then descends by the Action of the Steam untill it arrives at the bottom of the Cylinder, at which time the Machinery for that purpose, shuts the Valves or regulators **d** and **e.** and opens the Valve **c.** which admits the Steam contained in the upper part of the Cylinder to pass into the lower part of the same, and restores the equilibrium, whereby the weights at the outer end of the working beam are enabled to raise the Piston to its first position: When the Piston descends it pulls down that end of the working beam to which it is attached or suspended, and consequently raises the opposite end to which the Pump Rods are attached, and thereby works them, and raises the Water. When the equilibrium is restored the weights at the outer end of the working beam raise up the Piston of the Cylinder, and the buckett or Piston of the Air pump **g.** is also pulled up which discharges the Air and Water from the Condenser. The Machinery again shuts the Valve **c** and opens the Valves **d.** and **e** and the piston descends as before.

In the double Engines (see Fig. 3^d & 4.) the Valves **b** and **c** being open and the Valves **d.** and **e.** shut, the Steam rushes out of the lower part of the Cylinder by the Valve **c.** into the Condenser **1** where it is destroyed, and the Steam from the Boiler entering by the Valve **b** presses upon the Piston 'till it reaches the end of its Stroke, when the Machinery shuts the Valves **b.** and **c.** and opens the Valves **d.** and **e.** the Steam then rushes out of the upper part of the Cylinder through the Valve **d.** and passes by the pipe **f.** into the Condenser and leaves that end of the Cylinder empty, the Steam from the Boiler coming by the Pipe **g.** passes through the top regulator box **h.** (Fig 4.) down the pipe **i.** and enters through the Valve at **e.** under the Piston and presses it upwards to the top of the Cylinder, and the same operation is repeated as before.

When the Piston descends, the piston Rod **k.** by means of the Machinery at its top pulls down the end (**X**) of the Working beam, which causes the opposite end to rise and pull up the Planet Wheel **B.** which is attached to the connecting Rod **Z.** and causes the Sun Wheel **A.** and the fly **C.** to make one Revolution, and when the Piston of the Cylinder ascends it presses down the connecting Rod and the Planet Wheel and causes the Sun Wheel &c to make another Revolution.

I also apply these double Engines to work Pumps, by constructing them in such Manner that one Sett can be wrought by the ascent and the other by the descent of the Piston.—

Fourteenth — I make the Piston Rods of reciprocating Engines exactly cylindrical and in order to fasten the Pistons to them, I form the lower end of the Rod into the frustum of Cone from the Vertex or narrow end of which the Cylindrical part proceeds, and a hole being made in the Piston corresponding to this Cone, the Piston rests upon it by its weight see Fig 14. and in order to keep down the packing of the Piston I screw down upon it a Ring or segments of a Ring of Wood, Iron or other Metal **a.a.** Fig 14. which answers much better than

the old method of keeping it down by weights.

Lastly — I have specified the essential points and principles wherein my improved Steam Engines differ from those of Newcomens construction, which principles are all of my invention and application, and I hope will be clearly understood from these descriptions and drawings, but as I have necessarily been obliged to be somewhat diffuse in the general descriptions It may be necessary to bring into a more collected view the principal and distinguishing Characteristics of my said New Invented Steam or Fire Engines which are as follows

1st The Steam Vessel or Cylinder of the said Engines is during the time of working always kept at least as hot as the Steam which works the Engine, or as nearly so as possible—

2nd The Steam is not condensed (as usual) by a Stream or injection of Cold Water within that part of the Steam Vessel, wherein it exerts its Powers to work the Engine, But is condensed by Cold Water or other cold bodies either in a separate Vessel called a Condenser, or in some part of the Steam Vessel (separated from that part where it exerts its powers) and which part of the Steam Vessel it never enters, but in order to be condensed.

3rd — I extract the condensed Steam, Air, and other fluids from the Cylinder or Condenser by means of Pumps.—

4th The Piston (or moveable diaphragm) is acted upon by the elastic powers of Steam in place of the weight of the atmosphere which latter was used as the acting power in Newcomens Engines.—

5th The Piston is made and maintained Steam or Air tight by using Oil, Grease or Wax in place of Water to lubricate the said Piston.—

6th Certain Species of these Engines are made to act forcibly both in the ascent and descent of the Piston by employing the Steam to act and making a Vacuum alternately above & below the upper and under surfaces of the said Pistons respectively that is to say in each end of the Cylinders alternately

7th Other Species of these Engines produce continued Rotative or Circular Motions by the Action of Steam against Valves and against Weights placed within their Steam Vessels.—

8th Other Species of these Engines are made in the form of hollow Cylinders or other round hollow bodies or Segments of such hollow bodies having Axles passing through them, to which Axles Pistons or diaphragms are fixed, which by the power of Steam are made to revolve through greater or lesser Segments of a Circle or through the whole Circle, in which latter case they produce continued Rotative Motions.—

9th By the Application of various Machinery, I cause reciprocating or vibrating Steam Engines of any sort to produce Rotative Motions either continued in one direction, or interrupted, and thereby give Motion to Mills.

10th Instead of Chains I use other mechanical Contrivances to connect together the Piston and Working Beam; or Working Beam and pump Rods of Steam Engines, and to cause these and other parts of the said Engines to move in perpendicular or other right lined Motions.—

11th I use flat regulating Valves whose edges are of a pyramidal, conical, spherical or other form which are lifted upwards or pulled downwards to admit and keep out the Steam in place of the sliding Regulators or Cocks formerly used for that purpose (see Fig 8—

12th I make the Piston Rods of the Engines Cylindrical swelling out into a Cone at bottom, which fitting into a similar hole in the piston serves to support & fasten it

HvL to JW 1786-05-31

AoS ref. MS 3147/3/505/14. Copy from Hist.Mus.Rdam. Transcript by R. Daalder.

The fair copy of the specification (on parchment) and the accompanying beam drawing have not been traced; the final draft (found in the AoS) has been transcribed.

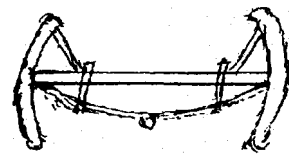
HvL proposes to have a downward beam stiffening post (i.e. what in English became known as a queen post), JW favours an upward (king) post; modern structural thinking would also favour the king post for this type of loading, as its stays are in tension, thus avoiding buckling loading. Whether this would be an explicit consideration for JW, is not known.

M^r James Watt
at Birmingham

Rotterdam 31 May 1786

Dear Sir!

I have differd (*Ed.Note:deferred*) to answer your very agreeable favour of 27th March last, hoping to receive soon another letter from you with further advice about the drawing and explanation, intended to be deposited in the charterroom of their Noble & High Mighth: But being till now deprived of it, and having an opportunity of sending you a letter by a good friend of mine, M^r Alexander Strachan of this place, I have resolved to give a reply to your abovementioned letter. In what you have stated about the different kind of arches, you are very right, my mistake was not so much in my conception upon that head, as in my method of exposing my idea to you; about is, my real meaning was that the lateral trust of a Catenarian Arch was the best pressing of any kind of Arches, which certainly you will approve; an arch in that place may easily be constructed, in case we lay the cylinder beams across the house, as we have done here in our former Engine, in lieu of laying them over the length of the house as you propose, for which I see no reason, and even one end of the Cylinder beams in said engine house are layin above a pretty wide circular arch, without we having experienced the least inconvenience of it; you will be so kind Sir as to consider if it will be convenient to alter so far that part of your plan, for laying the Cylinder beams across the house. In which case there would be no objection to making an arched door or opening in the front or mean (*Ed.Note:main?*) wall of the house; and If not, we should prefer the wooden lintels, in the manner you have proposed in your letter above the iron ones; by reconsidering this matter and reëxamining the different drawings you have send (after the above was written) I see no absolute necessity to have a door in the front wall of the house, because there will be a door in both the side walls, by which we maïj go out and enter the Engine house well enough at that part. and then there will be only wanting two windows in that part of the front wall, to look out, who coming lower than th' opening of a door, and being narrower, may be arched over, and will do no harm, and in that case the Cylinder beams may be laid lengthwaij of the house, as you have planned them. We understand here very well what you mean by a blind arch and make use of them many times; we have no fear at all that the building up the walls of the Lander will occasion any inconvenience or that it will become leakij therebij; we take the risque of that for our account. I understand now very well by your explanation what you did mean by a kingpost, and we had nearly guessed it, but having seen so manij engines in England and Scotland, and never any one with such a king post, I do conclude it must be a particular contrivance of you, since but a few years. Because your pretty standard engine at Soho Birmingham has it not, nor that at Dudleij, neither that of M^r Wilkenson at New Whilly, at least they had it not in 1776, when I have seen them; we cannot but approve this improvement, only we are of opinion that in case it could be so contrived, that the kingpost was brought under the beam downwards, in lieu of upwards, it would answer your end still more effectually, because the pressure at the end of the arches of the great beam tends always downwards; In the construction of the former Engine here, we have at that time taken particular attention in the contrivance of the great Leaver, and we think to have hit upon a very good method for making it verij strong, without using very heavij pieces of wood, and in the same time bring its center of motion as near as possible its center of gravity; and because this same Leaver is still in an exceeding good condition, I shall propose to you to make use of the same, for our present Engine, and therefore given you an accurate drawing and description of it and its dimensions in an inclosed paper herewith; and in the same time would propose to you, what you should think, If we did invert this beam, to know (*Ed.Note: Dutchism for i.e.*) lay its curve downwards, and fasten the gudgeon in the middle of the curve, in this manner which I am of opinion would make it as strong as possibly it may be, and this beam having done very well for a Cylinder of 52 Inches, will be strong enough for one of 36.— In regard to the method in which we lay the foundation; we must submit to the great Expence it requires; because we must absolutely be delivered of any risque on that account, there being no remedy afterwards, if any fault is done in the beginning; the digging of the pit, notwithstanding its great depth, and the driving of the piles in it,



have succeeded to our wishes, 177 piles of above 45 feet length being driven down with a ram of 1500 lb. weight, in about 3 weeks time.

I saw with pleasure you had finished the specification and only wanted th'Engrossing or writing it out fair, and that you intended to have it done on unstamped parchment, which certainly is more durable and fitter than paper to be laid up in a publick Office.

I hope that now you may have time to make out th'other drawings for our Engine that we may not be delayed; we will now very soon begin with the masonrij. You will very easily conceive the reason, for why in the Patent no use is made of the terms of executors, administrators or assigns, it is because the Patent is given to the Directors of a Corporation; who have never any executors administrators or assigns; these Directors remaining always in being as long as the Corporation stands;— If you have any leisure for giving me any particulars of your great Albion cornmill, you will greatly oblige me. I give you joy that in setting it to work, it has given satisfaction. After having written this, I receive the written parchment containing th'explanation and drawing of the general and particular principles of your invention, of which I shall take due care to have it forwarded, but not a single line from you with it, after which I long now greatly, and remain meanwhile with every regard

Dear Sir

Your m^t ob: hum: Servant

J:D:Huichelbos van Liender

(in margin, in another hand:)

M^t Van Liender May 31 1786

JW to HvL 1786-07-03

AoS ref. MS 3147/3/86/70-71. Transcript by R. Daalder.

M^r Van Liender

Birm^m July 3^d 1786

Dear Sir

About 10 days ago I was favoured with your obliging letter of May 30th, which serious circumstances have occasioned to prevent my answering sooner. I should have written to you when I sent off the specifications, or sooner, but as I before mentioned have been much below par in health & spirits all this spring, & loaded with variety of perplexing business, particularly with devising means to prolong the working some of the mines in Cornwall, where we have an immense property at stake, & which admitted of no delay. That business is now in train & off my mind. I wished to have written you a longer letter now than I find I can do having a headach & not being willing to delay upon writing you any longer.

On the other side I send drawing of your beam as altered to suit this engine and below it drawing of the beam we would make if left to our values.

The construction of the old beam renders it extremely difficult to determine by calculation what its strength may be, if the wood be good & sound I think it may be strong enough, but I repeat that were the case our own I would prefer the new beam. however I leave the determination entirely to you & beg you may advise us as soon as possible which you fix upon that the gudgeon & other things may be prepared accordingly.

In relation to the door in the front of the house, on mature deliberation I cannot give it up, & beg it may be executed as in the last drawings, with wooden lintels surmounted by a blind arch, the arch being above the cylinder beams, & in order to accomodate it please leave out the under course of iron bars in the wall. Laying the cylr. beams across the house would derange all our plans.— We have built above 58 Engines in that way we propose for yours & find it the best.— King posts were obliged to be added to M^r Wilkinson(s) & to Bloomfield engines. Any the least bending of the beam in our Engine is exceedingly hurtful. The gudgeon in our engine sh^d not be in the centre of gravity, but above it if possible, so that the beam may be a pendulum vibrating nearly in the times of the strokes.

The particular & general drawings for your Engine are now in some forwardness & shall be dispatched as soon as possible for us, as I am really vexed you have been so much delayed,

I remain

Dear (.....)

(Ed.Note: letter ending incomplete in the AoS; on p.71 three sketches with the explanations below)

The turnout (**ab**) must be left as thick as you can lest you weaken the hold of the joggle at **b**.

(sketch 1, completely faded)

The beam must not be cut to let in the arches (**cc**) but they sh^d have a projection going into the space between the logs at (**d**)

(sketch 2, king post arrangement, e.g. showing that martingales are the stays of the arch-heads; too badly faded to be reproduced)

The upper part of the arch (**e**) has a shoulder which rests on the beam but this part (**f**) is not let into the beam. The arch stays are let into the Beam & the diagonal stays pass over them without being let in

(sketch 3, completely faded)

You will please to accommodate the distance of the two spring beams & the width of the opening in which the beam works to the Beam which you prefer

In the old Beam the distance of the spring beams will be only 28 inches & in the new beam below 38 inches

HvL to JW 1786-07-11

AoS ref. MS 3147/3/505/15. Stamped 15 IY. Copy from Hist.Mus.Rdam. Transcript by R. Daalder.

M^r James Watt
at Birmingham

Rotterdam 11th of July 1786

Dear Sir

I see by your very agreeable favour of the 3th of this month that my good friend M^r Strachan has acquitted himself of my commission in rendering you my last letter, which my bad luck has prompted you to answer in a moment you was plagued with a head Ach, bij which it seems you had nor the desired of thinking and considering fully mij proposition. I am of opinion that for restoring you to a good state of health, a little tour to this Country would operate powerfully, the change of air, and th'exercise of the jaunt, will prove the best medicine you can use. I offer you a room, a bed and my table for the time you like to stay here, and wish you would accept of it.

As you leave the determination entirely to us, which of the two beams we prefer to employ, we have thought best, because we are certain our beam will be strong enough, to use our former beam, besides if we found afterwards it did incline to bend, we can then add a kingpost to it, or we may fill it up entirely, when it will be a beam about forty inches deep, and then put the gudgeon above the centre of gravitij, just as you have drawn for your beam; then at least it will be fully strong enough I assure you, and If you approve of that method, you may order the gudgeon and th'other things accordingly, and advise me of it; the chains and martingals of our former engine will serve for this likewise. The door in the front of the house shall be made as you have directed it, and according your last drawings. As we will go on now as fast as possible with the masonry, you will be so kind as to let us have drawings of what walls will be wanted in th'Inside of the building and how the beams for the several floors must be laid, according the contract we have made. The whole building, pumpwell, aqueduct to the Schie etc. must be build up and roofed before the end of October, and in the same time the boiler ought to be made and set down, which I think we will be fully able to do after your drawings. And I hope now to receive in a short time th'other particular and general drawings you have ordered for us, that we may not be obliged to put any stop to our operations.

M^r Savage from Hull has paid me a visit, and been with me to see the spot and the foundation of th'Engine. He told me many things about th'Engine you have planned for an oil mill at that place. Some more particulars of that and of your great Albion corn mill would be very acceptable for

Dear Sir

Your m^t ob: S^t

J:D:Huichelbos van Liender

P.S. I take the liberty of recommending th'inclosed to your care. (*note R.Daalder: seal on that enclosed letter was still intact; in 2004 this letter was not found*)

HvL to JW 1786-07-21

AoS ref. MS 3147/3/505/16. Copy from Hist.Mus.Rdam. Transcript by R. Daalder.

M^r James Watt
at Birmingham

Rotterdam 21th July 1786

Dear Sir

Ten days ago I had the pleasure of writing to you, but not that of receiving any of your desired favours. Since that time the masonrij of th'Engine building is begun, and its Contractor takes it up with so much vigour, that I think he will be much before his stipulated time; which do me wish to follow him with the same alacrity, and I see the necessity of fixing the pump in the proper place, the sooner possible the better.

Therefore I sollicit you to have it forwarded here by the first opportunity; as I suppose that piece has been ready since any time. The Pump pit, and sluice gate will be finished in a short time and therefore if the pump was fixed, we could remove the dams, and in the same time make the mean (*Ed. Note: main*) ditch deeper and clean it out in due order, which can be done easier now than afterwards in another Season of the Year; we want likewise to know in what manner the walls for supporting the Condensing Cistern must be built and exactly were; perhaps the particular drawing we expect now daily will be satisfactory to illustrate what we now want to know. If the Cylinder is ready, it may be sent in the same time with the pump; all th'underground work want to be done first, because as long as any of it is unfinished, we are obliged to keep the foundation pit drij with pumps, and of which we wish to be delivered if possible. Wishing you a prosperous state of health I remain

Dear Sir

Your m^t ob: Serv^t

J:D:Huichelbos van Liender

JW to HvL 1786-07-26

AoS ref. MS 3147/3/86/85.

Copy/transcript of sketch mentioned, included after this letter; not entirely clear if this sketch was inclosed in this letter, or if it was sent via Mr. Hog

M^r Van Liender

Birmingham July 26th 1786

Dear Sir

I am favoured with your obliging letters of the 11th & 21st, the last yesterday. I return you my sincere thanks for your kind offer which it would give me great pleasure to be able to accept, my health certainly requires relaxation, but I fear the necessary attention to business will not permit me to enjoy it till age has made me incapable of receiving any benefit from it. From the unexpected and unwished for business which fell upon us this season I have been harassed untill my existence has been a burthen to me; nor do I see the end of it yet. You propose to use the old chains & martingales, to that I must object unless they can be accommodated to the drawings which I shall send — I will provide gudgeon for the beam as you desire, that is fitted to the place of it where I have drawn the Gudgeon which is better than what you propose of putting it above ——— The Drawings of the Engine shall be sent off this week ——— from the unexpected Engines ordered for Cornwall we have not been able to get your pump &c ready, but these orders being over or nearly so it shall be done with all speed it admitts of. In the mean time if the walls of the pump well were carried up above the water say to the bottom of the lander or floor on which the pump delivers its water, and the sluice gates fixed the place could be readily dryed at any time & the pump lowered down into its place in which it will be readily fixed ——— On the other side that no more time may be lost I send sketch of the walls for supporting Cylinder & condenser cistern which I hope you will understand, & which may immediately be begun to & the Cylinder platform beams laid in their place but so that they may be moved a little backward & forward to adjust them to their place; I hope the house will be made water tight & that that you will make a small pump well at **G G** that at any time the water may be pumped out from under the cistern when repairs are wanted. The brick pavement under the cistern may be laid a few inches lower if convenient as there is rather too little room left under the beam.

I shall write again as soon as I possibly can & shall send the drawings to care of M^r Hog as before.

I remain

Dear Sir

Yours sincerely

James Watt

JW to HvL 1786-07-?

Copy from Hist.Mus.Rdam. B&W archive ref. acc to Daalder: LB11/11-12, conversion to AoS reference system initially failed and was not re-attempted. The date would suggest LB12 rather than LB11, maybe Daalder inadvertently wrote the fol.number also for the LB number.

The xerox (two A3 sheets) at the Hist.Mus.Rdam has following elements which by judging the irregularities of paper edges etc. must be adjacent or very close to each other in the Letter Book.

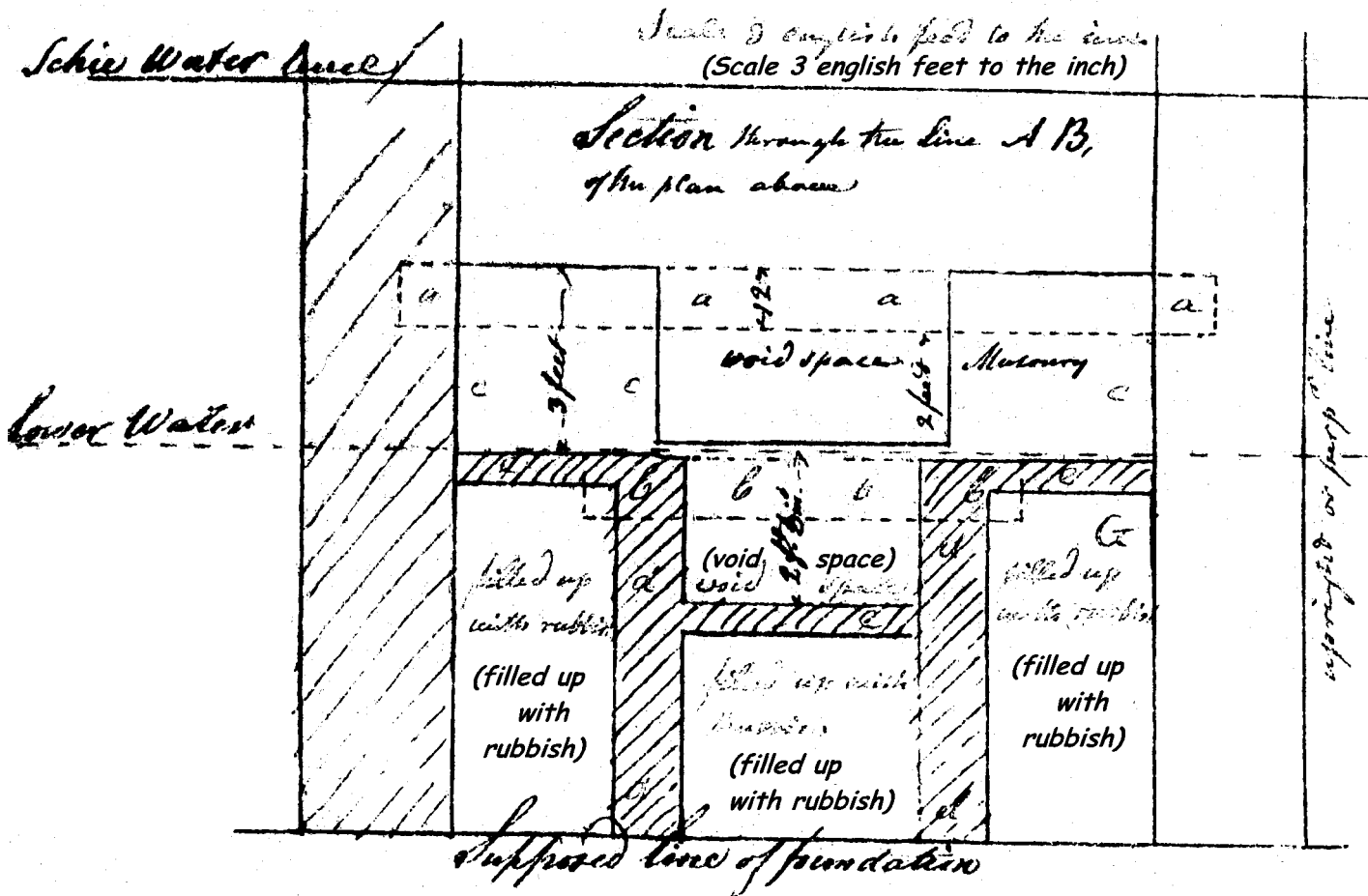
(1) A note marked "B.G's Engine", specifying "a set of nozles same as London Bridge", plus a steam pipe and an eduction pipe, dated 31 July 1786 with note "Ordered from Bersham". B.G. might mean "Bataafsch Genootschap", as in element (5) below.

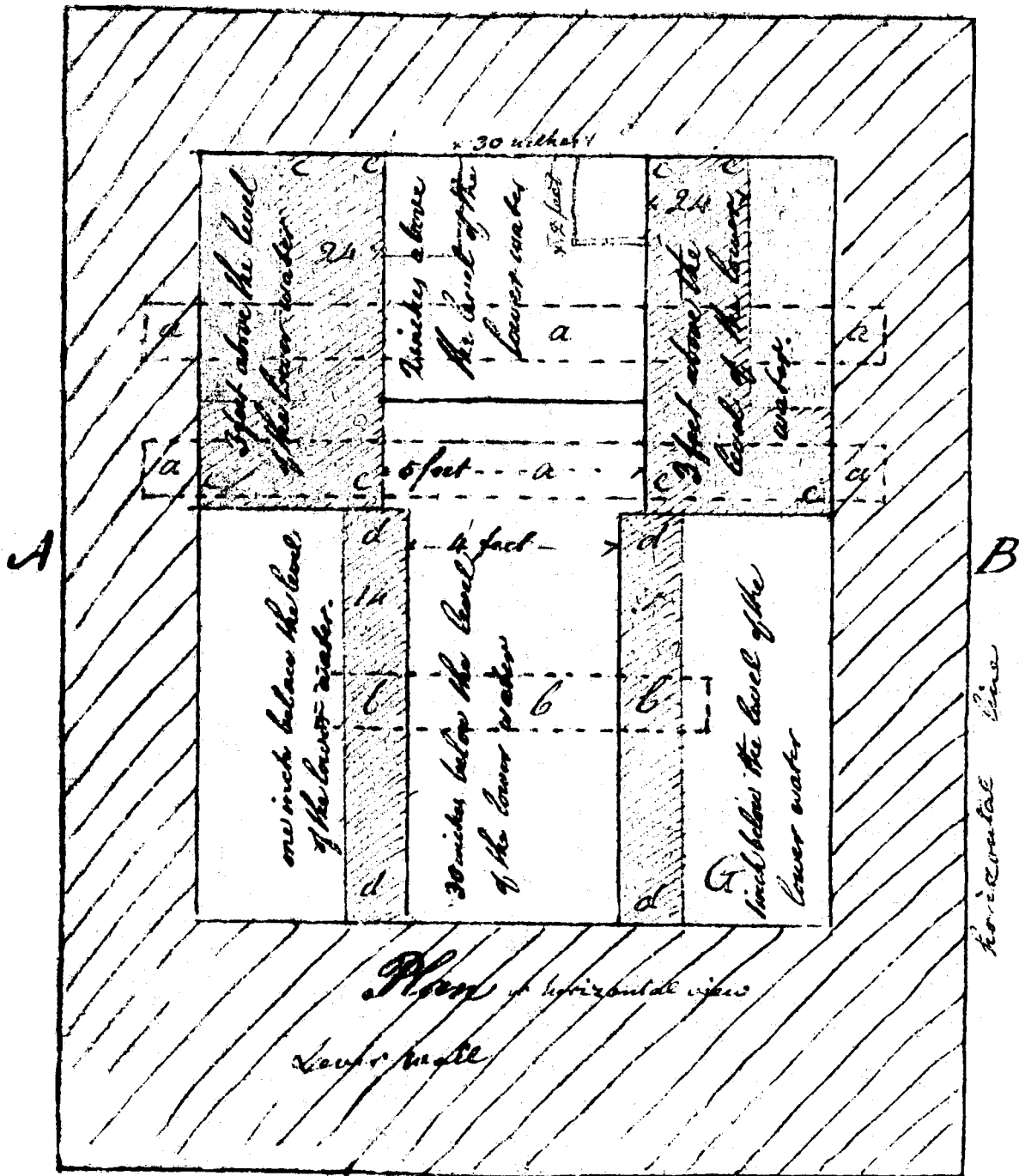
(2) A specification of castings for United Mines, of no interest for the present compilation.

(3) Letter by John Southern dated 21 July 1786, no addressee noted, covering sketches "for your enginemill (...) for the satisfaction and opinion of your Millwright"; Southern heads the letter "Gentlemen" as to a firm, in other letters he addresses HvL as "Sir"; This letter is obviously not for HvL. The copy is semi-transparent, as for B&W's copy press. It partly obscures:

(4) Letter in JW's hand with sketch of a 14½ inch round piece with a 6½ inch square hole, unlikely to be for HvL, and no date discernible.

(5) On 2nd sheet a sketch plan and section of engine house foundations, marked "B G", and designating the "Schie Water level", and thus evidently for the Blijdorp engine. The sheet is undated, but its proximity to the previous elements and the ref. in 1786-07-26 would suggest late July; it has been included below (bottom half, section) and on the next page (top half, plan).





Scale 3/4 English feet to the inch

- aa In both plan and section represent the beams which support the platform on which the Cylr stands, they are 12 inches sqr of best Dantzich deal or European oak
 - bb is a short beam which lies under the condenser cistern
 - cc are walls which carry the platform built up level with the top of cylinder beams
 - dd are two walls which carry the cistern & are built up level with its beam
 - ee is Brick pavement, under & at sides of cistern
- The void space under cistern extends on same level under the Cyl:r to the line f
 The void space under cylinder may be contracted behind according to the red ink lines

HvL to JW 1786-08-04

AoS ref. MS 3147/3/505/17. Copy from Hist.Mus.Rdam. Transcript by R. Daalder.

A martingale is a short stay to steady an archhead on a beam

M^r James Watt
at Birmingham

Rotterdam 4th of August 1786

Dear Sir

Your agreeable favour of 26th last came to my hands the 30th of the same, and I protest that that part of it, in which you decline my offer, gave me real concern, because I am firmly persuaded it would absolutely restore you to a good state of health, if you had a relaxation from business for some time, and nothing would better effect that, than a little tour in this country, and nothing should have given me more pleasure than making your stay here as agreeable and diverting as was in my power.

I doubt not the old chains and martingales which are made by M^r Wilkenson at New Whilly in 1776, may be altered and accommodated to your drawings, when you will send them.— It is very well you will provide the gudgeon for the beam; I see you prefer the place for the same in the beam; where we had planned it before; I did not propose to put it above, as because you had drawn it there for the new beam. If it is possible to have that gudgeon here before the half of september, as the walls will be build up then to that height, were it must be laid in, let us have it. where all the castings intended for our Engine are they made? If at New Whilly, all must be send to Bristol, and shipped there for here, which is a long and very uncertain transport.— I long to receive th'other drawings, as we do to receive the pump, Cylinder etc., the casting of which I see is retarded by Unexpected orders from Cornwall for Engines. I beseech you to have it forwarded with all possible speed; we are now already obliged to build the walls off the pump pit up as high as they want to be, the pump beams are already laid in them, and must afterwards emptij again the pump pit, for putting the pump in its place, which would now have been easier work. I take the libertij of reminding you the Iron cross under the pump. It is a pitty we did not had the drawings of the walls for supporting Cylinder and condensor cistern some time since, because then those walls could have been made up in the same time with the walls of the building, and thereby better united together; as it is likewise we were not acquainted that the house wanted to be waterthigt, which by making the foundation would have been an easij work, and now will given us â great deal trouble. I understand the void space under condensor cistern beam, must be â thight cellar, capable of holding water in it, not a dry cellar made thight for keeping water out; we begin today with building these walls and laying the beams in them, and take care to make â small pump well at G for pumping the water out of that cellar, when wanting; You will easily conceive how eager we are to go on now, because we are advised from several parts of the Country, the People are on the watch, to see how it will turn out, and If succeeding well, they intend to be followers; and the general plan and direction of the undertaking pleases everyone, who comes to see it. There is a neat wooden model of half an inch for one feet proportion made of the whole construction, as far as we were able to do after your drawings, which makes it now very easy to work after, to morrow we will begin to drive the piles and laij the floor upon them for the Aqueduct towards the Schie, which will have the length of 80 feet, and the width of 12 feet, locked at the Schieside with a double or twofolded doorsluice; upon this floor an arch of bricks nearly seven feet high, will be build up for a water through and for the carriage road going over it.— Eight days ago I have writed to Mess^{rs} Kinloch & Hog in London for providing me with the necessarij top, bottom and side plates of red copper for the boiler, after the just dimensions, forms and weight, given me by an able coppersmith here, after your drawings and dimensions; and I wrote those gentlemen, that in case there was any obscurity in my description or order, they would address themselves to you for elucidation. Which I beg you will be so kind as to given them when wanted; and now expecting and desiring greatly your further favour and advices; I remain with sincere regard,

Dear Sir

Your m^l ob: H: Servant

J:D:Huichelbos van Liender

P:S: by f in the last drawing send me, and under Cylinder platform there will be wanted another wall for making the separation between the higher and lower cellar or void Space. This cellar under condensor cistern, and the Cylinder platform etc. all perplexes us greatly and creates several thoughts with us, not knowing the true meaning and use of those things. We are thinking, If instead of making there a thight cellar of bricks, we had put down in that place, an oaken wooden waterthight bac or chest, as we have in our Watermills, wherein the drij wheel of the machinerij turns round; If that would not be less expensive and more easij in this case, and serve as well as th'other method? But not willing to loose more time, we shall make shift to go on as well as we

can, and all those things may be brought to a greater perfection when ever a second one or more will be wanted.
The Same as above

Another P:S: My particular good friend, M^r Corn^s Nozeman D.D. and now President Director of the Batavian Societij has undergone a very sudden Decease, and I am prevailed upon to succeed in his place as Director of said Societij.

Yours as above

JW to HvL 1786-08-07

AoS ref. MS 3147/3/86/96. Copy from Hist.Mus.Rdam. Transcript by R. Daalder.

M^r Van Liender

Birmingham August 7th 1786

Dear Sir,

I send off to night or to morrow to care of M^r Hog Esq^t a roll of Drawings of your Engine, containing General section, & cross section, outside front view, ground plan, D^o of second floor, drawings for Piston (*and*) cap, chains, martingales &c. You will please remark that the whole matter of the pump well being left entirely to you, the drawings are not to be regarded there any further than respects the pump itself & the pit head framing, with the troughs or Landers which convey the water to & from the cistern. I expect the swelling of the water by the stroke of the pump will fill the lander & supply the cistern but if it does not, a small pump must be fixed for this purpose. The spring beam need be carried no further out than the red ink line drawn on it in the **G1**: section. The dark part **xx** at the surface of the water is a mistake.— The working beam is drawn in the way we usually make them. You have already a drawing for the old beam altered to suit this engine. In the cross section (**g**) is the blowing cistern & valve, which is only need at first setting the engine to work. (**f**) is a lander to convey the water away from it, with a valve to keep out the external water when too high. (**h**) is a pipe & valve to lett the water (*out*) of the cistern. The beam (**k**) under the cistern need be no longer than the red ink marks. (**m m**) brick walls supporting cistern. (**l**) void space under it.— In the Ground Plan (**o**) is the lander which brings water to the cistern and (**p**) is the lander which carries off the hot water which may be led away by the pencil line, so as not to mix with the other. (**q q**) are 4 boxes of wood, 6 inches square within which go down to the platform beams to keep the holes open for the holding down screws. I think every thing else will be understood from the drawings. The building of the platform for the Cylinder & the seating of the Boiler above the level of the grate had best be left unbuilt until the person comes who is to put the engine to gether as he may be able to give you some usefull assistance. The condenser cistern is to be made of the best Dantzich fir planks according to drawing which comes with the rest, it is to be put together with long bolts, screwed at both ends, $\frac{3}{4}$ inch diar: which go through the planks edgeways, and is the best way of making cisterns tight. with comp^s to all friends, I remain Dear Sir

Your Obedient serv^t
James Watt

(Ed.Note: there followed a copy of part of the covering letter for mr Hog, dated 9 Aug 1786)

Roger Hog, Esq^t
Sir

Birm^m Aug^t 9th 1786

We present our best Thanks for your obliging care of the parcel you were so good as to forward to our mutual friend M^r Van Liender, & take the liberty of troubling you again with a roll of plans which we beg the favour of you *(Ed.Note: final line fell off B&W copy)*

HvL to JW 1786-09-22

AoS ref. MS 3147/3/505/18. Copy from Hist.Mus.Rdam. Transcript by R. Daalder.

M^r James Watt
Birmingham

Rotterdam 22th of September 1786

Dear Sir

Being returned yesterday from a tour to Hambrough, Hanover, Gottinguen, Francfort, Coln etc., I expected to find our undertaking greatly advanced since that time, but to my great mistification, I found it otherwise; because the walls being all around brought up to that height of the boiler seating, at which you have wrote in the beginning that we must stop, when we are come to that part, th'other Gentlemen have found it impossible to go on with th'other walls of the building, If in the same time the boiler seating cannot be drawn up together and united in good order with that wall of the building near which it is standing; Therefore I beseech you earnestly to give us the necessary Instructions how to go on further with the boiler seating or to send over instantly a Person to direct that part, that we may not be obliged to leave the walls of the building unfinished this whole winter; this dilemma now vexes me greatly, and has given great uneasiness to the other Gentlemen before my return; verij few hours before I parted for Germany (*Ed.Note:probably c.10 August '86*), I received the drawings you have send me by care of M^r Hog and I thought theij would have given the necessary Instruction for going on further, but I am told now they have been of no utility in that respect because in your letter of 11th October last year you have mentioned the following: In no.5 you have plan of boyler seating level with the bottom of the flues; & in no. 2. Section of the boiler & seating through the centre line of the Ashpit. The boyler seating should be build no higher than XX until further directions are given.

These further directions we are extremely wanting now; and I sollicit I maij receive them by return of post. I am likewise without your desired answer upon my last letter of 4th of August, and remain in haste with every regard.

Dear Sir

Your Most ob: H: Serv^t
J:D:Huichelbos van Liender

JW to HvL 1786-09-28

AoS ref. MS 3147/3/86/114-115. Copy from Hist.Mus.Rdam. Transcript by R. Daalder.

M^r Van Liender

Birm^m Sep^r 28th 1786

Dear Sir,

I am much mortified as much as you to find that the building has been stopt for want of sufficient explanation of my meaning and wish your friends had written to me on head as soon as they found the embarassment, The building of the Boiler seating was directed to be stopt at x x, because we seldom or never connect the masonry of the Boiler seating with the masonry of the house, because the former has occasionally to be pulled down for repairs, at least the upper part of it, and would damage the house if connected with its masonry, and the place where I directed it to be stopt is just below the bed of the fire place. However you may leave holes large enough for the three bearer bars under the Grate & build it up to the level of the bottom of the cavity under the boiler wch. is about 15 inches above the line x x & no higher can it be built with any degree of propriety until the boiler is upon the spot, that the ring of brick work on which it stands may fitt the Lagg or under edge of the boiler. The walls round the flues cannot be built until the boiler is set in its place & as they frequently want repairs it would be quite wrong to connect them with the masonry of the House.— For the reasons I have given we seldom connect the masonry of the chimney with the house nevertheless in your case I think it may be done, in which you will please observe the following directions. The cavity of the chimney which commences at the level of the bottom of the flues is to be 21 inches sqr: within quite clean and built exceedingly smooth, its situation in respect to the house will be seen in the plan n^o 5 first sent. The walls round the chimney on the outer end & one side are to be built 22 inches thick & the same thickness on the front, or side next the Boiler, & this thickness they are to carry up to 6 feet high above the level of the bottom of the fire door. The walls are then to be diminished to 18 inches for 6 feet & then to 14½ inches thick which reaches 11 feet 6 inches higher, and from there for 6 feet higher 11 inches thick, from which place to the chimney top they are to be only 7 inches thick all round the cavity of the chimney, which is to be uniformly 21 inches sqr. inside from bottom to top but as these diminutions of thickness may not suit your bricks, you may take in the thickness of the walls at more frequent intervals & less at a time & make the thicknesses such as suits your bricks, an inch or two is not material. They are drawn fully strong enough.

As the walls of the house fall back or decline in thickness as they go up you may (*set*) the cavity of the chimney 6 inches nearer the house or carry up (*the*) chimney independent of the house from the first 11 feet 6 inches high. This latter situation I prefer as it leaves the chimney in the best place in regard to the boiler, but have no objection to the chimney being built in with the house. In the wall of the chimney next to the boiler there is to be left an opening for the flue or horizontal chimney to enter into the (*.....one?*) this opening must be 13 inches wide & 3 feet high arched at top with a flat arch. The bottom of this opening must be level with the bottom of the flues in the section N^o 2 first sent. In the back wall of the chimney on the same level, & directly opposite the opening I have been describi(*ng*) must be made another opening about 18 inches square, for cleaning out the ashes, soot & dirt from the chimney (this opening is always built up when the engine is at work.) We have made some experiments on seating boilers lately, in consequence of which I shall make your horizontal flues 16 inches wide at bottom instead of 15 which they are drawn & 3 feet 6 inches high instead of 3 feet & shall raise the surface of the water in the boiler 6 inches higher than drawn.— I hope I have now satisfactorily answered every part of yr. last letter, & proceed to the other of Augt.4th. In relation to the gudgeon of the beam: it has no connection with the walls & we never put the beam in its place untill the house is quite finished. The castings for the engine at least the heavy ones are making at Bersham foundry near Chester & will be shipt at that port or at Liverpool.— I have done all I can to spur up M^r Wilkinsons people with your order, but the goods are not finished yet, nor do they fix the time when they can be done, but I shall not cease reminding them frequently of your wants until I get the goods out of their hands, for I grow very uneasy at the delay. The clack & bucket of your pump being so very large will turn out very troublesome to them, but they can manage them, the iron cross will come with the other goods also the grate bars, dead plates & fire doors. The piston rod & cylindrical part of the pump rod are done and on their way to Liverpool where they will lye untill the other things are ready. It is of no consequence that the walls under condenser and platform are not connected with the building. We never make them so, but build them in afterwards.— The void space under condensor cistern is not intended to hold in water but to hold it out, in order that at any time when repairs are wanted under the cistern a man may go in for that purpose, but that will be seldom, very seldom, & a little extra labour will keep the water out at such times.— The general section last sent will explain what was wanted in the former drawing about the wall at f. Some of these difficulties about the water might have been avoided by building the house some higher, but I was willing to keep it as low as I could on account of your unstable foundation. Since writing the first part of this letter I thought the directions about the chimney

not sufficiently intelligible. I have therefore corrected them & have enclosed a drawing of the chimney as seen from the the Lever wall of the engine or from the fire door of the boiler.—

I am sorry that you should have had so much trouble in understanding my meaning but we are so much used to giving directions to those who have already a general notion of the subject that we are not so well qualified to know what directions are necessary to those not so well acquainted, & the overhurry of this last year prevented the same attention which we should otherwise have given. I hope now it will be all clear & that you will be able to go on with the building the house without further assistance, but if you should not, please advise & we shall send over a man to assist you, which however we are willing to delay as long as possible both because the man being long detained there would be a great expence & we can ill spare him from hence & indeed cannot send him at all untill he has finished an engine he has now at hand which will be soon.— I should have written in answer to yours of Augt 4th but went from home immediately on the receipt of it & expected the drawings sent would have explained most of what you wanted. My absence from home was longer than I expected & many things fell behind in the mean time, which have made me neglect the Draught of the assignation of the patent which should have been sent for your approbation. I have now put it into the hands of our lawyer to put it into form & shall send it you soon. This death of your friend Mr. Nozeman seems to render it necessary to conlude the affair while those who made the bargain are still alive.

I have the pleasure of informing you that my health is much better lately and hope the journey you have made has contributed to yours. Had I known you intended to take such a jaunt I should have asked the favour of you to have called for my son, who has been for a year at Eisenach in Saxony learning German, but will soon leave it to go to Clausthal to study mineralogy. I beg my best respects to our friend M^r Ainslie & family & remain

with sincere regard—

Dear Sir
etc.

HvL to JW 1786-10-13

AoS ref. MS 3147/3/505/19. Copy from Hist.Mus.Rdam. Transcript by R. Daalder.

M^r Watt at BirminghamRotterdam 13th of October 1786

Dear Sir

Your very Agreeable favour and most satisfactory letter of 28th Last came to my hands in due time; Since my former was gone of to you, I took the necessary trouble of studying all the drawings and descriptions you had already furnished us with. And I saw very plainly, that th'other Gentlemen under the praeadvise of our architect here, had been detained and embarassed by a mere nothing, and notwithstanding the resolution was taken of stopping the building entirely till next spring, and this stopping already was commenced since any days, I have overruled this resolution, and we are now doing our utmost, to bring the building under roof before winter, which I hope we will be able to do notwithstanding the very unfavourable season and extremely bad and wet weather it makes daily;— There is so much rain fallen since the month of August that most of the Lands hereabout are overflowed, and the farmers been obliged to house their cattle. The Polder of Blydorp where th'Engine is erecting, is nothing than a Lake, and quite underwater, so that If th'Engine was now ready, we could give a good proof of our doing. This winter I propose to have all the needful leisure for making everything in the Inside ready, that next spring, when you send over your overseer, we maij complete all in a short time, with the help of the drawings send lately, and some few explanations I think it will be â most easy matter, and I wonder greatly, how men can be so indolent as to stop at so little difficultij; this winter will leave us time to finish the boiler, that next spring as soon as the weather will permit it, we may set it down, and build the fluess walls and chimney up;— Must not the top or dome of the boiler be covered with brickwork likewise? At our former engine, but â small part of about four feet diameter of the dome is left uncovered;— If you should have thought fit to leave the direction of the boiler seating flues etc. to us, we think we should very well have managed those, because so many fireworks of this kind are employed here in distilleries, Breweries and other manufactories, that that I Imagine those things are very well understood and perfected here. But now we shall strictly follow your instructions, but we have been from the beginning in th'opinion, that part of the flue of the boiler must come in or under the side wall of the building and the model which is made after the drawings and descriptions you have send in the beginning, do not leave us any doubt of it; our architect here was of opinion you had in view to strengthen that side wall, by having it rested on the walls of the boiler seating, but had we known you liked to have the walls of the house detached or unconnected with those of the boiler, there would not have been the least difficulty in this respect. I have taken out the three bearer barrs, from under the boiler of our former engine, and intend laying them under this, so as the Irongrate,damper plate etc. of the former will serve likewise for this;— I shall take due attention on th'alteration in the dimensions you have noted of the horizontal flues etc. ,and am obliged to confess you have most satisfactorily answered my last letter.— I sollicit your further attention in reminding M^r Wilkenson's people of finishing the castings for our engine. My good friends Mess^{rs} Coysgarne & Lloyds, who are likewise his, have writed purposely for me on that head to M^r Wilkenson. The walls under condenser cistern, and cylinder platform are now very well connected with th'other walls of the house, which will do no harm, and a good thigh cellar under condenser cistern made.— It is very good that the house is kept as low as possibly it could be for many reasons, but for th'instabilitij of the foundation there is no reason of the least fear; we are very sure that the foundation is, and will be as firm and stable as any foundation can be, and that no complaint whatever therefrom will occur;— The drawing of the chimney will be exceedingly useful, when we are so far advanced as to build it up. It is certainly much more troublesome to give directions to us, who are quite unacquainted with the subject matter, as when you inform anyone who has some notion of it, or is in the possibility of seeing any Engines of the kind. I doubt not or we will now be very able to go on with the building in due order, without further assistance.— I expect the draught of th'assignation of the patent, and when received, shall have it passed in due form, and returned to you. It gave me real pleasure to see your health was so much better, than it has been since any time. The journey I have done has been very favourable to mine, as I have always found much benefit from the little tours, I am accustomed to take every summer since more than twenty successive years.— Having now answered your letter in every point, I shall join to this some few Questions which you will be so kind as to elucidate;— I do not rightly conceive the manner nor the meaning of the cylinder beams being provided at their ends with notches and screws called in the drawing no 4 by **M:M**: holes to adjust the binding barrs of the cylinder beams in. It seems to me as if it must be possible, to move the cylinder beams backwards and forwards which I never have seen before. Another obscurity for me consist in **(q q)** are 4 boxes of wood 6 inches square within which go down the platform beams to keep the holes open for the holding down screws. As far as I am able to conceive the meaning of this, you must forgive me, If I think it an awkward method of fixing the cylinder but certainly I have a wrong idea of this construction, which I beg you will explain. The manner in which I see you have contrived the clack of the waterpump, as far as I am able to judge from the drawing,

seems to be uncommonly Ingenious, and gives me the best opinion of its working. The wheel and pinion fixed under the roof of the house, is that likewise to be made and send from Bersham ? If you would send the particular dimensions of the throughs and Landers, which convey the water to and from the cistern, and of the blowing cistern, and of the Lander which convey the water away from it, likewise of the 4 boxes of wood, and what planks will be wanted for making the platform for cylinder; we could prepare and make ready all those during next winter.— Now I leave th'Engine and go over to another matter, in which I am obliged to solicit your kind assistance. There has been here since about twenty years a company or association of about 50 members Lovers of Experimental Philosophy, who have had in winter time a weekly meeting, In which One of the members gave lectures and did experiments upon every object of natural Philosophy. Every member gave a yearly contribution of about two guineas for which they did make the necessary instruments and apparatus, for making every experiment. Of those there is now a very considerable collection, who has cost more than 700 £ St: By some unforeseen circonstance this association has taken an end, and there was resolved to sell this whole collection of exceeding fine instruments and models; by advice of me and th'other Directors, the founder of the Batavian Society (who has always been a member of this Compagny) has resolved to buy the whole collection, In which he has succeeded to his wishes, and th'Intention is to endeavour, to get an able man under a Yearly Stipend for giving lectures upon Experimental Philosophy in a more publick way, but with these we will not be ready this winter and therefore, we intend to give in the Interim some lectures upon the steam engine and its principles, which Doctor Bicker, the first secretary of the Society, has taken upon him to do, but has prayed me to ask You, If you would be so kind as to furnish him with some materials of which undoubtedly you must have a copious store, having made so many experiments upon every part of this subject; all what belongs to the old Newcomens construction, we can find materialls enough by Desaguliers and Belidor etc but for the new construction we must have resource to you, as the only Parent of that ofspring. All what you will have the kindness of sending to me, I give my word, it shall be returned in good order when you require it. A principal point will be to make clear the difference in principles between the two constructions, and by what chain of reasoning you have been led to this improvement, and th'Experiments you have done for trying and perfecting this method. It is now the time of familiarising our Countrymen with this object, and it is undoubtably a very interesting one. As a true Philosopher I am confident you will gladly contribute, whatever you may, for extending human knowledge, this persuasion has made me bold in asking this favour.

M^r Enslie and family begs me to return their compliments to you and I remain with every esteem

Dear Sir.

Your much obliged Friend

J:D:Huichelbos van Liender

P.S. A letter from Doctor Priestley of the date of 6th (*Current?*) to the Reverend M^r Corn^s Nozeman, deceased, is received this morning by the family, and I am solicited to pray you of telling M^r Priestley, that Doctor Nozeman has been dead since about three months, but that his son the reverend Doctor C^s Nozeman at Leijden, shall answer his letter to my deceased friend.

JW to HvL 1786-10-16a

AoS ref. MS 3147/3/86/130. Copy from Hist.Mus.Rdam. Transcript by R. Daalder.

The enclosed draft assignation has not been located. For its definitive form, see [1786-11-08].

M^r Van Liender

Birm^m Oct^r 16th 1786

Dear Sir,

I wrote to you upon the 28th Sep^r with explanation relative to the chimney, which I hope came safe to hand. I have now prepared and shall send off tomorrow per coach to Mr. Hog a sketch of the boiler seating in its compleat state containing all the alterations which I have thought necessary to make; but as this sd. sketch only relates to the building of the walls round the flues & the covering the boiler it need not be waited for as it has no respect to anything you have now in hand.

I take the liberty of sending inclosed a draft of the assignation of the patent in our favours which is approved of. We shall be obliged to you to get translated into the Dutch language & put into the hands of some able notary or proper man of the law to draw up in due form according to the laws of Holland.

As we were at a loss to know whether you would chuse to make the assignation for yourself & the other Directors, or whether such assignation would be legal in Holland I have caused draw it so that it may answer for either by changing a few words, If you are to make the assignation in the name of the other Directors & as taking further on you for them, then all that is written in red ink must be omitted, but if the Directors chuse to make the assignation along with you then all that is written in red must be inserted and all that is underlined with red must be left out. We shall be much obliged to you to get this assignation finished as soon as convenient for you, & to place whatever expences may be incurred thereby to our account.

M^r Wilkinson was here last week he desired his com^{ts} to you & promised to cause expedite your Engine materials as much as possible.

As in about a fortnight it is possible I may be obliged to sett out on a long journey, if there is anything you wish to correspond upon I shall be obliged to you to write soon. If I should be obliged to go from home, which is not yet certain, I shall leave proper orders for the forwarding your goods.

I remain

Dear Sir

Your Obliged Friend

James Watt

JW to HvL 1786-10-16b

AoS ref. MS 3147/3/86/129. Copy from Hist.Mus.Rdam. Transcript by R. Daalder.

*Covering letter for drawings sent via Mr. Hog
No ending in the AoS copy.*

Van Liender

Birm^m Oct^r 16th 1786

Dear Sir,

I send with this a drawing for fixing the boiler on its seat & the covering it with bricks &c. But we wish the whole of that business to be performed by the directions & under the eye of the person we send to put the engine together. In any case please lett the following directions be observed. The bricks immediately about the fire grate & those of the ring the boiler stands upon should be what we call fire bricks, or that kind which can bear an intense heat, & they should be laid in some good fire clay or loam. The whole of the bricks which form the walls round the flues may be of common bricks, the two outside courses should be laid with mortar made with lime as usual but the two inside courses which are next the fire should be laid in some kind of loam or mixture of clay & sand, we commonly employ the dirt of the high road which having a little horse dung in it is the better for it.

The tops of the flues should not be formed by arching, as that generally fails, but by making the bricks reach over one another as drawn. The spherical part of the boiler top should be covered all over about 4 inches thick with horse dung well tamped with a little water and very close clapt on, above that 2 or 3 courses of bricks must be laid in the best lime mortar, so that they may be water tight if the boiler should be exposed to the rain.

The flue should be contracted to 12 inches wide by 3 feet high just before it comes to the place where the damper is fixed.

What is called the uptake or place where the fire passes from below the boiler to go round the sides of it, it should be made at least as roomy as any part of the flues. It may be found convenient to cover & enclose the boiler with a slight wooden building, large enough to give room for the supplying the fire with fuel & a small quantity of that article. This shed will preserve the heat of the boiler & will also be a shelter to the engine man in bad weather while he is firing

JW to HvL 1786-11-01

AoS ref. MS 3147/3/86/136. Copy from Hist.Mus.Rdam. Transcript by R. Daalder.

M^r Van Liender

Birm^m Nov^r 1st 1786

Dear Sir,

I was duly favoured with yours of the 13th Oct^r Some drawings sent lately to the care of M^r Hog would serve to explain the boiler seating perfectly, notwithstanding the frequent use of stills & boilers, nothing is less understood than the proper way of seating them. therefore we have been the more particular because bad seating may waste $\frac{1}{4}$ of the fuel or more. I do not understand your meaning in saying that part of the flues must come under (the) walls of the building I can find nothing in the drawings which could lead to it, the flue wall is thinned on the side next the building so as to leave only about 6 inches between the cavity of the flue & the outside of the wall; but if you mean that the flue walls come under the walls of the house you are right, only that these walls are left (...) in that place & the house wall comes in stead of them. The fire barrs dead plates & cet. for the Engine were ordered & made before I read your's, but as they are articles which soon wear out, there will be no loss in having a double sett. I am advised by the Bersham foundry that the castings for your Engine will be ready in about 20 days, and as I shall be in London next (...), I shall if the operator we intend for your Engine is disengaged to send him over to you that he may give directions for preparing things a wanting with you, so that you may be ready

Copy in AoS ends here; remainder would probably have contained a note about JW's plan to visit Paris, referred to in [1786-11-17].

Cession contract 1786-11-08

AoS ref. MS 3147/2/28. Initially transcribed from the copy in the notarial archives [Akten 3015/592-608], then checked with original found in the AoS.

The wording of this document was discussed by HvL, JW and their counsel, as e.g. [1786-03-27; 1786-05-31; 1786-09-28] indicate.

Original sent to B&W by "trusty person", see [1786-11-17]. The original has been countersigned by the notary and two witnesses, the copy has only the signatures and seals of the Batavian Society Directors.

HvL, who had become a Director of the Batavian Society three months earlier [1786-08-04], is still consistently mentioned separately from and in addition to "the Directors", maybe for consistency with the distinction made in the Privilege [1786-01-12] and in the Specification [1786-05].

In this document MB's first name is consistently spelled Mathew as in the Specification; other sources give it as Matthew.

This Indenture or Contract made the Eighth daij of November in the Year of our Lord One Thousand Seven Hundred & eightij six Between The Directors of the Batavian Societij of Experimental Philosophij at Rotterdam in Holland and Jan Daniel Huichelbos van Liender One of the Directors, and Consulting member of the said Societij of the one part, and Mathew Boulton of Soho in the Countij of Stafford Engineer and James Watt of Birmingham in the Countij of Warwick Engineer of the other part **Whereas** Stephen Hoogendyk of the Citij of Rotterdam aforesaid Esquire, being desirous of erecting at his own Costs and Charges in or near the said Citij of Rotterdam a Fire or steam Engine to be applied to the draining of certain Polders or Meadows in order that the Effects of the same might be Compared with the Wind=Water Mills Commonlij used for that purpose having no other View in the said Erections than the Benefit and advantage of his Countrij and on account of his great age having committed the care of seeing the same properlij executed to the directors of the said Batavian Societij of Experimental Philosophij at the Citij of Rotterdam aforesaid in conjunction with the said Jan Daniel Huichelbos van Liender **And Whereas** the said Gentlemen having Confidence in the Superior Powers of the new Fire or Steam Engine invented bij the said James Watt did through the said Jan Daniel Huichelbos van Liender applij to the said James Watt in conjunction with the said Mathew Boulton (who bij virtue of an agreëment with the said James Watt is interested in the said Invention and in the Business of constructing the said new Fire or Steam Engines which the said James Watt and Mathew Boulton Carrij on in Partnership under the firm of Boulton & Watt) requesting the advice and assistance of them the said Mathew Boulton and James Watt in furnishing proper plans and drawings, in procuring proper materials and otherwise furthering the said Work who highlij approved of the Generous and Patriotic Designs of the said Steven Hoogendijk, and the said Mathew Boulton and James Watt were inclined to further the same — **Yet as** bij an Act of the Parliament of Great Britain made and passed in the Fifteenth Year in the Reign of his present Majestij King George the Third, The sole privilege of constructing and vending such Engines throughout the British Dominions was vested in the said James Watt, his Executors, Administrators and Assigns for the term of twentij Five Years from the time of passing the said Act, and as the Demand for the said Engines in Great Britain was verij considerable and encreasing **And also as** the said Mathew Boulton and James Watt having no exclusive Right in the Province of Holland & West Friezeland could not hinder others from imitating anij Engine which theij the said Mathew Boulton and James Watt might erect in that Province and thereby the said Mathew Boulton and James Watt might eventuallij receive no Reward for their Labour and Experience, theij the said Mathew Boulton and James Watt therefore considered that consistentlij with a reasonable degree of attention to their own Interest they the said Mathew Boulton and James Watt could not complij with the Request of the said Gentlemen unless theij the said Mathew Boulton and James Watt could procure an exclusive Privilege which should secure to them the Benefit which might fairlij accrue to the said Mathew Boulton and James Watt from the Introduction of the Said new Steam Engines in to use in the said Province where the said Mathew Boulton and James Watt are persuaded theij will prove of Great Public Utilitij **And Whereas** the said Directors of the Batavian Societij and the said Jan Daniel Huichelbos van Liender being convinced of the proprietij of the reasoning of the said Mathew Boulton and James Watt in Consequence thereof did bij their Petition most respectfullij beseech the **Noble Great and Mightij Lords the States of Holland and West Friezeland** that theij would be pleased to grand unto the said Petitioners (although theij had not therein the least view to their own private Advantage but proposing the same to to be used onlij for the benefit and advantage of the said Mathew Boulton and James Watt and their legal Representatives) a Patent and exclusive Privelege to be the sole Erectors of Steam or Fire Engines according to the Invention of the said James Watt in the said Province of Holland and West Friezeland, **And Whereas the said Noble Great and Mightij Lords** have been most graciouslij pleased to grand unto the said Petitioners their Letters Patent in the

usual form bearing date at the Hague the twelfth daij of Januarij in the Year of our Lord and Saviour, One thousand Seven hundred Eightij and Six granting to the said Petitioners the Privelege of erecting the said Engines in the said Province for the term of Fifteen Years and enjoining the said Petitioners to furnish a neat and accurate Plan and description of the said Engines to be deposited in their Secretarij's office, **And Whereas** the said James Watt in order to enable the said Petitioners to complij with the said Injunction hath (with the advice and consent of the said Mathew Boulton) drawn up in the English language a description of his said new Invented Steam Engines and Hath accompanied the same with drawings of several applications of the Principles on which theij proceed and the same hath been translated into the Dutch Language, and Such Original Specification together with the translation thereof hath also for the greater Authenticitij and Securitij thereof been deposited in the Proper Office where the same ought to be lodged and deposited. And the said Mathew Boulton and James Watt having also agreed to take upon themselves the trouble of providing and furnishing at their own proper costs and charges the necessarij drawings and directions for Constructing and Erecting the said Engine and also of providing and furnishing all the costs and charges of the said Directors as well proper materials for erecting of the said Engine as proper and capable workmen to erect the same. **In** consideration that the Directors members of the said Societij have agrëed to assign to and vest in the said Mathew Boulton and James Watt the said Patent and all Benefit and advantage thereof in manner Hereinafter mentioned.

Now this Indenture witnesseth that in pursuance of the said agreëment and in consideration of the covenants of the said Mathew Boulton and James Watt Hereinafter Contained and also in consideration of the Sum of Ten shillings of lawfull moneij of Great Britain to the said directors of the said Batavian Societij and to the said Jan Daniel Huichelbos van Liender in hand paid bij the said Mathew Boulton and James Watt at and before the sealing and deliverij of these presents the receipt whereof is Herebij acknowledged and for divers other good causes and considerations them the said directors of the said Batavian Societij and the said Jan Daniel Huichelbos van Liender hereunto moving Theij the said Directors of the Batavian Societij and He the said Jan Daniel Huichelbos van Liender for and on the behalf and with the Consent and approbation and bij the direction and appointment as well of the said Steven Hoogendyk as of all and everij other the Members of the said Batavian Societij and their successors, **Hath** granted bargained sold, assigned; transferred and set over and bij these presents **Doth** grant bargain sell assign transfer and set over unto the said Mathew Boulton and James Watt their Executors, Administrators and assigns **All that** the said Patent and sole Privelege of erecting during the said Term of fifteen Years, Fire or Steam Engines according to the Invention of the said James Watt within the said Province of Holland and West Friesland so obtained bij the said Directors of the said Batavian Societij and bij the said Jan Daniel Huichelbos van Liender as aforesaid **And all** benefit and advantage of the said Patent and all Right, Title, Interest, Propertij, Claim and Demand whatsoever of the said directors of the said Batavian Societij and of him the said Jan Daniel Huichelbos van Liender of in or to the said Patent. **And all** Powers, Rights and Authorities to be had or derived therefrom. **To Have and to Hold** the said herebij assigned or mentioned to be herebij assigned Patent and all Right Title Interest, Benefit, Propertij Claim and demand whatsoever of in and to the same and all Powers, Priveleges and Authorities to be derived therefrom unto the said Mathew Boulton and James Watt their Executors, administrators or assigns from henceforth for and during all the now unexpired residue and remainder of the said Term of fifteen Years for which the said Patent was so obtained as aforesaid in as full ample and beneficial manner to all Intents and Purposes as they the said directors of the said Batavian Societij and He the said Jan Daniel Huichelbos van Liender can or maij assign or transfer the same or as he and the other Directors of the said Batavian Societij could or might have held or enjoied the same had not these presents been made. **And** the said Directors of the Batavian Societij for and on behalf of themselves and their Successors and the said Jan Daniel Huichelbos van Liender for himself, his Heirs, Executors and administrators do Herebij & each of them doth Covenant, promise and agree to and with the said Mathew Boulton and James Watt their Executors, Administrators and assigns bij these presents in manner following (that is to saij) that he the said Jan Daniel Huichelbos van Liender, his Executors administrators and assigns and the said Directors of the said Batavian Societij and their Successors and all and everij other Person and Persons now or at anij time hereafter having or lawfullij claiming any Estate, Right Title or Interest of, in, or to the above mentioned Patent or the Priveleges therebij granted and herebij or intended to be herebij assigned, or anij Benefit or advantage thereof, or of anij part thereof, bij, from, or under, or in Trust, for him, them or anij of them, or bij, from, through, or under the act or Deed of them or anij or either of them shall and will at all Times hereafter upon everij reasonable Request and at the costs and charges in the Law of the said Mathew Boulton and James Watt their Executors, administrators or assigns make, do, and execute, or cause to be made, done or executed all and everij such further and other lawfull and reasonable assignments and assurance in the Law Whatsoever for the better and more effectullij assigning and assuring the same Patent and the Priveleges therebij granted, and all Right Title, Interest, Benefit and advantage thereof and Powers and authorities to be derived therefrom, unto the said Mathew Boulton and James Watt, their Executors, administrators and assigns for and during all the then Residue of the said Term of fifteen Years thereof so granted as aforesaid as bij the said Mathew Boulton and James Watt, their Executors, administrators

or assigns shall be lawfullij and reasonablj devised or advised and required, **and also** that he the said Jan Daniel Huichelbos van Liender and the other Directors or Members of the said Societij shall and will at their own expence erect, or cause to be erected, a Steam Engine of his the said James Watt's Invention according to the Plans and directions to be furnished bij the said Mathew Boulton and James Watt, their Executors, administrators and assigns for that Purpose, and shall and will also paj and reimburse to the said Mathew Boulton and James Watt their Executors, administrators or assigns all such Expences as theij shall incur or be put unto in providing Materials for erecting the said Engine pursuant to their Covenant hereinafter contained and paj the wages and Expences of the several workmen to be provided bij the said Mathew Boulton and James Watt and sent over to Holland to erect the said Engines as hereinafter mentioned. **And** the said Mathew Boulton and James Watt, for themselves their Heirs, Executors and administrators do Covenant and agree to, and with the said Jan Daniel Huichelbos van Liender and the rest of the Directors of the said Batavian Societij, their successors and assigns bij these presents that theij the said Mathew Boulton and James Watt, their Executors, administrators or assigns shall and will at their own proper Costs and Charges when therebij required bij the said Jan Daniel Huichelbos van Liender or the other Directors of the said Batavian Societij furnish and provide for the said Jan Daniel Huichelbos van Liender and the other Directors of the said Societij their successors and assigns or their agent or Deputij all necessarij directions in writing with proper Plans and Drawings for the setting up, erecting, completing, finishing, using, and working the Engine so intended as agreed to be erected as aforesaid. **And also** shall and will provide and procure at the Costs and charges of the said directors of the said Batavian Societij and of the said Jan Daniel Huichelbos van Liender in some convenient part of Great Britain proper materials for the erecting said Engine and proper and capable Workmen to go over and erect the same in such Place near the Citij of Rotterdam aforesaid where the said Jan Daniel Huichelbos van Liender and the other Directors of the said Societij shall fix and agree that the same shall be so erected; **And lastlij** it is herebij agreed and declared bij, and between the said Parties hereto that in case this present Instrument or Assignment shall not vest the said herebij or mentioned to be herebij assigned Patent and all Right, Benefit and advantage thereof in the said Mathew Boulton and James Watt, their executors, administrators and assigns fullij and effectuallij according to the true Intent and meaning of these presents and of the said Parties thereto that in such Case the said Jan Daniel Huichelbos van Liender and the said other Directors of the said Batavian Societij and their Successors shall stand and be possessed of the said Patent and all Benefit and advantage thereof and all Powers Priveleges and authorities to be derived therefrom. **In Trust** for the sole Use and behoof of the said Mathew Boulton and James Watt, their Executors, administrators and assigns until a legal and proper assignment shall be made thereof unto the said Mathew Boulton and James Watt.

In Witness whereof we have hereunto sett our hands and seals at the daij and Year aforesaid.

L: Bicker
P: Hartog
J: D: Huichelbos van Liender

S: de Monchij
Pieter van Swieten

Herm: Royaard (?)
A^{ij} De Raaydt } Witnesses

In Testimonium Veritatis
J: Th: Frescarode
Not^{ij} Pub^{ic}

HvL to JW 1786-11-17

AoS ref. MS 3147/3/505/20. Stamped 28 NO. Copy from Hist.Mus.Rdam. Transcript by R. Daalder.

Letter was forwarded to JW in Paris, with covering letter of Anne Watt on verso. The "Contract of Cession" (or "patent" as Anne Watt designates it) was delivered separately and has been filed in this compilation under its own date [1786-11-08].

The windmill reference would appear to be to a copper mine in the Parys Mountain region in N.Wales, where about this time a windmill pumping trial was conducted. The gentleman mentioned would then be from nearby Penrhyn.

M^f J^s Watt

Rotterdam 17th of November 1786

Dear Sir.

I am duly favoured with both Your Esteemed letters of 16th past and 1st of Curr^l and notwithstanding I have learnt by the last mentioned, you will not be in England upon the receipt of this; I thought fit not to loose this good opportunitij of sending over the contract of cession by â trusty person; which is followed litterally after your prescription by our Notary, who is accustomed to make contracts in English (when wanted here) just as in Dutch; and this act shall always be as authentick Legal and Serviceable in Holland as any Contract can be; and therefore it did not want to be translated; So many transactions are done here with England and Englishmen, that there are in this town three or four Notarijs who make acts and contracts of every kind in English and in the English waij. Our Notary was of opinion, it ought to be made in the name of all the directors of the Batavian Society, just as the Patent was given.

I shall with pleasure receive the drawings of the boiler seating and cause them to be followed strictly; with the walls of the flue, all will now be right, and as you have explained it.— It gave me great satisfaction that the castings for our engine were so nearly finished. I wish that all possible speed may be made in sending them off;— To the Cylinder of our former Engine was cast a strong flanch, at about one third of its length from the top. This flanch had four square claws with round holes in them, through which the Cylinder was screwed down upon the Cylinder beams, by strong Iron bollts, and has always been kept as firm, steady and immoveable, as he could be.

It will give me and M^f Bikker real contentement to receive, what you shall think proper to write about your Invented Engines. It seems you are obliged to pay â visit to that fine, strong and solid engine near Paris, of which I saw the foundations in 1779, and which in 1785 I wished to see in action, but was prevented â cause there was another pump adjusting to it. Perhaps it is now in disorder and the Messrs. Perier not able to cure it, and obliged to call for your help.— I wish you a prosperous voyage to the capital of France, and a safe return, and I remain with these sentiments

Dear Sir

Your very oblig: friend

J:D:Huichelbos van Liender

(Forwarded to Monsieur Monsieur (sic) Watt Monsieur De Lessart (?), Rue Coghiron (? no street of that or similar name found today) Paris, with following on verso)

Nov^r 27 1786

Tho I sent a letter by Mr Walkers box my Dear Jamie that will go by the same mail that this will I cannot omitt sending you this letter which I received to day by the coach with the draught of a patent from Holland signed by by *(sic)* L Bicker, S de Monchy, P. Hartog, Pieter van Swieten, J.D. Huichelbos van Liender, with each their seal affixed to the name & after In Testimonium veritatis of sh (?) Frescarode and another seal & two witnesses; it is wrote on stamp paper. I wish to know if I shall send it over to you or if there is any thing that can be done here before your return, if I can find a direction for Van Liender I will write him of its safe arrival. Since I sent my letter to Mr. Walker I received one from Liverpool saying that they had shipped 15 pieces of cast iron & 1 cask of goods for Mr. Steen on board the Swan for London the Bershram company had wrote Mr. Beckett that they would send from 15 to 20 ton of engine materials to be sent to Rotterdam in a few days a Letter from Hugh Jones saying he had received goods from Bershram for Burton upon Trent & wanting a remittance for his last account — I shall send his letter to Mr Pearson. I forget if I told you in my last that I saw in the news papers that a new Patent wind mill had been erected on a mine near Paryunel to raise water it is the invention of a Benyⁿ Hearne Esq. of Pinrin.

M^f Southern has just now told me that he has Van Lienders adress & will write him by this post with comp^t to M^f Boulton in which miss B. joins I remain

My Dear Jamie

Your sincere & Most

Aff. A. Watt

B&W (John Southern) to HvL 1786-11-27

AoS ref. MS 3147/3/170/8. Copy from Hist.Mus.Rdam. Transcript by R. Daalder.

The document JS refers to is not the Patent Specification [1786-05] but the Cession Contract [1786-11-08]

J.D.H. van Liender Esq^t

Birmingham 27th Nov^t 1786

Sir

Your favour with the specificat^{ns} of the Patent are received and safe; for your care of which our best thanks are presented.

Your cast iron materials will be ready to be shipped in about a week or 10 days time, of which you will have advice. The materials from this place are also gone or nearby ready to go, & a person will be with you probably before the arrival of them who is sent to erect the engine.

For Mss^{rs} Boulton & Watt very respectfully I am

Your most obedient serv^t

John Southern

B&W (John Southern) to HvL 1787-01-11

AoS ref. MS 3147/3/170/16. Copy from Hist.Mus.R'dam. Transcript by R. Daalder.

J.D.H. van Liender Esq:

Birmingham 11th January 1787

Sir

Yours of 2^d inst. is received, & we are truly sorry that you are not in possession of the materials for your engine before this; but I trust you will find that no avoidable delay has been committed with us, & I hope none with M^r Wilkinson. The day after the date of my last to you I received a letter from M^r Wilkinson's agent at Bersham which says "the cylinder for M^r van Liender having a number of holes in the inside we have been under the necessity of casting another, which when bored you shall be advised of dimensions &c". This was the cause I presume of the delay, at least the principal cause. About a week since we had the pleasure to receive advice of its being shipping at Liverpool, & I hope you will have received the Bill of Lading by the time this arrives with you.

Of the very same date of the letter from Liverpool that you mention (*viz* 16th Dec^s) a letter was addressed from a M^r James Roberts of Liverpool to M^r Wilkinson & has the following "a M^r Becket Broker here has applied to me to ship one engine by order from some person at Bersham. I should therefore be glad to know whether this is the one my friends write about". The gentlemen whom he calls his friends he in a another part of his letter calls "Mess^{rs} Coysgarne & Lloyds in Rotterdam". M^r Wilkinson sent the letter hither, and I wrote to M^r Roberts of Liverpool, that I thought it was likely to be the engine he alluded to, though I could not positively say so, because I had not been witness of any correspondence between Mess^{rs} Coysgarne & Lloyds & Mess^{rs} Boulton & Watt. For the latter gentlemen I subscribe myself,

Your very obedient servant

John Southern

We hope to have M^r Watt at home in the course (*of*) 7 or 10 days.

B&W (John Southern) to HvL 1787-01-15

AoS ref. MS 3147/3/170/17. Copy from Hist.Mus.Rdam. Transcript by R. Daalder.

Birmingham 15th Jan^{ry} 87 .

J.D.Huichelbos van Liender Esq^t

Sir

I have the pleasure to enclose you Bill of Lading of your Engine Materials from Bersham, shipped at Liverpool on board the Charlotte D. Carter, which we hope will arrive safe. I directed the invoice to be sent to you some time back, so that when you receive this you will be in possession of materials for Insurance. M^r Becket, the person who shipp^s our goods from Liverpool writes word that he has not lost an hour in expediting the business. For Mess^{rs} Boulton & Watt very respectfully I am

Sir your most obedient servant

John Southern

HvL to JW 1787-04-13

AoS ref. MS 3147/3/505/21. Stamped 17 AP. Copy from Hist. Mus. Rdam. Transcript by R. Daalder.

M^r James Watt
at Birmingham

Rotterdam 13th off April 1787

Dear Sir.

I am now no longer able to differ (*Ed. note: defer*) to write you, according what you had the kindness of promising me before you set out for Paris, I did expect long ago a letter from you, but till now I was only favoured with a postscript under M^r Boulton's letter of 24th february; by which you informed me that M^r Logan was to be sent off for here by you immediately, which likewise till now is expected in vain. What the cause of this disappointment may be, I am at a loss to conceive, and as we are now here at an end with th'Engine the working barrel or pump being put in its place having a height or basis of 45 inches under its rim, which leaves sufficient room for the surrounding water to enter it; and having fixed it as steady as possible and as sufficiently as wanted. The condensor cistern made and put in its place, the great leaver made and suspended on its gudgeon, the boiler readij; we know now not how to go further on, therefore I beseech you, to send us M^r Logan directly;— all the materials send off from Liverpool and Hull are received in good order, but I have not found the Barometer pipes, cocks & scales, nor do I know to have seen a fitting nozzle with double set valves, racks, sectors etc; likewise no valves for clacks or Piston of the working barrel, which it seems you will have made here.

By studijng and calculating, I find that the size of the Cylinder is rather big enough in proportion to that of the working barrel, and that even bij calculating the height of the water to be raised at six feet, which will very seldom be the case, everij square inch of the Cylinders area will not be loaded with seven pounds; (*Ed. Note: above the word "with" is clearly written a numeral 6, see note below*) which with Newcomen's construction could have been done at the same rate; I fear this will create a prejudice against your improvement by people of knowledge, everyone that understands the principles of the Steam Engine is able to make this comparison; and certainly the construction of th'Improved Engine, is more expensive than Newcomens. You will oblige me by giving me your reason for thus proportioning the two main pieces.—

If M^r Logan could not be spared for coming over here; I would wish that Jabez Carter Hornblower was still in your good graces, for sending him over. He knows how to go on, for instructing the carpenters and other workmen, understanding something of the language how it is, we must have one or other able man and ought to have had one since several weeks, because I have no time nor leisure to attend that business continually.

I remain with every regard

Dear Sir

Your m^t ob: H: Servant

J:D:Huichelbos van Liender

HvL's calculations mentioned are based on engine, pump and polder data which are difficult to extract with certainty from the letters or from [Bicker, 1800].

(1) For the steam cylinder diameter Watt initially uses 37" (6' stroke) or 32" (8' stroke); in [1785-03-29], reduced to 30" & 34" respectively (load 8.7 psi), in [1785-10-11] decision 6" stroke, 34" cyl, pump see below; in [1785-11-29] HvL agrees, but in [1786-05-31] mentions 36".

(2) The pump is 55" (Bicker, 1800 p47); earlier, Watt [1785-09-04] mentions 57.7" for 6' stroke, 50" for 8'; in [1785-10-11] 6' decided, pump less than 58"; in [1786-05-31] HvL agrees to about 55" or 56".

(3) The lift is max. 6' [1785-01-30; 1785-06-03]; from the sketch in [1786-07-?] a level difference of 5.8' is measured; Bicker, p39, mentions 5.5'; some variation is expected.

Assume steam cylinder 34", stroke (equal beam) 6', pump 55", lift 5.5'=66". Neglect piston rod areas.

The effective water column on the pump piston is 66", that on the steam piston is then $(55/34)^2 \times 66" = 173"$ equivalent to a pressure of 6.26 psi or an "engine load" of 6.26 pounds to the inch. With the uncertainty about the data, this is close enough to 6 to surmise, that the numeral 6 added to the letter is the result of Watt's check on HvL's calculation.

JW to HvL 1787-04-19

AoS ref. MS 3147/3/86/173. Copy from Hist.Mus.Rdam. Transcript by R. Daalder.

M^r Van Liender

Birm^m Ap^l 19th 1787

Dear Sir,

Yesterday we received yours of the 13th. Since I wrote you the short postscript I was obliged to go to London where bad weather & too much agitation of my mind threw me into a fit of bad health similar to that I had last year, attended with a kind of nervous asthma which for some time has much disabled me for business. I am now much recovered & when the easterly winds cease hope to get well. — When at London I wanted to have dispatched Malcolm Logan but he told me that he was not yet quite able to go on account of a very dangerous fistula in and which he had almost died of, but said the Doctor said he would probably be able to go in a fortnight which I hear has not been the case but that he is now able to set out & I have written positively for him to set out via Harwich if no other opportunity (*is?*) offered immediately, which I expect he will do, but if he cannot we must find some other. As to J.C. Hornblower, his very bad execution of the two last engines under his care is a sufficient argument against him if there were no other.

In relation to the load of the engine, you will please remark that one of the principle merits of our engine is saving fuel & we know by experience that at 7 or 8 lb. on the inch they will raise as many or more cubic feet of water to any determinate height by one bushel of coals as they will do at any other Load, & that Shadwell engine which makes almost the greatest performance of any of our engines is loaded under 8 lb pr inch. — That wide & short pumps give a greater resistance to the water than long & narrow ones provided the statical weight of the columns of water are the same in both cases therefore in the cases of wide pumps we never load the engine so much pr. inch as in narrow & tall pumps. —

That in your pump the water will probably sink in the well & rise in the lander or trough at each stroke which sinking & swelling must be added to the load of the engine & will probably lengthen the column at least one foot.

In short, my dear Sir, if you will believe that I have given every circumstance about your engine the most serious consideration, & have adjusted (*mak...?*) for the best according to my knowledge & experience you will do me no more than justice, and also that you will find that the engine proportioned as it is to the cylinder will raise more cubic feet of water p^t minute (by going more strokes) & with less coals than if it had been more loaded.

I am extremely vexed that M. Logan has not been able to set out sooner, as it deranges us in our business here, having more to do than than we have men to execute & having few who are so fit for your business or any other which requires judgement as he is, though he be a drunken fellow he is honest & ingenious.

I remain with great regard

Dear Sir

Your obliged servant

James Watt

HvL to JW 1787-04-27

AoS ref. MS 3147/3/505/22. Stamped MA 1 87. Copy from Hist.Mus.Rdam. Transcript by R. Daalder.

M^r James Watt

Rotterdam 27th of April 1787

Dear Sir!

I am now favoured with two of your much esteemed letters, one of the 10th of November Last Year, and another of 19th of this month. The first was handed me last Sundaj by M^r Malcolm Logan, who arrived then here to my great satisfaction; and according what you desired off me, I have boarded him decently in an English house, at a moderate price, very near were I live, so that we are able to communicate easily; one of our carpenters men having been prisoner in England last war time, serves him for an Interpreter, and that shall very well do, besides he seems very able to express his meaning by sketching it with a piece of Chalk;— by your last favour I saw with concern you had again a fit of bad health, but in the same time with pleasure your recoverij, which I heartily wish may be progressive and constant; I was surprised at what you tell me about J. C. Hornblower. When he was here in 1775 and 76 for putting th'Engine together, I have found him very clever, and it vexes me that you seem so much indisposed against him; I should wish greatly that I was able to reinstate him in your good graces and good opinion.— I take a complete satisfaction, whith what you please to tell me about the Load of th'Engine, and I stay fully persuaded, that you have calculated and considered every circumstance for the best of th'undertaking.— It is now by M^r Logan's desire that I write you these, because he is of opinion, that we ought not to risque, to work th'engine with the chains we have of the former Engine, because they are cast ones, and he wishes that you would order the four chains to be made of wrought iron under your eyes, and have them done and send off for here as speedy as possible. Therefore I pray you will forward that business, with the most possible speed and with everij care and attention. In which expectation I remain with great esteem

Dear Sir

Your m^t ob: H: Servant
J:D:Huichelbos van Liender

JW to HvL 1787-05-07

AoS ref. MS 3147/3/86/191. Copy from Hist.Mus.Rdam. Transcript by R. Daalder.

M^r Van Liender

Birm^m May 7th, 1787

Dear Sir,

I was duly favoured with yours of the 27th & immediately put in hand chains for the inner & outer end of the beam for the condensor & plugtree. The smith has promised to have them ready in 3 weeks, & no time shall be lost in forwarding them. I am glad Malcolm arrived safe & I hope continues better of his disorder, & that you will on all occasions favour him with your best advice, particularly if he should fall into his old vice of inebriety, by which he has too often observed excellent abilities. I shall write him a letter soon, meanwhile please tell him that he will dispatch the work as fast as it admits of & be particularly careful for your & our honour.

I remain with great regard, in haste

Yours

JW

HvL to B&W 1787-06-22

AoS ref. MS 3147/3/505/23. Copy from Hist.Mus.Rdam. Transcript by R. Daalder.

Mess^{rs} Boulton & Watt
at Soho Birmingham

Rotterdam 22th June 1787

Sirs!

According your favour of 10th May and your M^r Watt's letter of 7th of same month, I did expect many days or rather weeks ago advice of your having send off the chains and adjusting screws for th'Engine here. Your M^r Logan is nearly at a stand by lack of them; he is not able to fix the Cylinder in its place, without having the just measure of the chains links, and without fixing the Cylinder, many other parts cannot be adjusted; therefore I sollicit first in answer the just dimensions of every part of the chains you shall send off, and secondly that they may be sent off directly to London, and forwarded here by the first opportunity; there is nearly a month more lapsed than M^r Watt's letter did hope, they should be finished. M^r Logan has expected likewise in vain since all that time a letter from M^r Watt, as he had promised then.— In longing desire after those so much wanted and necessary parts, I remain with due consideration

Sirs!

Your M^t ob: H: Servant
J:D:Huichelbos van Liender

(on verso, probably in JW's hand, dimensions of chains, as communicated to HvL by letter 1787-06-28)

thickn			dist			pins
			centres			
1½ — 7/8	Great Chains	2¾ —	6	—		1⅝
1 — 5/8	Small	1⅝ —	4	—		1¼

JW to HvL 1787-06-28

AoS ref. MS 3147/3/86/214. Copy from Hist.Mus.Rdam. Transcript by R. Daalder.

M^r van Liender

Birm^m June 28th 1787

Dear Sir

Yesterday I had yours of the 22^d same. The Chains have indeed been a shameful time in hand. We could not do them in our own shop & were obliged to give them out to a Birmingham smith & the hurry of business in this town is such, that there is no getting any thing from these people but lies.

I was absent in London for some time & perhaps in my absence he was not so hard pushed, at last they came home, but so ill fitted that we were obliged to send them back by which a week was lost & after all they are such a rough job that, though strong enough, I am ashamed to send them. The screws we made ourselves, nearly of the dimensions of the drawing sent you, all is now packing up & will go off to morrow to London as you desire.

The dimensions of chains are as follows

Great chains: 2 chains for each end of beam, 6 inches long between centres of pins.— Pins $1\frac{5}{8}$ diar., middle stave $1\frac{1}{2}$ inches thick, side staves $\frac{7}{8}$ thick each, half breadth of chain, that is from the arch end to centre of pins, $2\frac{3}{8}$ inches.

Condensor chains: 4 inches long between centres of pins, middle stave 1 inch thick, side staves $\frac{5}{8}$ inch each, pins $1\frac{1}{4}$ diar., half breadth of chain $1\frac{5}{8}$ inches.

What I had to say to Malcolm was not very material & I have but time to save the coach to London. The past I missed while seeing after the chain.

I remain

Dear Sir

Yours very sincerely

James Watt

JW to M.Logan 1787-07-03

AoS ref. MS 3147/3/86/216. Copy from Hist.Mus.Rdam.

On the same subject of valve slapping, see also [1788-04-05] JW to HvL.

JW mentions a "water box" to provide pauses at the ends of the stroke; this would seem to be what is more generally known as a cataract. Opening a valve "gently" was often achieved by adding a friction element (wooden disks or planks) to the control mechanism.

M^r Malcolm Logan

Birm^m July 3^d 1787

Since you went away they have set London Bridge Engine agoing for a constancy & found the Clack slapp so much there was almost no living in M^r Till's house

I had advised them long ago to make a hole with a cock between the Bucket & Clack or below the suction pipe to let in some air, but it was never done, but on repeating the advice on this occasion they did it & the Clack was immediately silenced. It is much more difficult to silence Buckets in this way than Clacks as they require more air. In the Engine you are about the Bucket & Clack both will probably make much noise from this great surge, the best remedy is to make the regulator open gently & if possible to pause a little at top & Bottom of the strokes, for which purpose the water box I sent you a drawing of at London Bridge is a good thing, we have tried it at Soho. 2^{dly} to prevent the slap of the Clack 4 holes about $\frac{3}{4}$ inch diar: may be bored in the working barrel near the surface of the underwater & 4 copper pipes fixed in them rising up to some convenient place above the surface of the higher water with cocks there of $\frac{3}{4}$ bore by opening which more or less you will silence the Clack. As to the Bucket if it can not be silenced by the working gear, or in part by these cocks, I see no way except forcing a stream of air down a pipe to ender under the bottom of the pump, the quantity about 2 cubic feet pr. stroke & as this must be either continual or at the very time the bucket is at the lowest; it will best be done by a wide pump say 19 inches diar: & one foot stroke, with a piston raised every stroke by a rope or chain fastened to the outer end of the beam & pumping over a pulley so that in the last foot of the descent of the bucket this piston might be raised & blow its air into the pump. The same might be done by a strong bellows with the upper board sufficiently loaded, should avoid this if possible by regulating the working gear so as to make a pause, & care must be taken that the piston of the cylinder rise every stroke to or a little above the square pipe at top so that no water may remain, otherwise this regulation will be out of your power. The Chains went from hence last week & as we were obliged to give them out they are a very ugly job though seemingly sound enough, there are two for the inside & two for the outside. As to the rest I expect you will do your job to satisfaction & request that you may explain every thing to M^r Van Liender that he may be at no loss after you are gone, and also instruct the Engine man in the proper management of the machine.

At your leisure hours please to make some observations in the neighbourhood & if you can procure (*the?*) answers to the following queries — The length of stroke of the saw — The number of strokes p^t minute — The number of saws in each frame — how much the log advances p^t minute — the length of the saws — the size of the teeth — the thickness of the saws — how much wood they take out & the manner of stringing them

The size & length of the sails with the number of turns p^t minute in a moderate wind, with anything else you judge useful

I hope you have recovered your health & that you find things agreeable to you — I shall be glad to hear from you — I desire best respects to M^r Van Liender & remain

Your Obed^t serv^t
James Watt

Do you properly understand the gearing of the bucket & Clack I think I explained it to you if not please advise

HvL to JW 1787-09-07

AoS ref. MS 3147/3/505/24. Copy from Hist.Mus.Rdam. Transcript by R. Daalder.

M^r James Watt
at Birmingham

Rotterdam 7th of September 1787.

Dear Sir

Not being favoured with any of your esteemed Letters; notwithstanding it was mentioned to me by our mutual friend M^r John Enslie, that you intended to write me soon after his departure from Birmingham; these shall mostly serve to acquaint you that In th'Assembly held by the Directors of the Batavian Societij the 16th of July Last they with an unanimous vote resolved to offer you the qualification of their member correspondent and I have had the Commission of giving you due notice of this resolution, and that by the first opportunity the diploma of this Election shall be forwarded to you. I have differed (*Ed.Note: deferred*) to discharge this trust some weeks; In the only hope of receiving this promised letter; but shall now no longer refuse myself the pleasure of telling you the satisfaction we feel in having made th'acquisition of such an useful and honourable â member for our Society.

In my former letter to M^r Boulton you will have seen, what I did mention about M^r Logan and the steam Engine, with which in the end we hope to make a beginning of Experiments in some few days, having been continually detained by the Smiths. And hoping to give you a satisfactory account of the same, remain, In th'Interim with due Consideration

Dear Sir

Your M^t ob: Humble Servant
J:D:Huichelbos van Liender

(in another hand, probably JW's)

London

answered Sep^r 14th returning thanks to the Society mentioning reasons why I had not wrote him, wishing success to the Engine etc.

(addressed to:)

James Watt Esq^r

Corresponding Member of the
Batavian Society (.....)
at Birmingham

HvL to JW 1787-10-09

AoS ref. MS 3147/3/505/25. Docket: Octr 9th 1787. Copy from Hist.Mus.Rdam. Transcript by R. Daalder.

Dateline faded and unclear, could read 9 or 19; assumed 9 because of docket.

M^r Watt
Birmingham

Rotterdam 9th of October 1787

Dear Sir.

I was duly favoured with your very Agreeable letter of 14th last, and I saw with real pleasure your ready acceptance of the fellowship of our Society, the communication of which was very acceptable to th'other Directors. I saw the very obvious reasons you have of not being so very prone in writing letters, when not absolutely necessary, which therefore I must approve of, being very much obliged for your kind sentiments towards me, not wanting (I am sure) to protest you likewise with what perfect esteem I am filled for your mental qualities.

We have now in the end since some few weeks set th'Engine to work, and have now nearly brought it to its perfection as I suppose, Logan having made several alterations since its first trying it. It goes now since three or four days with an even pace, making 16 or 17 strokes per minute, and raising its water in good order. We are now busy to make experiments how many inches we can lower the water in the polder in a certain number of hours. I have communicated to your Logan what you have desired me to acquaint him with; and I am very well contented with his abilities, but I am sorry for himself, that he is so little master of his passions for that low vice of inebriety. He is quite addicted to it, and it will alwaijs prove his ruin; â great pity it is, that a man with such fine parts, is so much a slave of that misconduct. — This good success so far of our engine, should have given me great satisfaction, was it not that the political situation of this Country embitters now everything, and makes that every man of sentiment must lose all relish for anything of public concern. Since a month's time this Country has suffered a revolution, the like of which never was recorded in any history. Upon the point of getting the success of four or five years hard labour and struggle for an established free and pure constitution, there comes a foreign tyrant and overturns all, plunders and ravages every property, and obliges a great number of the first citisens to abandon their own Country, and to take refuge elsewhere. As it was for so many circumstances quite impossible for me to leave this Country on a sudden, I am one of those who have stayed behind by necessity; but I am firmly resolved to untie every band which now binds me to my native Country, being positively persuaded this Country is undone. I shall first loosen every commercial connection that I may be master of retiring, wherever I shall think fit; and as England has always had many charms for me, and as other friends of me talk likewise of retiring to England, but as to live in London, will not suit every one's fortune, I am sollicitated to inquire if in Birmingham it is possible to live decently with â moderate income. And this obliges me now to give you the trouble of answering some few questions, which I shall take the liberty to propose, hoping this letter may come to your hands in a time, you may have leisure and disposition of mind to give it the wanted attention. What I wish to know is; If there is opportunity in Birmingham to be lodged and boarded in private families upon reasonable terms? by Instance what would it cost, when â Gentleman and Lady with a men servant, wanted to have two furnished bed rooms and one parlour, and lodging for the servant, per three months or a quarter of the year? and be boarded in the same family, or otherwise have their victuals from â public house. What is to be paid for breakfast, and what for supper? And what you should think it would cost, If such a family by taking two maid servants besides, kept up their own household, and hired â house or an apartment in â house? And if you think it would be possible to be accommodated in Birmingham, if two, three or more such, or more numerous families, should take the resolution to retire thither? & If you should think that any other town in that part of England, Coventry, Lichfield, Shrewsbury, Chester or Manchester by instance, should be better calculated for that purpose than Birmingham? which nevertheless is not my opinion; If I well remember, the Environs of Birmingham are very pleasant, the town being populous and manufacturing, makes living there more consonant with Dutchmen coming from a commercial city, as in other places of less bustle; If it makes any real difference in cheapness to live in â town in that part of England, or in the Country? and should it be possible to be accommodated with the abovementioned desiderata in the Country?

To be favoured with an explicit resolve of those queries will be very grateful to me.

I give you heartily joy for the good success of th'Albion Mill; I have long desired to give a look at it; there will be an opportunity for me, I hope, in some few months. — M^r Enslie joins his best respects to mine, while I remain with every consideration

Dear Sir

Your M^t obed^t Humble Servant
J:D:Huichelbos van Liender

HvL to JW 1787-11-02

*AoS ref. MS 3147/3/505/26. Copy from Hist.Mus.Rdam. Transcript by R. Daalder.
Addressed to James Watt, 6 Green Lettice Lane, London.*

With the letter, R.Daalder found a sketch of a boiler, obviously sent with an earlier letter, almost certainly [1775-05-11] and thus filed there.

M^r James Watt
at Birmingham

Rotterdam 2^d of November 1787

Dear Sir

Yesterday I had the pleasure of receiving your very gracious answer upon my former letter and leaving till another opportunity all what belongs to th'Engine, I shall now only mention that Logan thinks to sett of for London in three or four days, our people making bold to manage th'Engine well enough.— And as my resolution is firmly taken to leave this Country next spring, I beseech you earnestly to give yourself the trouble, (when returned to Birmingham) to give another look over my letter, and a more explicit resolve (if possible) off my questions. For the remaining I wish you all the success of your Yaunt in Cornwall you may expect, and begging my compliments to M^r Boulton, I am with every consideration

Dear Sir

Your M^t ob: H: Servant
J:D:Huichelbos van Liender.

HvL to JW 1787-11-08

AoS ref. MS 3147/3/505/27. Copy from Hist.Mus.Rdam. Transcript by R. Daalder.

Logan apparently left for London shortly before 1787-11-16, carrying this letter for JW. In London he spoke to Mr Matthews in connection with another engine, and the latter writes to JW on 1787-11-23: "..... he tells me Engine at Rotterdam is very much approved indeed having been twice advertised in the papers there that it will only be required to work about 20 days p.annum Performs beyond their Expectations but that the Proprietors being Patriots have been obliged to leave Rotterdam for the present" [AoS ref: MS3219/4/103/40 via R.Hills]. As far as HvL is concerned, there is no evidence of his having left Rdam at this time. Enough Batavian Society people remained in Rotterdam to organize and execute the extensive demonstration programme described in [Bicker, 1800] and in the introductory essay of this study.

M^r James Watt
at Birmingham

Rotterdam 8th of November 1787

Dear Sir

Your Malcolm Logan intending now to leave this Country has desired of me to give him a line for you, by which you may be instructed of the time he has been here, and what money I have paid hem (*Ed.Note: hem is Dutch for him*); he arrived here the 22^d of April Last; and during the time he has been here, we were well contented off his conducting the business he has been send for, and I have paid him on account in several times the sum of two hundred guilders dutch currency, which sum is put to the account of Mess: Boulton & Watt. I remain further with every consideration

Dear Sir

Your m^t ob: h: serv^t

J:D: Huichelbos van Liender

(Ed.Note: following note in Logan's hand)

Sett out from London upon the 16th April
Arrived in London the 16th November
Expence of passage in going to Rotterdam & returning to London £ 6-6-0

Malcolm Logan

(enclosed account statement in James Pearson's hand)

John Daniel Huichelbos van Liender Esq ^t	
1787	To Boulton & Watt
July 4. To account transmitted	£ 66- 5- 3
Nov ^r 16. To Malcolm Logan's time from 16 th April to this date	
both days inclusive = 30 weeks 5 days a 25/	38-10-10
To expence of his Passage from London to Rotterdam	
and back to London	<u>6-6- -</u>
	£111- 2- 1

Deduct 200 Guilders Dutch currency paid to M Logan when at Rotterdam

JW to HvL 1787-11-15

AoS ref. MS 3147/3/86/264-265. Copy from Hist.Mus.Rdam. Transcript by R. Daalder.

M^r Van Liender

Birm^m Nov^r 15th 1787

Dear Sir,

Just before I left London I was favoured with yours of the 2^d inst^t Since I came home I have made some enquiries concerning houses &cet. On the subject of Boarding I have yet got no information except that a single man boarding in a good family pays from £ 40 to £ 50 pr. year, but that it is difficult to find a house that takes in Boarders & has the conveniences you ask. Neat new small houses in good situations, near me, with two rooms on a floor & cooking kitchen & other conveniences backwards let at from £ 20 to £ 24 a year. They are 3 stories high with cellar underground, parlours about 14 feet sqr. I pay 28 £ out for the house I live in, have 2 parlours & 5 bedrooms Kitchen & Brewhouse (?) & landry in a separate building, parlours one 15 by 18 feet, one 14 feet sqr. with closets off it. Rent £ 28, Poors rate £ 8, house & window tax £ 6-16, church levies £ 2-2. High way levies 14/. Man servant tax £ 1-2 for married family, 25/ for batchelors. Maid servants 10/6 each. Man servants wages from £ 10 to £ 20 per year. Maid servants from £ 4 to £ 12 a year & £ 1..1 (?) in lieu of Tea & sugar also livery clothes for the man servt. about £ 5 a year. Butcher meat about 4½ d. per lb veal & pork sometimes 4 — Bread 1½ pr. lb., fowls from 1/- to 2/- pr. fowl. Ducks same price, may in general be bought in the market from 1/- to 1/4 each, Rabbits 18d. each, a Goose about 2/6d, turkey 3/6 to 4/ Cod, fresh, about 6d pr. lb., salmon 9d to 2/- pr lb., eel 8d per lb., carp 10d to 1/ -, pike & perch the same. Butter 9d to 11d per lb., cheese, good, 4d to 5d pr. (*lb*), eggs from ½d to 1d each, garden stuff reasonable, candles at (...) to 10d per lb., being dear at present, mens shoes 6/6 pr pair, lump sugar 10d per lb., double refined 13d to 16 d. — Coals 8/6 pr. ton at the house.

I have now stated fairly to you the prices of most of the necessities from our house books, the (*Quantities*) to be assumed depend much on the station or ceremony of the Person, & the number of company he keeps. Wine I do not know the price of as I have bought none since the reduction of duties, but before that Port wine was 45 £ per pipe, but English claret is now sold as I am told at £ 35 per hhd (*Ed.Note:hogshead*), brandy from 8/ to 10/ per gallon of 231 cubic inches (*Ed.Note: this later became known as the US gallon*).

House rates, fowls, servants wages, poor rates, vegetables are certainly lower in towns where there is less trade, but Butcher meat does not differ much from what it is here, nor do many of the other articles. From what I have said you will be able to form a judgement of the expences of Housekeeping & I hope you will consider that if living is dearer here than in some other places, there is also more opportunities of getting money for those who dare to engage either in trade or manufactures.

I should add some more but fear I shall be too late for the post, but shall write again as soon as I get more information, meanwhile I remain with compliments to all friends

Dear Sir

Your most Obed^t serv^t
James Watt

HvL to JW 1788-02-12

AoS ref. MS 3147/3/505/28. Copy from Hist.Mus.Rdam. Transcript by R. Daalder.

The Kool polder mentioned is adjacent to the Blijdorp polder, for which the engine was erected — after heavy rains the polder asked for help, and an emergency drainage channel was cut to connect the two polders.

The performance data in the last part of the letter allow a rough calculation of duty:

- average lift 5 ft
- 16/17 strokes/minute (letter 1787-10-09)
- water raised by 55" pump at 7' stroke, 16 strokes/min c.100 cu.ft = 6200 lb/min = 372000 lb/hr
- 130 lb coal per hour is c.1.6 bushel/hr
- approx.duty $(372000 \times 5)/1.6 = c.1.63$ million ft.lb/bushel.

For a Watt engine this is not impressive, 2.5 million would be more like it.

The note at the end about the engine being "condemned and abhorred" as being a work of Patriots, pre-echoes the rejection of the engine by the polder as reported in [Bicker, 1800] and discussed in the glossary under "Keezending".

M^r James Watt
at Birmingham

Rotterdam 12th of February 1788

Dear Sir!

I am still indebted to answer two letters from Birmingham of the Month of November Last, the one of you and th'other of your Son. I acknowledge my obligation for the many Informations partipated by both, from which I see plainly that in every case I shall find in Birmingham accomodations enough to stay there for some time, or for a longer if it suits me; I am determind to leave this Country in the month of maij and to go over to England, but as all things in this country are still extremely embarrassed; and no dependance to be had, how they will turn out; I can only take th'above resolution conditionally, to know in case that publicq circumstances do not hinder me to leave my house, Manufacture, and merchandises under the care of another. It is at present impossible to sell anij effects than much below their common value, the number of Houses, gardens, Country seats, Lordships (*Ed.Note:probably manor, domain, seigniorj*) etc. now published for sale or to let, is uncommonly great; and with every article of commerce it is no much better, and for all these fine things we are indebted to our good friends th'English, who endeavour to enslave everyone; and keep theirselves free. But this will be better explained by mouth than by the pen, and as you will see I am not able to fix upon anij certain plan, I must leave every thing to chance, till I find an opportunity to come over, and as Intend to stay some weeks in London, there will be time enough to provide a Lodging for me in Birmingham;

I will now go over to give you a detail how we have succeeded with the Steam Engine. Since M^r Logan's departure besides some small accidents, two very heavy ones have befallen us. The first was that the Steam Valve was lifted out of the hole in which its pin slides up and down, and by the coming in of th'Engine the pin missing the hole pushed the iron bridge out of order, and broke two wooden pins in the working plug, one of the men standing by took hold directly of the geer and stopped all further mischief; It was afterwards found that the leather under the beam, who occasions the tumbling over of the leaver of the valve was wearied away, and thereby did fallen the beam lower than it must; the remedying this accident was accompagny with a great deal of trouble, nevertheless we got the better of it, and th'Engine worked afterwards as good as ever; th'other accident befell us in the beginning of the month of December, when some minutes after th'Engine was sett to work, th'iron rod of the working barrels piston was broken off even with th'upperside of the piston, this was a hard stroke; th'Engine was nearly out, by which the barrels piston did not given a great stroke, but th'engine came in with a terrible stroke; but very lucky without any material damage; the cause of this accident must be ascribed by the tearing away of the leather of the valves, and those valves hanging then lose, and not keeping the water, the piston is therefore unequally loaden, by which the loaded part of it shrinks, down, and thereby nips the piston rodd off the heavy wight of of the piston augmented by the column of water pressing unequally upon one side of the rod with the sharp edge of the piston, must it cut off at least this seems to us th'only plausible reason; and our great plague are those valves, of which the leather is in so short a time wearied away. I am afraid that we will be in the same predicament as the Carron Company were formerly, a friend of mine wrote to me in a letter from Borystheness (*Ed.Note: Borrowstouness or Bo'ness*) in 1780.

- = The Carron Compagny fire Engine's working barrel was only 52 inches Diameter,
- = and the Compagnij found the valves of the bucket and clack so difficult to
- = keep in working order, that they have of late by direction of M^r Smeaton given
- = up their 52 inches working barrel, and put in her stead four barrels of 26 inches
- = diameter. -

Nevertheless it would given us a great deal of trouble besides th'Expences to make such an alteration, we have now let made two valves in the bucket, and two in the clack with Iron hinges, so as those of th'Engine's working barrel at Haerlem are, which has the diameter of 35¼ inches, divided only in two valves or parts, and turning up and down by iron hinges, and had kept out now very well Since four Years, and we will see if those will do better, several of our valves in bucket and clack after the leather was teared, are struck in pieces, some of 'em even in two pieces, the column of water lifted up by every stroke is terrible. This circumstance is a great vexation for us, because without that, th'Engine gives entire satisfaction; and its triumph over the windmills is as complete as could be expected; our greatest opponents have been obliged to give us a publicq testimonium veritatis:

= That by the working of th'Engine the water in the Polder of Kool was lowered

= since the month of November from 16 inches above its Summerpeijl (*Ed.Note: i.e. summer level*)

= (when that polder was quite a Lake and totallij overflowed) to 2½ inches under the same peijl,

= which had been effected before the first of Januarij following.

which no mill in the world could have done in that time, and this th'Engine has done in about 12 days working; and we have found, that, after having kept a very regular account, of the coals burnt in five days and nights constantly working, she requires 130 lb. coals per hour, by a former account kept for five days and nights constantly working, it gave 133 lb so that the medium of those two quantities will be very near the truth. I should wish now to be informed, how this quantity of coals stands in comparison with other Engines of your construction and with those of the common or Newcomen's construction; we found a difference between one day and night and another, because there was a difference in the height, the water was lifted to, which runs from 4½ to 5½ feet, and gave a difference of 450 lb per 24 hours. Were public circumstances in another turn, than they now are, the Steam Engine would undoubtedly take footing in this country, but by being a work of Patriots it is quite condemned and abhorred. Besides there is not the least chance at present, that anij undertaking of publicq concern and utility can be thought off, nothing than private Interest and profit is now kept in view, and the publicq good is totally unregarded. I shall be very glad to receive your esteemed answer upon this letter, and remain mean while with every regard

Dear Sir

Your M^t ob: H: Serv^t

J:D:Huichelbos van Liender.

JW to HvL 1788-04-05

AoS ref. MS 3147/3/170/76-77. Copy from Hist.Mus.Rdam. Transcript by R. Daalder. B&W archive ref.: LB13/76b-77b

No copies found of the drawings mentioned.

Acc.to [1788-05-29], HvL received this while in Brussels.

Letter in the hand of John Southern.

About the valve slapping problem, see also [1787-07-03] JW to Malcolm Logan.

M^r Van Liender

Birmingham 5th April 1788

Dear Sir,

Your favour of 12 Feb^y came to hand while I was ill of a slow fever which has confined me and rendered me incapable of business for more than two months, and from which I am now recovering, though slowly.

I have taken the first opportunity of a clear head to consider the circumstances of your engine and to write to you, being (*most*) concerned at the misfortunes which have befallen the engine, though it is rare that new beginners with engines escape without something of the kind. — The accident of the piston rod may have been occasioned from the cause you mention, or from its being badly welded, such large pieces of forged iron being liable to be left unsound even from the hands of the best smith, but I hope (*you/we?*) are now guarded against a repetition of the same accident (*from?*) bad workmanship, and if it should happen again, the only remedy seems to be a larger piston rod, which if you judge nece(*ssary*) we can get prepared for you.

The valves of the bucket and clack are a more serious m(*atter*) and will be a subject of uneasiness to me until I know they are effectually cured. In all pumps of a larger diameter than eighteen inches they are found to be extremely troublesome. I exert(*ed*) our best skill to make yours as durable as possible, but it (*seems*) I have not succeeded. The iron hinges we have tried in some cases but not with the success we expected; perhaps they (*may*) answer better in yours. In some of the valves of the bucket, (*the*) breaking may be caused by the upper plate not being supported on the joint side by the piece of iron below it. In drawing N^o 1 on the other side is a section of one of the ribs of the bucket, sh(*ewing*) the method of supporting the plate on the joint side, upon the (...) of iron that screws the leather to the rib. The leather ought to be of the strongest sort and two thicknesses. The real cause of the frequent breaking of the valves is the quickness of the working of the engine, or rather the rapidity with which it changes its motion at going in and coming out; which would be remedied, if, by the management of the working gear, the engine could be made to stand a moment at the top and bottom of the stroke. Since your engine was set about we have had some trouble with another that has a wide pump, which though it did not break its valves yet slapped them so hard as to endanger the building and the best remedy we found was admitting a small quantity of air by a cock under the piston, which by mixing with the water, most wonderfully took away the slap. As the piston or bucket of your pump is entirely under water at the bottom of the stroke, air cannot be admitted by mere suction; it therefore must be pressed in by some external force; to effect which a method is shown in drawing N^o 2 wherein (**a**) represents a cylinder or working barrel 15 inches diameter having a solid piston made tight by leather and forced down by a weight fastened upon the rod (**b**) which is hung upon a pin on one side of the working beam. This weight by means of the piston condenses the air and forces it down the pipe (**c**) of 2 inches diameter which at (**f**) divides into 4 pipes of half that diameter (two of which appear in the drawing) that conduct the air to 4 different places under the water pump at equal interval from each other. Each of these pipes has a valve that opens upwards, permitting the air to pass into the water pump, but preventing the water from entering the pipes. The pump (**a**) which may be called the bellows has a valve (**g**) at its bottom 6 inches long by 3 broad, which permits the air to enter freely during the ascent of the piston, but prevents its regress that way during the descent. This will throw in about 2 cub: feet of air at each stroke, and considerably lessen if not wholly prevent the slapping of the valves; at least it has done so in every case wherein it has yet been applied. — If you approve of this, and you cannot readily procure the pump, we will get it made for you & sent. — As you do not mention the number of strokes I cannot judge of the quantity of coals whether too much or not, but if 16 as you formerly mentioned the consumption is very moderate. I shall be very happy to see you in the month of May as you mention, (*and*) shall be glad to know when you come to England, that I may look out for a lodging, but I will not engage it till you see it yourself. Below is copy of your account with us, which hope you will find right. I remain Dear Sir, with the greatest regard & esteem —

Your obedient servant
James Watt

(Ed.Note: account information on next page)

John Daniel Huichelbos van Liender Esq ^r	
1787 To Boulton & Watt	£ - s - d
July 4 th To account transmitted	66- 5- 3
Nov: 16 th To Malcolm Logan's time from 16 th April to this date	
= 30 weeks 5 days a 25/-	38-10-10
To expence of his journey from London to Rotterdam,	
& back to London	<u>6-6- -</u>
	£111- 2- 1

Deduct 200 Guilders Dutch currency paid to M Logan when at Rotterdam

As I am still much indisposed you will excuse my employing another hand to write y(ou)

HvL toJW 1788-05-29

AoS ref. MS 3147/3/505/29. Docket: About lodgings. Copy from Hist.Mus.Rdam. Transcript by R. Daalder.

M^r James Watt
at Birmingham

London 29th of May 1788

Dear Sir

My Sister and I arrived in this Town, since four or five days, in Compagny with another Gentleman and his two daughters, and with this friend we shall staj for five weeks Longer in London, when we propose to remove to Birmingham, and my friend to return back to Holland; so that in that Interim, I should be obliged to you, if you could find out an apartment for me, of two bedrooms and a parlour, (If possible) in a pleasant part of the town; to be contracted for by the month or by the week; If dinner and supper could be got in the house, so much the better, if not we must do as we do now here, and get it from any ordinary inn or tavern; Yesterday I had the pleasure of meeting M^r Boulton at M^r Matthews house, he has been so obliging as to go with me to the Albion Mill, and I have with great satisfaction previewed this Stupendous fabricq; The last favour of your house in dato of 5th May (*Ed.Note: obviously 5th April meant, see [1788-04-05] with the receipt mentioned*) was received by me at Brussels, and the receipt joined to it is fully sufficient.

I shall gladly receive your kind answer at M^r Thompson's, No.26 King Street, Coventgarden, where I am now Lodged, and remain meanwhile with every regard

Dear Sir

Your m^t ob: H: Serv^t

J:D:Huichelbos van Liender

HvL to JW 1788-07-09

AoS ref. MS 3147/3/505/30. Docket: About giving up his lodgings. Copy from Hist.Mus.Rdam. Transcript by R. Daalder.

Steven Hoogendijk died on 3 July 1788.

For the Kool polder see also [1788-02-12]; is this (written 5 months later) a different instance of emergency drainage?

M^r James Watt
at Birmingham

London 9th of July 1788

Dear Sir!

A verij unsuspected and unwished Event obliges me to write you these, and to beg you will be so kind as to release me from th'Engagement of th'appartment taken for me at Birmingham, and to pay for the time it has been kept ready for me; Instead of coming to Birmingham, as I intended to do in some few time, I am now necessitated to go back to Holland; my good old friend and acquaintance M^r St: Hoogendijk, having departed for th'Eternity last week at th'age of more than ninetij Years, and having me since many years made one of his Executors. I cannot evite to fulfill in that respect mij promise to him; It is utterly impossible for me to guess what time there will be wanted, to settle those affairs, but as I do not Intend to stay in Holland, when there is the least opportunity to leave it, I hope to be able to return hither before th'Autumn, and in that case desire you to provide again the same or another apartment for me at Birmingham; M^r de Monchij mentions that heavy showers of rain, having greatly inundated the polder of Kool, he has been earnestly requested to drain the water by means of our fire Engine, to which after repeated sollicitations he has consented, (the behaviour of that people towards us is not meriting such a condescendance) and that in the beginning the Clacks and valves being rusty, th'Engine did not work well, but this being remedied th'Engine has worked 24 hours in very good order, and drained that and the Polder Blijdorp quite sufficiently.— It seems as If Nature would help to show the people in Holland, what an advantage th'use of those Engines in that country would be.

In hope to be acquainted with the continuation of your good health, and begging my compliments to M^r Boulton I remain sincerely

Dear Sir

Your M^t ob: H: Servant

J:D:Huichelbos van Liender.

HvL to JW 1790-06-?

AoS ref. MS 3147/3/505/31, Docket: MYDRECHT Mr Van Liender Queries for Engine near Utrecht June 1790

The footnote (in HvL's hand) indicates that HvL submits these queries on behalf of another person or of a committee, most likely Prof. Rossijn as chief consultant to the States of Utrecht's Committee for the Mijdrecht drainage.

1°. What are thought to be the best Construction and most convenient size of a Steam Engine, calculated to raise the water out of a large drainage (supposing 2000 Acres) at the height of 17 or 18 feet ?

2°. And what ought In particular to be the Construction of its working barrel ?

3°. What would be the quantity of water raised by such an Engine everij hour ?

4°. What would be the cost of such an Engine ?

5°. Is it possible to have such an Engine readij In the spring of 1791, to the end that it majj be put together in the month of June of the same Year to begin its operation directly after ?

6°. As from the circonstances naturally attending drainages In general it follows that the water in the beginning only wants to be raised at a trifling height, which height increases, In proportion the water is lessened in the lower bason (*Ed.Note: variant spelling of basin*), it is questioned, which would be the best construction of th'Engine to make the most profit of this circonstance, without making any alteration to the foundation or other principal parts of th'Engine itself # and thereby obtain the desirable purpose of raising in the beginning so much more water as the height is lesser and afterwards that the raised quantitij may lessen as the height increases ?

by this is meant the building I suppose

JW to HvL 1790-07-08

AoS ref. MS 3147/3/87/232.

“If your engine comes in for a share...”: if the 1787 Blijdorp engine is re-erected at Mijdrecht. Eventually the Commission would decide on a single engine, which turned out to be insufficient, and then plan to add the Blijdorp engine afterwards, which project came to nothing.

JW’s caution not to tell the Utrecht States Commission too much, lest they might consider to “go elsewhere” with that knowledge, is also reflected in [1790-08-30; 1790-09-23]. When JW writes to Prof. Rossijn [1790-11-12] he does indeed restrict himself to the house and foundations etc., writing little or nothing about engine matters.

M^r van Liender

Birm^m July 8th 1790

Dear Sir

I have spent some time in considering the subject you stated, abstract of the result follows.

2000 acres are wanted to be drained, & height 17 to 18 feet; Rotterdam engine is stated as = to 1000 acres to the height of 6 to 7 feet; we have in the present case twice the quantity of water to be raised to nearly three times the height which implies 6 times the power — Or we must now have Engines able to work two pumps of 55 inches dia^s to 18 feet high at the rate of 12 to 15 strokes per minute

The best construction for the present purpose seems to be single Engine of 8 feet stroke in the Cylinder & 6 feet in the pumps working pumps as yours does. No other method has been sufficiently tried to be ventured upon to raise so much water to so great height.

If the height be 18 feet we must reckon upon 19½ feet on account of the water sinking below & rising above by the storm, a 55 inch pump 19½ feet high 6 feet stroke will require a Cyl^r of 48 inches dia^s 8 feet stroke loaded 8 lb per inch

The metallic materials of the Engine will cost here	£ 1580 - . -
an Iron boiler about	195
	£ 1775
And it will require 2 such Engines	£ 3550
If your Engine comes in for a share then it will require, besides 2 Engines of 44 inches cyl ^{rs} the cost of the metallic materials of a 44 inch engine	£ 1450 - . -
An Iron boiler	162
	<u>£ 1622</u>
2 such engines	£ 3244
Your Engine with an Iron boiler, Engine	£ 894 - . -
Boiler Iron	<u>76</u>
	£ 970 - . -

Sum of the 3 Engines £ 4214 - . -

From which you will see that it would come much more expensive by this combination than, by the 2 Engines on the other side, and if it could be done with one engine or a double Engine it would come still cheaper, but the enormo(us) size of the pump is a bar to either of these methods — at least as far as I see at present besides it would not be so convenient nor frugal: as when the water is moderate one Engine may be stopt entirely & the other would not burn so many coals in raising the same water as both would do

The above estimates comprehend the Cyl^r the boiler & all the cast Iron, hammered Iron copper & brass work of the Engine, the chains and other furniture of the beam, but comprehends no woodwork, nor any part of the pump or its rods, as the previous materials end with the chains at the outer end of the beam

I have put the boiler in a separate article, it not being determ(ined) whether it should be copper or Iron & if the latter, whether it should not be a little larger than one usually makes as pump eng(ines) in general seldom exceed 12 strokes p^r minute.

To the above costs will come to be added the foundation masonry & carpenter work of the house & engine with the boiler seating & chimney, also the pumps, pump well, & rods The pumps I cannot readily estimate as I have no copy of the invoice of yours, but by a rough calculation a 55 inch pump, bucket, clacks & rod will come to about £ 260 or rather more, but for these articles we shall deliver p^r Wilkinsons Invoice.

18/ p^r cw^l plain pipe & 30/ p^r cw^l bor’d work, & the mounting, if done here

The Engines could be got ready by the spring 1791 if soon ordered

Where a pump is used I know no method of profiling by the lesser height at beginning a drainage, in so far as regards the quantity of water raised, but when the pillar of water is lower less coals will suffice to make

the same number of strokes, & the engine may go a litt(*le*) faster to the charges must be added that of the workman who goes to erect the Engine, say about 25/ p^r week his charges, & a suitable present if he does his work to content but all this must be as we can agree with the man

My reason for preferring an 8 feet stroke is, that the losses of steam are less in longer strokes, and that the saving if any by making it shorter & wider would be very small The great article to attend to is the coals, & for that reason I have only loaded the Engines to 8 lb per inch as that seems most advantageous both for the (.....) & the quantity of work in a given time — The coals for a 48 inch cylinder will be at the best about 3 8/10 bushels of new castle coals p^r hour for 15 or 16 strokes p^r minute

I have now fully answered the queries without reservations, but I think it will not be prudent to inform your friends yet of the size of cylinders &c. or construction of pumps lest they carry our knowlege else where, only to answer in general thus in the present case it must be done with pumps & that the cost of engines will be as stated.

I know not whether the engines proposed may not be too large if you think so upon mature considerations please advise and I will recalculate. I intended to have made this letter longer but have so bad a headache I cannot & would not lose another mail

(EdNote: half a page blank in the letterbook copy)

as we cannot propose you should do our business without profit If the business goes on we shall allow you 5 p^r cent on the engine (.....) by the boilers & pumps we shall get nothing.

M^r B. is still in London, but M^{rs} Watt joins me in best wishes & kindest comp^s to you and to Miss van Liender, I shall be glad to (*hea*)r from you in answer & remain with very Great solici(*tude*)

Dear Sir

Your obliged friend

James W(*att*)

HvL to JW 1790-08-30

AoS ref. MS 3147/3/505/32. Docket: MYDRECHT. Stamps: P.PAYÉ PARIS, SE 3 90 and SE 3. Note on cover: from Calais.

The letter of 26th July mentioned, is missing (maybe lost as result of the franking problem), but a copy was sent with letter 1790-09-23, see there.

The Professor mentioned is Prof. Rossijn of Utrecht University.

The small engine "for my own use" would be a rotative, suitable for operations in HvL's white lead manufactory, hitherto probably performed by a horse mill, e.g. flattening or crushing sheets of corroded lead, or grinding the white lead product.

Paris 30th of August 1790

Dear Sir!

You shall be greatly surprised to receive two of mine letters very different in date at the same time but my dear Sir I never suspected, that any letter going from this Metropolis elsewhere was to be franqued to the frontier town, as to my great disappointment I have learnt since a few days; by my letter of 26th July you shall see, what I have wrote to Utrecht. Since that time I have received an answer from the Professor In which he desired me to write to you, and to beg that you would be so kind, as to send him a compleat dissertation and full raport and Exposition of your plan, With all its circumstances and dimensions of everij part, etc at the End that he might be able to Judge Iff it was well digested; which I have very civillij declined, and have given him the best reasons I could for not doing so; I have told him further, that If he thought, the proposed Engines were more powerful than wanted, or he wished, he had onlij to tell me, what lesser quantitij of water he wished to be raised every minute, and that then I should write to you, and we should let him have the cost or amount of those smaller Engines he preferred; or If in the Contrarij he thought better to emploij Engines of still more power, than those you had planned, he hath only to mention it, and that you would note me, to what theij would come to; upon this last letter I have not yet received his answer; I cannot think he shall write to you directly, If so, I should think the best would be to send him back to me, as it seems the Professor will make a Parade of his great knowledge in those matters by the States.

Before Yesterday I saw the Steam Engine at Chaillot, it gives 8½ strokes per minute and I found that this Engine goes out very quick, but that she comes in after a very long pause; the Weight at the outer end of the beam being too heavij; and wanting to be counterpoised at the inner end, whereby I should think an unnecessary waste of coals could be prevented; a second pump Cylinder and boiler is constructed and ready for working, but seems not yet wanted, at least it has not been set a going; two others of smaller dimensions are erected for other parts of this large town, but I have not yet seen them; a very large one is now erecting with four boilers, for grinding corn, opposite this of Chaillot, but I have had no opportunity to go there to see it.— When you do me the favor of an answer, please to mention what would be th^e Expence or cost of One of those small Engines, which you have constructed for emptying part of Birmingham Canal, without its pump, I think you have told me their power is equal to that of two horses, perhaps I shall want one for my own use In Holland, for driving a horse mill if not to Expensive.

My Sister joins me in offering our best respects to you and M^{rs} Watt please to remember me to all my very honoured friends, and believe me very Sincerely —

Dear Sir !

Your m^t ob^d Humble Serv^t
J:D:Huichelbos van Liender

HvL to JW 1790-09-23

AoS ref. MS 3147/3/505/33. Docket: Mydrecht.

The letter is preceded by a copy of letter 1790-07-26, the original of which has not been found (probably lost in the post)

Professor J.Th.Rossyn (or Rossijn) of Utrecht University was the principal consultant of the States of Utrecht for the Mijdrecht drainage.

HvL discusses strategies to secure his own position as sole agent, e.g. to prevent direct contact Rossyn-B&W and to give him only data on a "need-to-know" basis.

For the 1786 Commercial Treaty see the General chronology section.

For a narrative history of the Lunar Society see [Uglow, 2002].

M^r James Watt
Birmingham

at Paris 26th of July 1790

Copij

Dear Sir !

The day after I wrote M^r Ravée and desired him to give you my compliments, and to let you know, that I was lounging for a letter from you, I was very glad to receive Your Agreeable favour of the 8th of this month, I have directly made Use of its contents, to write to Utrecht which I have done fully to Your intentions, by giving only generals and no particulars; and notwithstanding you seems to have not well remembered, what I have stated as equal to the power of the Batavian Society's Engine, and that we have been bold enough after th'Experiment we had made with it, to offer to keep only an extent of Land of nearly 2000 Acres I have thought most adviseable to state, that

= the drainage of a Lake of th'Extent of 2000 (1000 mergen) Acres † and deep 18 feet, shall require two Steam
= Engines; which will cost together 3160 £ their two boilers 390 £St: the two pumps 540 £St: which sums I
= have reduced to Dutch currency, and that now was to be added Mason and carpenters work, bricks, lime and
= timber which it was impossible for a foreigner to Calculate, but that th'undertakers of the drainage were best
= able, to get those things made by Contract, and In the most Oeconomical manner; I have been induced to do
= this, because I know that after the general rule of drainages In Holland Eight Stout Windmills will be wanted,
= to effect this drainage, and that therefore If one Steam Engine is able to do the work of four large Windmills,
= this must to every impartial judge occur as a verij Satisfactorij advantage and full inducement to prefer their
= use for this purpose besides that it will be absolutely preferable, to have this first drainage done in a verij
= speedij and efficacious manner; and even with to large Engines, it will always be more acceptable to diminish
= than to increase their size; I have made a calculation that everij one of those Engines shall raise every minute
= 1200 Cubic feet (which with a 6 feet stroke and 15 strokes per minute they will do) and that by this product,
= If they can always and freely deliver their water, they will in about 15 months empty the Lake, which the
= windmills never can do in less than five years, this being another material advantage which we certainly may
= bring in account, I have greatly urged upon, as being in every respect one of the most essential advantages
= derivable from the use of the Steam Engines in those cases. — I must now animadverse that it seems to me,
that you have altered your mind, which undoubtedly originates from the result of your reflections and
calculations, as in my first letter to Utrecht I have wrote, in consequence of what you had mentioned to me, that
a greater number of small engines were more adviseable, than a small number of large ones; If you could have
adhered to this plan, the Society's Engine could have come in for â share, which I now see, must in this case be
totally excluded; therefore You must now think, what other use the Society maij make of the Engine, If we
could use it for any manufacture, by applying the rotative motion to it, this would very well fulfill th'intention
and disposition of Mr Hoogendijk, as by his will, he has charged us, to do our utmost to introduce those Useful
Engines in general Use; — If you had given me the same particulars of the 44 Inch Cylinders Engines, as you
have done of the 48th (*sic*) Inch ones, perhaps I might have stated them as sufficient for the purpose; but I could
not resolve to differ (*Ed.Note: defer*) mij answer longer, and write first to you thinking that If afterwards we are
of opinion, that the 44 Inch ones will do, we can easily find a plausible praetext, for this alteration of our
mind. — I shall now given you for Your Government the dimensions of the Dutch land measure. A mergen or
morgen; which contains 600 square yards rods or verges of 12 Rhymland feet length, this makes the surface of a
mergen = 86400 square Rhymland feet and as we reckon that 97 Rhymland feet are very near equal to 100

† by another letter I have just received from Professor Rossijn the real Extent of th'Intended drainage is 1100 mergen, within its boundary dikes.

English feet, the surface of a Dutch mergen will be 89072 English square feet, by which you may easily find, what proportion your acre bears to our mergen, by what I have stated now, you will be able to make a nicer calculation, and you will oblige me, by giving me your further Considerations, and th'other particulars of the 44 inch Cylinders Engines; this I wish to have, at the end, that if any remarks in answer upon my letter are made, I may be fully prepared, to give my solution of them.— And now dropping for this letter this subject and as I have already been more than a month In France and at Paris, I shall given you some few particulars, of what I have seen & observed here; from the first moment I came over to this Kingdom, I have found every thing quiet and very regular, and in as good an order as I have ever before known it at Dieppe Rouën and other places in our route, everyone returned to his business, and very well contented with the revolution, and expecting great benefit from it; the City of Rouën a very considerable place, greatly flourishing, at least it seems so to me, by the so manij exceeding good new houses, that were building all around in the Suburbs of that large town, a fine port full of merchantmen of their own and foreign Nations; and a large Commerce carrying on; In Paris I found the people more turbulent, public good order and safetij is notwithstanding quite restored; but the fear and jealousij of loosing any part of their conquered freedom and privileges, makes the people so exceedingly watchfull and attentive, that their zeal and animosity is as strong as ever, only it will not now bring them to such extremes as a Year ago; and the National guard is a bulwark, quite impregnable for any power in or out of the Kingdom that would venture to overthrow this new constitution. The same day we arrived in Paris, that memorable resolution was taken by which every distinction of Nobility, Gentry and citizen is abolished, and the rules of this resolution are so well observed, that nearly now no coats of arms are to be seen on the pannels of anij carriage, and Servants liveries, no more or very seldom appear; that solemn day of the 14th is passed over, with th'utmost tranquillitij and decorum, and as the foreigners, then at Paris, hath obtained a distinguished place, to see this Ceremony, I have been there with about 60 Dutchmen more, the greatest in number of the foreign Nations then at Paris; I have now hired a good Apartment In one of the pleasantest parts of the Boulevards, very near the Theatre Italien, for six months, and we find the situation uncommonly agreeable;

PSS: Please to remember me to M^r Boulton and all the honoured members of the Lunar Society. M^r Raveé will have let you know, that the hogshead of Bourdeaux Wine is sent of to Dunkirk and London, and will be forwarded from thence to Birmingham; be so kind as to think of the Balfour familij's genealogy; the several pamphlets desired of M^r Benij anout the fens, and the dimensions of the large beer Cask, Excuse the trouble.

Paris 23th of September 1790

Dear Sir !

Four days ago I had the pleasure of receiving your verij agreeable favour of 12th Current by which I learnt that my former letter of 26th July, was not forwarded to you. Wherefore I send you a copy of it with these, because I wish to have your opinion upon some points of its Contents, and besides that you would not have known what I had wrote to Utrecht by my first letter; It gave me Satisfaction, that our opinions about that matter coincided very well together, till now I am without any answer; I have taken notice of what you have mentioned about the Small Engines prices, when I am returned to Holland, and find I shall want one (as I think I shall do) we shall agree finally about it.— I was very glad to see both the Casks of Bourdeaux Wine for you and Mr Ravée were well delivered, when you wish to put the wine in bottles, It ought to have lain quiet at least a fortnight before In the place; and good care taken that the bottles are well cleaned and neat it will fill 270 a 275 bottles; I have not yet received th'account.— I see that the Summer diversions have made an interruption in your Philosophical meetings, but that all the members are well, and that no Philosophical News of any consequence was offering; Professor Charle a very able Physician here, has told me, that after some pains and trouble, he has been able to repeat the famous Amsterdam Experiment of the decomposition of Water; has Doctor Priestleij succeeded In doing it by the heath of the Sun ? as he intended to trij in the height of the Summer.— I see Doctor van Marum of Haerlem has obtained his wishes of visiting England, and that he was very eager to have a model of your Engine; it would be of no service in the Muséum at Haerlem, only for show, as no Lectures are given there; a working model of a small size could be of service in the Manufactories of Haerlem, and such a one he ought to have desired, with a view of introducing them in general Use; a model of th'Albion Mill can likewise be of no real service for him or his Countrij.— As what belong & how matters go on here, I must saij as well, as when I came here, the Strange Accounts you hear about them Originate in your Countrij. It is th'Interest of Your Ministrij to discredite as much as theij can the French Revolution; because theij are in a continual fear, that you may take a liking of it and follow th'Example of the French, in disabling them to do you more harm, and it is therefore that theij have kept you in a continual suspens since six months with the Spanish War to amuse you, and divert your thoughts another waj and by impressing for that purpose Your most useful hands, has done material damage, to your fisheries, Commerce, Shipping and mining, they write me from Holland, that even a great number of able miners are pressed; and in the same time they employ a good part of the produce of your taxes, In London, Amsterdam, Hambro, and perhaps at Cadix and Madrid

Likewise, to keep the course of the french change (*Ed.Note: the exchange rate of the French currency*) as low as possible to drain this Countrij of its specie; but be assured that this Countrij shall certainly overcome all this, and deliver itself ere long of that heavy Incumbrance, its Commercial Treatij with England, which is â ruin for it, and of which theij begin to complain loudlij; Your Ministry must already have found that they begin to explain themselves upon â higher tone than they have done since four or five Years; and certainly Your Ministrij shall promulgate as much as possible the rumour that the bubble is like to burst, to deter you from taking any interest In the French funds, notwithstanding theij given a better Interest than yours, are as well founded , and the French National Debt bears no proportion to the English one, in greatness; No my dear Sir believe nothing of all those fictions, the French go on softlij but surelij, and if you will examine without prejudice, the very wise sound and manlij advices and resolutions, that are given and taken by the National Assemblj, you shall admire them, and confess that they have now far outrun their Instructors th'English. It is inevitable that in so large a Dominion and where all those new regulations are more or less hurtfull to the private Interest of so many Individuals, some turbulent Spirits maij execute now and then anij commotions, but those cannot be of any consequence, and are quelled directly and constantly, as so many instances have demonstrated already. You will excuse me, that I have given such an extent to my answer of your postscript, but mine firm persuasion of th'Improbability, that anything of that kind should now happen, has carried me farther than I at first Intended.— My sister joins me readily in our best respects and good wishes to You and M^{rs} Watt, but we are quite uncertain when we shall have the pleasure of confirming those by mouth, and please ourself greatly In th'Expectation; Meanwhile I remain very Sincerelij

Dear Sir

Your M^oOb^dHumbleServ^t.

J:D: Huichelbos van Liender

HvL to JW 1790-10-21

AoS ref. MS 3147/3/505/34. Docket: Mydrecht

M^r James Watt
Birmingham

Paris 21th of October 1790

Dear Sir !

I had the pleasure of writing you the 23th of last month, and to send you mean while a Copy of my lost letter 26th July last; I am not since favoured with your desired answer. These shall principally serve to acquaint you, that a letter of Professor Rossyn received by me two daijs ago, gives me to understand, that = the **States of Utrecht** are finally decided, to make use of One Steam Engine of the construction of = Mess^{rs} Boulton & Watt, for â tryall at th' Intended drainage of 1100 morgen near **Mijdrecht**. and that the = members of th' appointed Committee for that purpose have desired him, to write to me upon the subject, at = the end that I would order one of th' Engines you have planned, and of which I have given them th' Expenses = or cost, to know (*Ed. Note: "to know" is a too literal translation of a Dutch idiom, meaning "i.e."*) one of 48 = Inches Diameter, to be made readij as soon as possible, with every thing belonging to it, as far âs is included = in the bargain you have noted me, and likewise the pump and Iron boiler. This is what I now desire earnestly from you, that the several parts of this Engine, to be made readij under your care, may be done as expeditiously and properly as possible, and th' others recommended to be done as carefullij and as soon as possible. So that this first undertaking for real and determined Use In Holland, and which has cost me so much trouble and attention since 14 or 15 Years to bring it to this wished point, maij further encourage to pursue it more and more; — The reason for which only one Engine now is to be erected, is, that theij are of Opinion, that if the Water was to sudden drawn back, the new dijkes would not be enough firm and consolidated, to sustain the weight of the pressing upper level water, and that perhaps one Engine shall be sufficient for keeping the drainage drij with the two mills that are now standing upon it, and who shall be altered from Scheprad Molens to Archimedes screw or Vijzel Moolens, for raising the water 8 or 9 feet high and If theij find one Engine not sufficient, theij are always master to put a second up. and besides that another Lake contiguous to this, is in agitation likewise to be drained, In which case, by the tryall of this first Engine â better determination for both drainings may be concluded on; The Professor desires now further to be instructed as soon as possible, what number of cubical feet of brickwork will be wanted nearlij for the foundation, building, Chimneij etc, at the end, to provide In time the necessary bricks, and to prepare the Lime etc; and a well drawn plan for the foundation, shall be wanted to be sent over as soon as possible, and I think absolutely necessarij to provide â foundation for a boiler and chimneij on both sides, at the end that whenever afterwards a new boiler is to be put up, instead of a decayed one, this may be done at another side, without any interruption of the use of the first one, because this being a publicq work, it maij never be liable to anij detainment.— You shall thus greatly oblige me, in sending both those desiderata, the cubical feet of brikwork; and the exact drawing of the foundation, a Mons^r J:Th: Rossijn, Professeur en Philosophie etc a Utrecht. and to send me the dubble or copij, that I may explain everij thing afterwards to him, and as everij measure will be English, the best will be to include the dimension of your English feet, cut exactly of good strong white paper, that he may be able to compare it with the Rhijnland measure, and make his calculation after this reduction.— The building will be a very singular one working â pump of such a length above water, the pump rod will be a very short one above the pump, the house standing so low, with its bottom in comparison of the bason or river in which the water is to be emptied; it will not be â verij easij work to make â good deep hole in a lake, to laij the piled foundation of such a building in, but that will be the business of th' undertakers, and I doubt not, or it will be done properly; for it will not be adviseable after having laid the foundations below the ground or bottom of the Lake as certainly theij ought to be, to raise a rock of brickwork of eighteen feet high or more above the water, and thereupon to construct th' Engine House; this would require an immense quantitij of bricks and mortar, at least I think this is to be avoided as much as possible; I beg you will be so kind as to join as much explanation to the plan as possible, and a great deal more even as you did to that of the Batavian Society's Engine, because every one there, shall understand so little of the matter. ⊕

Manij things will be wanted to observe in the **Mijdrecht** Engine, the building being founded and situated so low, it will be a difficultij before the drainage is compleated, to deliver th' Engine of th' overrun Water of the Cistern, and of the water that comes from the snifting clack etc; the cold water Cistern will easily be filled from

⊕ N:B: the pump ought at least to have a room of 12 feet square to deliver its water In or rather 12 and 15 feet.

the upper Level water, without any trouble, but then the superfluous or changed water and that from the snifting Valve shall be wanted before the Lake is quite emptij, to be pumped up and delivered over the dike In the Lake. perhaps you have alreadij met with like circumstances in other places; and that you will know another method to obviate this; but I think that we cannot use to much precaution and attention in this introductorij case; The Lever I think will be best to have made according your plan; If I was in Holland, I should prefer to have made it, after that of the Batavian Society's, but that will not now be Executable, therefore If you could give me the length and dimensions of the beam, that shall be wanted for it, theij might see at their leisure to provide one.

My Sister joins me readily in our best respects to you and M^{rs} Watt and I remain sincerely

Dear Sir

Your m^t ob: H: Ser^{ts}

J:D: Huichelbos van Liender

JW to HvL 1790-10-29

AoS ref. MS 3147/3/87/265-266.

M^r Van Liender

Birm^m Oct^r 29th 1790

Dear Sir

I write now merely to inform you of the receipt of your obliging letter of the 21st and also of yours of the 23rd Sepr which should have been answered sooner, but have been much taken up by removing to my new house & putting things in order there. I have also been much plagued with headaches which have disabled me from venturing into any making of calculations, and am at present under the influence of one — the Engine you order shall be immediately put in hand & as soon as plans can be digested they shall be sent to you & to professor Rossyn. I approve of the reasons which have induced you to order only one Engine, and perhaps with the assistance of your Engine it may be perfectly sufficient, as you think your pump equal to 1000 Morgen at 6 feet high it will be equal to 300 at 18 feet high. The reason of changing the small Engines into large ones was merely an (.....) of the greater expence of smaller ones to do the same work, which I endeavoured to show by the calculations I made including your engine

Another query arises whether it may not be best to build the engine house large enough to hold two Engines as the expence will not increase proportionally, as the Cylinders may stand within 5 or 6 feet of one another, this proposition we shall consider but in the mean time wish for your opinion, on the propriety by return of courier.

As soon as my head permits me to consider the whole subject I will write you fully

Mean while please accept my thanks for your kind communications respecting french affairs in the principal parts of which your sentiments & mine agree perfectly & I shall not be sorry to see P. (*Ed.Note: probably Prime Minister William Pitt the Younger*) displaced if one could get a better.

M^r Boulton & M^{rs} Watt join me in presenting our best respects to you and Miss Van Liender & I remain Dear Sir

Your obliged friend
& humble serv^t
James Watt

HvL to JW 1790-11-04

AoS ref. MS 3147/3/505/35.

*The reference to 28th Last is in error, the JW letter is dated 1790-10-29.
The Watt family had just moved into Heathfield House in Handsworth.*

M^r Watt
Birmingham

Paris 4th of November 1790

Dear Sir !

I was very glad to be acquainted by your Esteemed favour of 28th Last, of your having well received my last letter of 21th of the same but I was in the same time vexed to see that you are still plagued, with your old complaint the head aches of which I heartily wish you a happy deliverance;

I wish you and M^{rs} Watt much Joij with and In your new habitation, and that you both may enjoij it in good health and happiness for â great number of years.— I saw with pleasure, that th'Engine I ordered for the Drainage of Meydrecht shall be put in hand Immediately, and that the plan of the foundation as likewise nearly the quantity of cubical feet of brickwork that will be wanted for the building Chimney etc shall be sent to Professor Rossijn and me, as soon as they can be digested, which is verij well.— and it pleased me verij much, that you did approve the reasons, which have Induced the Committee to order only one Engine, which has been likewise my opinion, as I have mentioned to the Professor for Indeed we are to learn and experience manij things in this new application of the Steam Engines, and I should not be surprised that this one large Engine, perhaps alone, or with th'assistance of the Batavian Societij's Engine, shall do this required bussiness in full order.

What you proposed in regard of building th'Engine House large enough to hold two Engines, seems to me â most excellent Idea; and I should amplect (*Ed.Note: ≈ embrace OED*) it certainly; If theij hath adhered to your first plan of putting up two large Engines of 48 Inches; because we had then a known basis to work upon, and we could make a determined plan for its foundation and for raising the building In the same time equally; but now as it is quite uncertain of what size the second Engine, that will be employed, maij be, I think it shall give us no advantage, in that respect, as the foundation and building might be planned and constructed upon â larger scale, as afterwards would be found wanting, or perhaps the reverse as we certainly in this business want still more **Data**, but we may very well preserve the thought for a following opportunity; and give them now only what they wish; viz² a plan for the foundation of a 48 Inch Cylinder's Engine, and pumps of 55 Inches diameter, etc;— It shall given me much Satisfaction to receive your further consideration upon this, and every other part of th'Intended undertaking.

As a further demonstration of what I have mentioned in mij former letters respecting French affairs, I can now add the the remarkable rise of the price of their funds, and the falling of Yours, which is certainlij a very uncommon and unexpected Phaenomenon, but I can assure you that since the greatly applauded decrees of the National Assembly of the 29th of September for the Creation of the new assignats, matters are greatly altered to the better here, and commerce has got a new vigour, and the selling of the National States (biens Nationaux) fetching such unexpected high prices and far above their Estimation, that it is quite unconceivable;

Mine letters from Holland advise me that the king of Holland (*Ed.Note:sic! Prince Willem V, who was Stadholder!*) (Vassal of England) with his whole family and some other German despotes, and accompanied by the grand Pensionary of Holland, have been at Rotterdam the 20th of last month, for seeing the Steam Engine, and that they have stayed at it one hour and a half, and have seen th'Engine working to their utmost admiration and satisfaction, this will be â great recommandation for your Invention, and a certain means of further introduction. (*Ed.Note: see also [Bicker, 1800 p71-73]*).

Please to accept my Sisters and mine best respects and to offer them Likewise to M^{rs} Watt, M^r Boulton and family, and believe me always

Dear Sir

Your m^l ob:H^c Serv^t

J:D: Huichelbos van Liender

B&W to Rossijn 1790-11-12

AoS ref. MS 3147/3/170/196-198.

Month Octr in the AoS copy crossed out in pencil and replaced by Novr in similar handwriting (i.e. probably contemporary), which does agree better with the chronology in the letter book.

The drawings mentioned are not in the AoS letter books, copies may have been kept elsewhere in the AoS, but have not been searched for, as they would not fit in this compilation anyway.

The letter consists mainly of detailed instructions for the foundations, house etc., without much discussion of the engine. Eventually Rossijn apparently left the actual supervisory task to Dirk Smits, a Rotterdam surveyor and polder engineer (and member of the Batavian Society) probably brought in by HvL, and working with HvL.

M^r J:Th:Rossijn, Professor
of Natural Philosophy at Utrecht }

Birmingham Nov^r 12th 1790

Sir

Our mutual friend Mr van Liender having at your desire, directed us to propose for the draining of a Lake at Mydrecht One of our Steam Engines with a Cylinder of 48 English inches in diameter & 8 feet long in the stroke to work a pump of 55 inches in diameter & 6 feet stroke to the height of 18 feet, & to transmit to you drawings for the Engine house for the same, we now comply with that part of his request & send you enclosed 6 drawings of the house & pump well, as well as for the foundations, of the Brick work the Boiler stands upon. We begin our explanations with the section (coupe du profil) **V.F.** which with all the other drawings are drawn to a scale of one fourth of an English inch to each English foot of the real magnitude, & all the capital dimensions are marked on the drawings in English feet & inches, 100 of which are by M^r van Lienders authority equal to 97 Rhymland or very nearly so.

As it will be necessary to have a considerable depth of water under the Bottom of the pump in order that it may take in its water freely, we have allowed 3 ft between the wooden ring **B** which forms the lower edge of the pump & the platform **AA** on which it stands. And again the lower side of the Ring **B** is 2 feet under the low water mark, so that the wooden platform **A.A.** on which the whole building is founded will be 5 ft 0 inches under under the lowest point you mean to drain the water to which circumstance we beg your particular attention to, as any fault in laying the foundations of the well too high is irremediable; the foundations of the (*house*) we have made as low as those of the well, as we consider that they might not otherwise be secure. We do not pretend to direct you in the manner of securing the foundations that article being better understood with you than here. We wish however that it may be understood that it must be done in the most effectual manner so that neither the house nor the pump may give way by the shaking of the Engine. The wooden platform and the walls of the house as high or higher than the water will ever reach them must be made perfectly water tight, as otherwise the drainage of the leakages will bring on a perpetual expence of power besides being very inconvenient

Our first proposition to M^r van Liender was to make the pump working barrel (*corps du pompe*) 55 inches in diameter & 6 feet stroke but upon more mature deliberation we find it will be better to make the pump 8 feet stroke and 47½ inches diameter, which will raise exactly the same quantity of water per stroke & will have the advantage among others of making the two ends of the Balancier or working be(*am*) of equal length; but in order to give the water a freer passage we pres(*erve*) the dimension of 55 inches dia^s in the suction pipe or piece under the working barrel. The Beams **C.C.** are intended to steady the pump, & must moveable ind slitts or holes in the walls of the pump well until the pumps are put in when they must be wedged quite close up to the pump. The depth they go into the walls of the well will be seen in the Plan **UX**. The floor **DD** forms the bottom of what we call the Lander (& we believe you call the Stortvloer) which conveys away the water from the pumps into the canal or river it is raised to, this floor must be strongly supported by strong beams built into the walls & made perfectly water tight. We will give directions for placing these beams so as to admit the pumps, in future drawings. We have represented the wall of the well which joins the Engine house wall as only connected by Juxta position, but you may build them in one mass if you prefer it though we think that as we have designed it any cracks in the one will not be so apt to extend into the other, as they might do if one mass. The hole **E** is intended to discharge the superfluous hot & cold water from the cistern when the engine has completed the drainage below that point, in the mean time it must be effectually built up and that water discharged by means of a pump at the hole **F** shown.

In the Lever wall of the house (*mur du Balancier*) courses of Iron b(*arrs*) must be built in the walls at **G**. **G.**, in order to more firmly to tie the Brick work together each course consists of two barrs running the length of the wall & crossed at 5 places by barrs laid through the thickness of the walls (see **VK**) The dimensions of all the barrs or plates may be 3 inches broad and ¼ inch thick, & their ends should be bent down over the

outside and inside of the walls, One Barr without any cross barrs should run along in the middle of the thickness of each of the side walls & come quite through to (*the*) front & back of the house (see plan **VG**)

The lower part of the house as high as the Bottom of the door **H** will be filled up with the platform which supports the Cylinder, with the cistern & with the small pump so that there will be no space lost unnecessarily. The Cylinder Beams & spring beams may be of good Fir timber. The Cylinder Beams must have room to shift horizontally in order to admit the Cylinder. The pricked lines in the plan **VG** shew the width of the holes they lie in. The ends of the spring beams which rest in the house wall must be secured down or bolted to a piece of oak timber 6 inches thick and 12 inches wide built into the house wall & extending from 2 feet on the outside of the one beam to 2 feet on the outside of the other. At the opening in the lever wall through which the Balancier, or working beam works, a piece of the best oak plank 6 inch thick must be built in the wall as represented at the plan in **VF** & **VK** into this planking must be mortised about 2 inches deep the tenons of two upright pieces of oak plank of the same thickness, and cut out so as to let the spring beams rest upon them & to go up before the spring beams 2 inches thick. the upper end of these upright planks are to be spiked to the spring beams (see **VF**, **VK** & the Plan **VH**). You will please to remark that the spring beams are in no way to be cut out to receive the tops of these uprights but are to rest upon their shoulders as drawn. As to the roof of the house it must be made in the form drawn as there will be stays upon the back of the balancier which a beveled roof could not admit of unless the side walls were built higher. The tops or lintels of all the doors may be formed with strong pieces of oak & arches in the Brick work to take off the perpendicular pressure of the superior part of the wall — We have by Mr V.L.^{rs} desire provided for 2 boilers & to save expence have carried the Chimneys up together on the backside of the house. The Chimneys should be built with your best bricks and in the most solid manner working to the dimensions marked. The flues or tunnels for the smoke may be brought up from near the foundation & filled up with any Rubbish or sand to the bottom of the openings **KK** at which level they must be paved with a course or two of bricks. When the Engine is completed the charge doors **HH** may be converted into a door & windows each or shut with folding doors as may be thought convenient. We refer now to the plan **UX** which shews the foundation of the house, well & boilers. As the walls of the well may be subjected to support a great pillar of water pressing against them we have draw(n) them strong & sloping on both sides so as to be much thicker at their foundations than at their tops & have also added counterforts or buttresses to strengthen them still more. As we are ignorant of the circumstances attending the situation of the Engine house and well & know not whether it will be convenient for you to have the spaces **LL** on each side of the pump well in a dry or wet state during the time of the drainage, or whether you will bring the ends of the bank of earth or dyke, which is to keep the waters of the lake out of the Engine house & space about the boilers, to butt against or join to the walls of the well at **LL**, but even in that case we should consider the counterforts to be necessary. The Lander or canal which is to convey away the water is proposed to pass over one of the sides **LL** and therefore the center line of the Cylinder and pump should be parallel to the side of the canal or river which receives the water from the Lander. The nearer you can place the Engine house to the bank of the lake, the shorter, & better, the Lander will be; but at least 10 feet should be left between the foot of the bank & the outside of the brick work on which the boiler stands. There must be a strong gate or Sluice door upon the canal **M** which leads the water from the Lake to the well & the sill or threshold of that gate may lie its own thickness above the wooden platform as Dock gates commonly do, by shutting this gate you can at any time drain the well by the Engine & rectify any thing which may be amiss about the bottom of the pump or well. The Gate must be so constructed as to have a clear water way to the pump of 12 feet wide & 4 feet deep at low water, consequently there must be recesses made for it in the walls as usual in such cases. How far this canal should be prolonged from the well, as well as every other thing relating to the construction & strength of the walls of the well we leave entirely to your own judgement & that of other experienced persons on the spot. In regard to the boilers we have only marked out their foundations at present, in order to enable you to judge where piles must be driven and platforms laid. Each boiler seating will require about as many bricks as would cover the space marked out to about 8 feet deep. We propose that the bottom of the Ash pits should be on a level with the low water mark. The space where the provision of coals is to be, and the area round the engine house may be considerably higher say about 4 or 5 feet under the sill of the door **H**. As during the time of the drainage there will be some leaking of water through the (.....) with which you surround the excavation, there must either be a pump put in to raise that water, or a small tunnel or pipe laid through the walls of the Engine house to convey it into the well **J** made for the house water pump. This pipe or tunnel should be finished with a valve to shut it occasionally; but if the quantity of that leakage water is likely to be considerable, it will be better to make a well externaly & put in a pump to drain it than to permit it to enter the house — The dimensions of the area necessary to be embanked to contain the building we must leave to your own prudence only remarking that you ought to leave a clear passage round the ends of the Boilers, and at least 10 feet clear of the sides of them. we shall be glad to be informed as soon as may be convenient, whether you can make an excavation in the dry ground near the lake, for this erection, or whether whole must be formed by an embankment within it, and if you could accompany your remarks with a plan of the place & the relative situation of the canal or river into which you mean to discharge your water it would

make it more intelligible to us.

We send with this a slip of tin plate cut exactly to the length of six English inches or half a foot which may be of service to you in adjusting the dimensions.

The Drawings sent are **VF**, a section of the Engine house and wall. **VI**, an outside view of the back wall & chimneys. **VK**, an outside view of the lever wall (Mur du Balancier) or side of the house next the pump. **UX** a ground plan of the Engine house the pump well & Boiler seating. The house plan is taken on the level of the sills of the large Doors, the pump well at the top of its walls & the boiler seating at the level of their foundations

(Ed. Note: in the B&W letter book the ending of the letter is covered by a pasted-in flap containing a probably different ending which is given below and seen not to be contiguous with the preceding text; the original ending has been considered inaccessible)

necessary shall be sent as soon as we can get the drawings for the whole, which we wish to delay until we (*hear from you, least*) there should be occasion for any alterations.

Hoping to hear from you soon, we (.....) Remain, with much respects

Sir

Your Most Obedient humble serv^t
Boulton & Watt

HvL to JW 1790-11-15

AoS ref. MS 3147/3/505/36. Docket: Not fully answered.

This letter refers to calculations JW sent in his letter of 1790-11-07, which was not found in the AoS; this makes HvL's reply difficult to fully understand.

The "very ingenious expedient" Watt came up with was, after the drainage had achieved a certain depth, to replace the pump and its clack (i.e. a top cover with a number of small discharge clacks) by a smaller one, thus reducing capacity per stroke, but gaining lift, as one solution to the perennial lift/capacity problem facing initial polder drainage in the 18th century (i.e. draining a lake, as distinct from maintenance drainage with virtually constant lift). Watt planned a suction piece (a vertical flanged pipe of similar size as a working barrel) permanently mounted on a wood/iron cross support on the pump well floor, with its bottom flange somewhat below final polder level, and thus always immersed. The support structure (an iron cross on top of a wooden one) would allow the water to enter this suction piece from below. On the top flange of the suction piece either of a number of working barrels with its own clack piece could be affixed as desired. Note that [vdPols & Verbruggen, 1996] gives a different (but wrong) description.

As this letter shows, the idea (which, in its original form, HvL did not fully understand) can be extended. HvL suggests 60-62" and 47.5-48" and possibly the re-used Rotterdam 52" between. Eventually two pump barrels were made, 60" and 47.5" and the 52" was not re-used.

The Blijdorp engine, erected on an existing polder, did only maintenance drainage, so it did not have this problem.

M^r James Watt
Birmingham

Paris 15th of November 1790

Dear Sir !

Yesterday I was favoured with your agreeable of 7th Inst by which I saw you hath then not yet received mine letter of the 4th of this month which I doubt not or the following daij shall have handed you, and to which for the contents I refer myself. Answering now yours I think in the first place unavoidable to set one another to right in our calculations, I am verij certain that I have made no mistake In my calculations about the time, in which two Engines working pumps of 55 Inches diameter and giving 15 strokes of 6 feet length per minute, should be able to drain a Lake of one thousand mergen extent or surface, and 18 feet deep, for which I have stated about 15 months; so that with one Engine it will take about 30 months, and a sketch of my calculations hereunder will shew you that I am right. but Since that time we have learnt that th'Extent of the Lake is nearly 1100 mergen, this gives a difference of one eleventh part, and the Commission for the drainage will begin or try it with one Engine, this is another difference, both together shall bring it to 33 months; but mine first basis of calculation remains true; which I doubt not or you will find it so; About the height of th'Engine house It gives me pleasure, that the height you commonly make them for an eight feet stroke, will do very well, for the Meydrecht Engine If its foundation is laid equal or even below the bottom of the Lake as bij the Batavian Societys Engine we have 4,5 Inches distance between the pumps underflanch and the foundation or rather the floor whereupon it stands, which floor is 10 Inches above the common or general foundation of the building, and the Meydrecht Engine ought to be the same; If one Engine alone was to drain the lake it will take up (as stated above) 990 days or about 33 months, but In this drainage is to be considered, that the two Scheprad Mills, now standing at the Lake, shall be altered (as I have mentioned) to Vyzelmills to raise the water nine feet high, this alteration will be Done long before th' Steam Engine can be set a going, it is true those mills would do very little to th'undertaking, but we must notwithstanding take them in account as perhaps they maj encounter some favourable Saison and high winds, and in the beginning they will work very easij and dailij having to raise the water a much lesser height than afterwards; and therefore we must make our plan accordinglij In making use of the very Ingenious expedient you have thought of for employing as much power of th'Engine as possible; and I should therefore propose to leave out the 72 Inch pump and to make only use of one of 62 or 60 inches, to bring the water lower than theVijzels can reach, and afterwards make use of the Standard pump of 47½ Inches; If it will be not worthwhile to employ another of 52 Inches, for which the Cylinder of the old Batavian Society Engine could serve, which is cast and bored at M^r Wilkenson's works in 1774 or 75; and as the 72 Inch Cylinder you had in view, will not do, I think what I have proposed the more adviseable; and as it seems you have determined to employ for the Standard pump one of 47½ Inch diameter, and eight feet stroke and as I have mentioned in my former letter, that it will be most adviseable to lay the foundation for onlij one Engine; I should wish to have made out the drawing for that foundation and a rough calculation, what number nearlij off Cubical feet of brickwork the foundation and building will take, because if theij have that at Meydrecht they can go on with this most essential part, and we may in th'Interim dicuss at our leisure th'other points, and as soon as we have agreed, I shall write to the professor and explain to him our plan, and ask what resolution theij will take about it. In the case as I have proposed, the pump of 62 or

60 Inches with one bucket and one clack and the bucket of the 52 Inches barrel would be th'extra expence; notwithstanding I have wrote to the Professor after he has ordered th'Engine, that your plan was to emploij a Cylinder of 48 Inches and a working barrel of 55 Inches with a Stroke of 8 feet in the Cylinder and of six feet in the pump; I think it unnecessarij to write to him before I have your final determined plan in everij respect; and that in the same time you may surely go on with the pump 47½ or 48 Inches, as its upper part may be made apt to receive the ring for putting up a more or less wide barrel;— I am Indeed greatlij pleased and satisfied, that you have Imagined this most simple and very Ingenious method of making use of the greater power of th'Engine in the beginning of the drainage; ——— About th'Improvement in the hinging of the valves of the bucket of the Bat:Soc:Engine, I shall write to Rotterdam to have a sketch of it, meanwhile I think that for the bucket and clack of the Meydrecht Engine, you may follow the same plan as you have done, with the Rotterdam Engine; what you have added about a 55 Inch Suction pipe to remain alwaijs. & to Serve for all the 3 working barrels, is not verij plain for me, please to Illucidate that to me in your answer; Accept my and my Sisters best respects for you and M^{rs} Watt and believe me sincerely

Dear Sir Y^e M^t ob: H: Serv^t
J:D:Huichelbos van Liender

1100 mergen at 600 square rods
off 144 square feet
 2400
 2400
600
 Every mergen = 86400 square feet
18 feet deep
 691200
86400
 Every mergen = 1555200 Cubical feet
 of the lake 1100 mergen
 155520000
1555200
 The whole Content 1710,720,000 Cub: feet
 of the Lake
 to be divided by 1,728,000 Cub: feet
 that one Engine will raise everij
 24 hours is 990 daijs
 at 80 feet everij stroke
 or 1200 Cub: feet everij
 minute.

 = 1728000
990
 155520000
15552000
 1710,720,000

JW to HvL 1790-11-16

AoS ref. MS 3147/3/87/273.

M^r Van Liender

Birm^m Nov^r 16th 1790

Dear Sir

I am duly favoured with yours of the 5th Curr^l (*Ed. Note: probably 4th meant*) having satisfied myself by calculation that one Engine could entirely keep the lake dry, from rain water. I had dropt the use of two Engines before I received your opinion on this head — With this you will receive copy of this letter & drawings sent by last mail to M^r Rossyn. I have made no calculations of bricks as I am uncertain of their dimensions but any builder will readily do it from the drawings & at any rate this cannot err from having some bricks too many — I did not make any mention to M^r R of the scheme of having different pump barrels until I know your opinion, but you will see the largest pricked in Vf.

in your letters to them I hope you expressed yourself clearly as to the materials we were to furnish as Engine Materials say the whole Iron & brass work of the Engine & working beam, with an Iron boiler & its fire grates &^c Comprehending the chains over the outer end of the beam, but extending no further & containing no part of the pumps or this apparatus, nor any wood work whatsoever. The pump for raising the waste water will turn out very large much more so than our common cold water pumps. The Engines are undertaken by the piece or contract we furnish only the working barrel Bucket & Clacks of the cold water pump The suction pieces & plain pipes form a separate charge We shall furnish the working barrel bucket & Clack of this waste water pump though larger than usual, and the remainder of it must be a separate charge We wish for an answer concerning the large working Barrels as soon as possible, as until we have that & M^r R^s remarks on the plans we do not wish to proceed with ordering the materials least something should require alterations.

The measure of taking the assignats in payment of the national estates stampd a real value on them & was a very nice one.

I hope the visit of your Batavian king (*sic*) may produce good effects; but I would rather have the custom of an Opulent sensible merchant than of a King. I know what I am doing with the one because he knows what he is doing & because knows he must pay me or leave the exchange, but where is the lane(?) for Kings, Ministers I should say.

We have at last got the tidings of peace confirmed at which I am much rejoiced, for the end of war is death & Taxes the only things which we are quite sure of — with respects to Miss Van Liender I remain

Dear Sir, Yours sincerely
James Watt

HvL to JW 1790-12-16

AoS ref. MS 3147/3/505/37. With copy of [1790-11-15]. Misdoctored Novr. 15 1790. Stamped: DE 21 90.

Note on cover: affranchi jusqua Calais. Probably English postage note: 1/3

HvL fears the original [1790-11-15] was lost in the post, hence this (not strictly verbatim) copy; the original is in the AoS, however, so it must have turned up eventually.

Copij

M^r James Watt Birmingham

Paris 15th of November 1790

Dear Sir

Yesterdaj I was favoured with your agreeable of 7th Instant by which I saw you had then not yet received mine of the 4th of this month which I doubt not or the following daj will have handed you, and to which for the Contents I refer myself; answering now yours I think in the first place unavoidable to set one another to right in our calculations, I am verij certain that I have made no mistake In mij calculations about the time, in which two Engines working pumps of 55 Inches diameter and giving 15 strokes of 6 feet length per minute, would be able to drain a Lake of 2000 mergen extent or surface (*Ed. Note: one thousand in the original letter, maybe HvL intended to give figure in acres but forgot to change the unit*), and 18 feet deep, for which I have stated about 15 months; so that with one Engine it will take about 30 months, and a sketch of my calculations here under will shew you that I am right but since that time we have learnt, that th'Extent of the Lake is nearly 1100 mergen, this makes a difference of one eleventh part, and the Commission for the drainage will begin or try it with one Engine, this is another difference, but mine first basis of calculations remains true; which I doubt not or you will find it so; About the height of th'Engine house It gives me pleasure, that the height you commonly make them for an eight feet stroke, will do very well for the Meydrecht Engine, If its foundation is laid equal or even lower than the bottom of the Lake as bij the Batavian Societys Engine we have 4,5 Inches distance between the pumps underflanch and the foundation or rather the floor whereupon it stands, which floor is 10 Inches above the common or general foundation of the building, and the Meydrecht Engine ought to be the same; If one Engine alone was to drain the lake it will take up according my calculations 990 days or about 33 months, but In this drainage is to be considered, that the two Scheprad Mills, now standing at the Lake, will be altered (as I have mentioned) to Vyzelmills to raise the water nine feet high, this alteration will be done long before the Steam Engine can be set â going, it is true those two mills alone will do verij little to th'undertaking, but notwithstanding we must take them In account as perhaps they maij encounter some favourable season and high winds, and as in the beginning theij will work verij easij and dailij having to raise the water a much lesser height than afterwards; and therefore make our plan accordinglij, In making use of the very Ingenious expedient you have thought of for employing as much power of th'Engine as possible; and I should therefore propose to leave out the 72 Inch pump and to make use of one of 62 or 60 inches, to bring the water lower than the Vijzels can reach, and afterwards make use of the Standard pump of 47½ Inches; If it will be not worthwhile to employ another of 52 Inches, for which the Cylinder of the old Bat: Soc: Engine could serve; which is cast and bored at M^r Wilkinson's works in 1774 or 1775; and as the 72 Inch Cylinder you had in view, will not do, I think what I have proposed the more adviseable; and as it seems you have determined to employ for the Standard pump one of 47½ Inch diameter, and eight feet stroke and as I have mentioned in mij former letter, that it will be most adviseable to lay the foundation for onlij one Engine; I should wish to have made out the drawings for this foundation and a rough calculation, what number nearlij of Cubical feet of brickwork the foundation and building will take, because if theij have that at Utrecht, they can go on with this most essential part, we may at our leisure discuss th'other points, and as soon as we have agreed, I shall write to the Professor and explain to him our plan, and ask what resolution theij will take about it; In the Case as I have proposed, the pump of 62 or 60 Inches with one bucket and one clack and the bucket of the 52 Inches barrel would be the Extra Expençe; notwithstanding I have wrote to the Professor, after he has ordered th'Engine, that your plan was to Emploij a Cylinder of 48 Inches and a working barrel of 55 Inches with a Stroke of eight feet In the Cylinder and of six feet In the pump; I think it unnecessarij to write to him before I have your final determination in everij respect; and that in the mean time you may surely go on with the pump of 47½ Inch, as its upper part may be made apt to receive the ring for putting up a more or less wide barrel;—

I am Indeed greatly pleased and satisfied, that you have Imagined this most simple and very Ingenious method of making use of the greater power of th'Engine in the beginning of the drainage— About th'Improvement in the hinging of the valves of the bucket of the Batavian Soc:Engine, I shall write to Rotterdam to have a sketch of it, meanwhile I think that for the bucket and clack of the Meydrecht Engine, you may follow the same plan as you have done, with the Rotterdam Engine; I remain etc.

mij calculation is that 1100 mergen + 600 square rods + 144 square feet + 18 feet depth make 1710,720,000 Cubic feet water In the Lake, which divided by 1728,000 Cubic feet Water one Engine will deliver in 24 hours, gives 990 dajs for the whole Quantity.

M^r Watt

Paris 16th of December 1790

Dear Sir

I received In due time your favour of 9th of this month by which to my great surprise I learn that mine letters to you are not so safely carried, than yours to me;— I have punctually answered your letter of the 7th of November, the 15th of the same month, as you will see by the Copy above, I have put and franked myself that letter in the Post Office here, and notwithstanding that it has never been carried over, This is now the second letter under those I have wrote you from hence that has been lost, the franking of letters is an abominable thing, and serves for nothing than to make rascals of the postoffice clerks and there is nothing to be done against it. Your very agreeable letter with the drawings of 16th November I received In good order the 24th of the same month having laid some days In London; I saw by the same you had found my calculations right and that you had dropt your Idea of making the foundation for two Engines; I was greatly pleased that you had with so great a promptness forwarded the drawings to Utrecht, they have very much satisfied me, and I have directly translated those parts of your letter to the Professor, which regarded the foundation and have added my Explanation and remarks to them, so that they now shall be able to go on with this most essential part; You have done very well to give an area of 16 feet square to the platform Lander or Stortvloer, and to have put counterforts or buttresses against the walls of the well, because the weight of water raised by the pump being in a continual motion, is very apt to shake those walls and to endanger them, If not strongly build and supported. I have nothing mentioned to Professor Rossyn of the scheme having different pump barrels, as you will already have seen by the copy of my former letter;— I have certainly expressed myself clearly to them as to the materials you are to furnish them with as Engine materials; your letter to me upon that subject was very clear; and I have taken good care to follow your prescription literally; and your further explanation in this letter is quite consonant to it;— I cannot see or you may freely go on with the Cylinder and the Standard pump; the more so If you have upon receipt of these, no letter from M^r Rossyn; so as you could have had certainly long before, It is a (*se..ng?*) to me that he approves of your plan. I have desired him to send me a sketch and explanation of the situation on the spot and its environs, upon which they intend to erect the Engine, and that I should participate it directly to you, of this I am daily in expectation. Our best respects are offered to you and M^{rs} Watt and I remain always

Dear Sir Your m^t ob^d H^e Ser^t
J:D:Huichelbos van Liender

(Ed. Note: the following on the cover is in HvL's handwriting; JW mastered French, but why HvL chose to use that language just for a postscript, is unclear)

L'Administration des Eaux de Paris ou La compagnie Perrier, est a present dans une tres mauvaise crise, on trouve, quelle a su se defaire avec beaucoup de Prudence ou plustot d'astuce des $\frac{7}{8}$ de leurs actions, quelle a tirées a peu pres 20 millions du tresor public, pour un effet qu'on ne peut Estimer d'aucune valeur, puis que jusquici, Il n'a donné aucune benefice. Je n'ai jamais pu scavoir comment Ils on agé avec vous je suppose bien mal; ou avez vous eu quelques actions don't vous avez vous defait a temps? cest M^r de Mirabeau qui a bien su apprecier au vrai cette Entreprise.

(attempt at translation)

The "Administration des Eaux de Paris", or the Perrier Company, is now in a serious crisis. I have been found that they managed, with considerable prudence, or rather astuteness, to rid themselves of seven eights of their shares, and to draw nearly 20 million from public funds, for a result that is totally without value, as until now it has shown no benefits at all. I never knew how they acted towards you, quite badly I suppose; or would you have had any of their shares, which you have timely got rid of? Mr de Mirabeau has certainly judged this enterprise at its true value.

HvL to JW 1791-01-13

AoS ref. MS 3147/3/505/38a. Docket: Mydrecht.

Even though the location drawing, mentioned in the letter, has not been found, the letter contains some clues as to the site. It is on the east bank of the Amstel river, opposite Uithoorn, or some distance to the NE; from [1793-06-13] it transpires that the site is in the grounds of the Ter Schelling estate (see Glossary) on the east bank of the Amstel.

M^r James Watt
Birmingham

Paris 13th of January 1791

Dear Sir !

The ninth of this month I had the pleasure of receiving your verij agreeable favour of the 3th of the same, which conveys to me your further opinion about the use of pumps of different diameter for draining the Lake of Meydrecht more speedily; but a letter I have received some few days sooner from Professor Rossyn, occasions me thinking, that much of your labour about that point will be fruitless, because he mentions to me in that letter, that the difference between the highest and the lowest water in the river Amstel is three feet, and as the upper part or top of the clack of the working barrel ought to be at least 4 inches below the lowest watermark in the river Amstel, and the under part of the suction pipe one feet lower than the surface of the lower water, this circumstance leaves but 15 feet 8 Inches in all Rhymland measure, or 16 feet 2 Inches English measure, for the whole length of the pump or working barrel and suction pipe, and as I suppose that a stroke of eight feet length, shall require a working barrel of at least 9 feet 6 Inches length, the suction pipe will have only the length of 6 feet 8 Inches, and therefore in case of using pumps of different diameter, must serve for all, so that in my opinion the best would be to have a suction pipe of 62 or 60 Inches diameter, and to use two pumps first one of 62 Inches and afterwards the standard one of 48 Inches, and leave out the pump of 52 Inches, in that case One working barrel of 62 Inches with a bucket and clack would be th'extra expence, and would be afterwards a compleat working barrel for another opportunitij, and by calculating how much time this would save, we may be able to make a calculation, If it will be worth while to resolve on this extra expence; — We have made a wrong calculation by making the height of the water in the Lake 18 feet, it is but 14 feet 6 Inches at most, it is true, that when the Water in the River Amstel is at its highest mark, and the Lake drained to its lower watermark, that then the difference between both levels will be 18 feet, but this will rarely, and when it happens, th'Engine shall not be obliged to work, and when the Lake is drained, very seldom be In the case of raising the water 18 feet. If the Professor had given me sooner the difference between the highest and lowest watermark in the river Amstel (as I have desired earnestly from the beginning) this mistake would sooner have occurred to me; If the Standard working barrel of 48 Inches can be put in good order upon a suction pipe of 62 or 60 Inches diameter, I should think it will always be a very material advantage, to have the suction pipe of that large diameter; As M^r Rossijn in the same letter gives to understand, that by th'advice of the surveijors the surrounding bank (Ringdyk) will not be closed before the first of April, which before was determined to be done the 1st of Februarij, and that by the same advice it is resolved, to go on in the beginning of this undertaking very slowly, in the same view as I have before mentioned, of having the bank verij well consolidated before the water is drained awaij, notwithstanding I never before in other drainages have heard of this consideration, and that it seems to me of no value, because it exposes in the mean time that same bank to the ravages of the Waves bij stormij weather; it gives us so much more time to digest our plan, and as I have by the same letter received a good drawing of the spot its environs the river Amstel and part of the Lake, where th'Engine is to be constructed, I include the same herein, that it maij serve to your conceiving fully the situation, which seems to me to be a very good one and very well chosen, and will leave plenty of room about th'Engine for coalsheds and other necessarij buildings; Th'above related considerations (in mine opinion quite illfounded) I think will occasion a decline of adhering to our plan of using different working barrels because the Professor adds that theij therefore In the beginning only shall work with the two Vijzelmoolens, but theij are not aware of the time it will take up of putting th'Engine in working order, and besides that even in their case, it would be verij useful to have the building quickly finished, that the bricks and Lime maij very well cement together, which I should think of much more consequence than the consolidating of the dijkes, but this my supposition shall not hinder you (I hope) of perfecting your plan, and participating it to me that I maij laij it before the Professor and let not their considerations lessen the speed of making the Engine materials readij; I should think that it would be verij adviseable to have th'Engine house quite finished this summer, which I am afraid, shall not be the Case; — Th'explanations I have given to the Professor about the drawings you have send him, were that as you have planned the floor upon which the pump was to be put up, to be five feet under or below the lower watermark that by this determination (which was verij consonant, with what I had already before mentioned to him upon that head) the general foundation ought to be laid 23 feet below the highest watermark In the river Amstel, and that I should even prefer and advise to have it laid 23 feet 6 Inches lower

than said watermark; that the more room there could be made under the pump the better it should be, and that unquestionably the foundation of the House ought to be upon the same level, and verij well connected as one whole with that of the pump well; I have further the several dimensions of length and breath of the principal parts of the foundation, and that I was verij glad the Lander should have a surface of 16 feet square; and that the walls after being well dried and consolidated, ought to be filled on and covered at two sides with earth and rubbish, to strengthen them the more; and thus I should advise to have the Spaces LL kept in a drij state (this will now easily be effected) as likewise to lengthen both the sidewalls of the pumpwell forward, and to turn their ends or corners round about to the right and left for the better Influx of the polderwater, which shall always more easily flow about a round corner than a square one; In mij opinion the whole new made surrounding bank around the Lake was not wanted, If the old riverbank was only fortified more or less according it was here or there wanted, it should have spared â great deal, In common drainages with windmills such a ringdijk cannot be avoided, because the first sett of new mills raise or empty their water, in the dith or ringsloot, between the ringdijk and the old bank of the river; but in this drainage the water must be raised and evacuated over the ringdijk and ringsloot and through an opening in the old bank directlij in the river; — By the drawing you will see, that they maij given as much room around th'Engine house as theij please, and that they easily shall follow your prescription of leaving ten feet between the foot of the bank and the outside of the brickwork on which the boiler stands. I had mentioned that being now provided with your drawings, and mine explanations of them, theij were able to go on forward directly with digging out the hole at the mentioned depth, for driving the piles down, and laying the wooden floor for the foundation on them, and that it would be very adviseable to begin this latter part In the first daijs of februarij and finish the foundation in that month, and to begin the masonrij in the month of march, then the building could have been finished this summer, which I am afraid will now not be. If you have after having inspected the drawing, anij other observations or advices to add, please to participate them to me, that I maij forward them to Utrecht. — I have kept â copij of the drawing for mij own use; so that you may keep this I send you; I have advised them to consult th'Engineer, who has had the direction of the foundations of the Batavian Societij's Engine (*Ed.Note: i.e. Dirk Smits*) and who is a verij able and experienced man, in these matters, and theij have followed that advice, and send him the drawings and mine explanations.

I am very glad that the Bourdeaux Wine has given you satisfaction, the cask must not have been quite full, otherwise there must have been a dozen bottles more. My friend in Holland who has bought them for me, has not yet send me th'account of em, so that I am unable to let you know what its amount is; we have remembered Your and Your families health more than once, with â glas of Burgundij, for I cannot find here Bourdeaux Wine to my liking, I have tried manij, and I assure you we remember always with pleasure our staj of nine months In Birmingham.

I am not so conversant here with the French Chemici, I know mess^{rs} Lavoisier et de Foureroij very well, but I do not see them very often, we reside so far from one another; I am now here more in the Companij of the cultivators, being admitted In th'Assemblies of the Royal Society of Agriculture twice everij week; and where verij interesting memoirs about th'Oeconomical affairs of France are read and discussed.

I have foretold to manij of your Countrijmen who were so verij sanguine in the prosecution of the Spanish War that the best fruit of it would be a new burthen of taxes; to buy Nootka Sound (*Ed.Note: a waterway on the W coast of what is now Vancouver Island, Canada*) for more than 3 millions of pounds Sterling is really too dear, or it must given th'English In the same time, th'Exclusive priviledge of â NorthWest Passage from the Pacific to th'Atlantic Ocean; which Passage M^t Buache in a verij excellent memoir read before the the Royal Society of Sciences here supposes to be verij possible, and doubt not or is very well known to some of your first English Navigators.

My Sister is as well as I verij sensible of the kind compliments of you and M^{rs} Watt, which we return verij cordially to your both, and I remain

Dear Sir

Your Sincere Friend

J:D:Huichelbos van Liender

M^r Van Liender

Birm^m Jan^y 27th 1791

Dear Sir

I am fav^d with yours of 19th in due course. From which I understand, the height from the surface of the low water in the drains of the Polder, will be 15 feet under the low water of the River Amstel & 18 feet under the high water of the same river. And that the Amstel does not continue long at those extra heights, in which case it may perhaps be advisable to increase the dia^r of the pumps so much, that when the river is high, the Engine may be loaded to ten pounds on the inch & when low to 8½ lbs as I have proposed — 48 Inch Cylr at 8½ lbs = 15500 lbs at 20 feet high (allowing 2 feet for the swell and sinking below) = 48 inch barrel, & 15500 lbs = at 17 feet *(sic)* high = 52 inch barrel —

52 inch pump at 20 feet high = 18300 = a little more than 10 lbs on the inch, at which rate the Engine will work slowly say from 8 to 10 strokes p^t minute. But at the small height, the 52 inch pump, will raise more water than the 48 in the proportion of 7 to 6. And supposing such a larger working barrel to be applied as would be able to drain the water to 10 feet deep when loaded to 8½ lbs p^t inch such barrel would be 62 inches dia^r & the common suction pipe might be the same. Now the points to be determined are 1st whether the 14 feet 6 inches or 15 feet English is the height from the low waters in the drains of the Polder to the low water of the Amstel 2^d Whether the Amstel is so frequently in flood, as to cause any considerable retard in the drainage? 3^d Whether the Gentlemen wish to go on with such expedition as to need the larger pump?

The contents of the 62 is to the contents of the 52 as 17 to 12 in that quicker ratio would it drain the lake as far as it would go. The sooner these points can be settled the better as we shall give no order about the pumps till then, but shall go on at leisure with the Engine materials

In respect to the situation of the Engine house it must be left to them upon the spot, who must be best judges of convenience. (when they have the plan of the house before them) only that care should be taken to preserve a very free access for the water to come at the pump well. Therefore the Engine house should be built as far from the bank in front as circumstances will permit, unless the water is intended to be brought into the well sideways which I would not at present so well like, though it certainly may be done if necessary. I am very glad to hear that they are to get the Batavian Societys Engineer (*Ed.Note: i.e. Dirk Smits*), as nothing is like having a man of experience in such great undertakings. I thoroughly agree with you that they ought to be urged to complete & cover the Engine house this summer, without fail; for as you observe that if the bricks are not well cemented together a few rude (.....) of the Engine (which at first when it has nothing to do may readily happen) would break the bond of the bricks (.....).

If the house is got ready & they desire to go forward, the Engine might be got to work in the spring following, and the drainage go on with expedition; but we must go at their train.

Please to advise them to dig out room enough about the Engine house it will be wanted for various uses.

I find I am too late for the mail to day, so that this letter must remain till Monday, & in the interim shall add anything which occurs. M^{rs} Watt joins in comp^{ts} to Miss Van Liender and I remain

Dear Sir

Yours sincerely
James Watt

JW to HvL 1791-02-24

AoS ref. MS 3147/3/88/25

Bicker's letter to JW has not been found in the AoS.

One cannot but wonder whether JW is aware that the Mijdrecht engine in hand, is for the province of Utrecht and thus formally outside the jurisdiction of the 1787 patent.

In connection with the model, see also [1791-03-14].

M^r Van Liender

Birm^m Feb^r 24th 1791

Dear Sir

It is some time since I had the pleasure of hearing from you ——— Yesterday we had a letter from M^r Bicker your & our friend at Rotterdam informing us that they had sold their Engine to the States for a good price. And asking us to get them a model made for their museum with a rotative motion annexed to it, which we should with pleasure do but for the following reasons.

We never were so much pressed with business as at this moment having nearly 20 Engines ordered, not having men enough to make them in the desired time, & though we have repeatedly advertised have got very few additional, every department of the business of this neighbourhood being equally overpowered with orders. We could indeed employ a Mathematical instrument maker to make it but that would cost us much trouble in explanations & drawings & after we had instructed him, how would we be sure that he would not make models for others who were not our friends & injure us in our foreign business we should therefore be very loth to take that step. We have always resisted the making models to be placed in museums, being sensible that at best, they only served to gratify curiosity, and may set peoples brains at work to our prejudice.

We have full confidence in the present directors of the society, & were we to make them a model to be kept under key for their own informations we are persuaded it would be so, but can they answer for their successors, there may come Pharoahs who know not Joseph. Our exclusive privilege being only for Holland, & all the neighbouring countries gaping after our invention, should render us more cautious. We have been doubly injured by the attempts of ignorant men to make our engines .

They have deprived us of customers in the first instance and have injured the credit of the invention by making them badly. We hope you will see the force of what we have said & beg the favour of you to write to M^r Bicker & endeavour to turn aside from us this seeming evil, but if that cannot be done we shall certainly make them the model though with reluctance, & cannot at at (*sic*) any rate do it soon.

M^r Boulton begs to be remembered to you & joins me in best wishes to you & Miss Van Liender .

I remain in haste, Dear Sir

Your obliged friend

James Watt

HvL to JW 1791-03-14

AoS ref. MS 3147/3/505/39.

Dutch merchant premises often had a "front house" with business facilities (e.g. a shop) at ground level and living quarters above, and a "rear house" - often a warehouse, with maybe upstairs servants' quarters. The space between was often a garden of sorts, or additional space for storage. With successive extensions, this space often became a sort of atrium, which would eventually be covered over. Jan Jacob Elsevier was a well-to-do man and like HvL an outspoken Patriot. He was a City Corporation member and sometime alderman.

The Albion Mill, mentioned in the letter, was destroyed by fire on 3 March 1791.

Dear Sir !

Two of your esteemed favours are before me to answer viz^t one of 27th Januarij and one of 24th Februarij; by the first I have observed your last plan for increasing the diameter of the pump of the Meydrecht Engine in case the River Amstel does not continue long at its utmost or extra heights and to employ a large working barrel of 62 Inches to drain the Lake at the depth of about 10 feet, and the three points to be determined, for adhering to this new plan, I hope to receive the certain information about after M^r Smits th'Engineer employed by the Batavian Societij, shall have been at Meydrecht and examined minutely everij circumstance there; as I have begged him to do; I am verij glad that I have succeeded in mij introduction of him in this undertaking, because the people employed by the States of Utrecht, were not at all sufficientlij enough acquainted with the dangers and hazards of those perilous undertakings of laying good foundations at so great a depth below the level of the surrounding water; M^r Smits has given me to understand, that he could by no means venture to keep the first floor of th'Engine house on which the Cylinder is to be set upon; as low or so much below the level of the water in the river Amstel and of the water now in the Lake, the soil in that part of the Province being still more swampij and boggij than about Rotterdam; that he wishes to know If it is not possible to have it laid nearly at the same height in regard with the River Amstel water as that of the Batavian Societ^s Engine is laid in regard of the River Schie Water, that in case it was absolutely required to have it laid as low or deep as the drawings have planned it he would not answer for the bad consequences that unevitably should follw from it; and as I conceive that this your determination is not absolutely an unremovable point for the working of th'Engine, and that you have resolved upon this low determination mostly with a view of keeping the house as low as possible, as I had desired from you, I have given him libertij to raise this floor and the masonrij of the house so much higher as he should think absolutelij necessarij for avoiding any hazard or danger of this kind, only keeping in view to increase the thickness of the walls from their bottom or ground floor, that theij maij remain at least at the same thickness upon the height of the first floor, as now determined by the drawings, and to add one or two buttresses against every one of the sidewalls of the house, to add so much more strength, as the more loftiness of the house shall make it required; and if you have any other advice or remark to give or add, in regard of this alteration and of which the just dimensions will be mentioned in time, to what I have advised you will be so kind as to note them to me; M^r Smits is verij Angry, that the directors of that undertaking have not on the same time, of making the dykes, begun with laying the foundation for th'Engine house etc, because he is verij certain, that the whole execution of this drainage shall depend from the Steam-Engine, the two windmills shall do very little to it; he is gone the 2^d of this month to Meydrecht to take a close inspection of everij circumstance, and to draw the final plan for their direction, and shall acquaint me with everij part of it, and with their final determination about the use of different pumps after his return; M^r Smits is enough convinced of th'absolute necessity and utility of a free access for the water to come at the pump well, that he shall take care of providing it in the best way possible, as likewise of having the building raised and covered in If possible this summer; as the ground round about th'Engine house shall now certainly be filled up to the same level or nearly so with the present one there shall be plenty of room about the house for the varous uses wanted;

By your second letter I saw you had then received the letter of doctor Bicker to desire you to have a model of the Steam Engine made for the Batavian Societij, as they have disposed of theirs to the States of Holland; D^r Ten Haeff the Secretarij had mentioned this intention to me, without leaving me time enough before, for giving my opinion upon it, otherwise I should have spared you this requisition; I have now answered D^r Ten Haeff^s letters according your sentiment, and the matter shall rest there.

I am very much satisfied, that the States of Holland have bought th'Engine, because it shall certainly be employed for an useful purpose, for a drainage or any other object of the like kind which the more shall serve for th'Introduction of your useful Invention.

A very good friend of mine in Holland being in the necessity of having an open area in the middle of his house renewed, and wishing to cover it with sheet copper in stead of sheet Lead, as is the common method with

us, has desired me to given him every information upon it, that I maij, and as I have left every annotation about that matter In England, you will greatlij oblige me, If you shall be so kind, as to send the printed particulars with the different prices, so as I have had them from you in Birmingham, directed to J.J. Elsevier Esq^f Rotterdam.

I am extremely sorry for the great loss of th' Albion mills, for which I sincerely condole you , this must be â very vexatious circumstance now with you.

We intend to leave Paris at the end of this or the beginning of next month, but are not yet determined, If we shall return then to England, or stajj this summer In France in anij other part of the kingdom; your letters for me, may, till I mention otherwise, still be directed to Mess^{rs} van den Yver Freres & C^{ie} here; Accept our best respects for you and M^{rs} Watt, be so kind as to participate them to M^r Boulton and believe me always

Paris 14th of March 1791

Dear Sir

Your obliged friend
J:D: Huichelbos van Liender

JW to HvL 1791-04-14

AoS ref. MS3147/3/88/32.

M^r Van Liender

Birm^m Ap^l 14th 1791

Dear Sir

I should have ans^d yours of Mar 14th sooner but was obliged to set off for London immediately after I received it, & there I remained till the end of last week.

In regard to the Engine house you are right, our only reason for drawing it so low was to Save building (on the supposition that it was to be built in the bottom of the Lake). We therefore approve of the alteration & of the foundations you have added of thickening the walls below, But we hope that the pump well will not be abridged of any of its depth as that would be hurtful, and we shall be glad to receive a complete section of the building taken in the line of the working beam showing the level of the ground, the pump well to the bottom & that we may conform to it in the finished drawings. Please also say when the materials will be wanted.

I have not been able to procure a copy of the paper on Copper roofs I sent you, but shall write to M^r Elsevier what I know on the subject, which is that the least proper thickness of the copper is 16 oz to the foot (*Ed.Note: = c.0.5 mm*) price about 10½^d That the copper laid in place costs about 14^d p^t sq^{ts} foot measuring wherever the copper goes, that it is laid upon rough ¾ inch boarding or slight spars.

We have certainly suffered a great loss in the A.M. (*Ed.Note: Albion Mill*) which it appears was set on fire maliciously, though we have not yet been able to fix upon the (.....) as we could not get above half the value insured.

The extent of the loss is not yet ascertained (.....) an immense sum (*sum owing?*) us by the bankers which we fear will be badly paid. The worst is that our fall has been a subject of rejoicing to the publick, yet we have proved that in consequence of the Mill, flour has been sold ¾^d per sack cheaper on the average of the last 5 years than for the 12 preceding years which to the City of London has made a saving of almost £ 200000 p^t annum.

M^r B has never yet got any orders for a (.....) coinage but is doing a considerable one for the (.....).

We are now on the eve of being plunged again into another foolish war, which the whole nation execrates; because we can gain nothing by it.

M^r Boulton, M^{rs} W. and other friends join in presenting their best respects to you & Miss Van Liender wishing you health & happiness wherever you may be, & I remain

D^r Sir
Your sincere friend
James Watt

HvL to JW 1791-04-16

AoS ref. MS 3147/3/505/40.

M^r James Watt
Birmingham

Versailles 16th of April 1791

Dear Sir !

The 14th of last month I have wrote you and answered two of your esteemed letters; Since that time I have not been favoured with anij of yours, and referring myself to my said letter, I shall now mention what M^r Smits has learnt bij his ocular Inspection of the drainage at Meydrecht, after the draining shall have been perfected, the Land shall be 17 feet 1½ Inches below the highest watermark in the River Amstel, and the water ought to be kept in summer 1 feet 6 Inches below the surface of the land, this makes together 18 feet 7½ Inches, that th'Engine at most shall have to raise the water from level to level; the middling watermark being 1 feet 1½ Inches lower than the highest, leaves for the middling height, the water is to be raised to =17 feet 6 Inches and it is upon this middling or standard height M^r Smits advises us to calculate; wherefore I should think that it will be most adviseable to determine that the Standard working barrel shall not excede the diameter of 48 Inches, so as you hath planned in the beginning; this answers the 1st and 2^d points of your letter of 27th Januarij last, and in answer to the third point, shall serve, that the Commissioners of the drainage have resolved to make use of a larger working barrel for drawing of the first 10 or 11 feet with more expedition; those points so settled, You should be able to order the casting of the pieces for the pumps; Onlij Mr Smits has given me the highest and middle watermarks of the River Amstel not the lowest, which leaves us somewhat in the dark of the length of the different pieces, because the length of the suction pipe, working barrel and its clack when put up in the pump pit or well, together ought not to supersede the lowest watermark in the river Amstel, this I have mentioned to him and expect hereupon his answer; — M^r Smits has finally determined to raise the first floor of the house, and the whole upper part of the building in consequence 8½ feet English measure, of which you will be so kind as to take notice, for regulating the length of the great chains etc.— M^r Smits desires now to be provided with exact drawings of the brickwork of the underpart the ashpit furnace of the boilers etc., that those may be brought up and well connected with the capital walls of the building, likewise of the walls etc to be raised within the building for supporting Cylinder, cold water Cistern etc, to be likewise constructed in the same time with the building, because the constant drainage in wet weather of the hole In which the foundations off and Engine house itself are to be laid and erected, Is so expensive and he therefore wishes to be as soon as possible out of the danger of the water. Those drawings may be send to him directly, to M^r Dirk Smits Engineer and member of the Batavian Societij at Rotterdam and copies of them to me; — As it is quite impossible for M^r Smits to given a close attendance to this construction at Meydrecht, his principal concerns being in and about Rotterdam, he wishes to have th'English Workman to be send over, even If possible from the beginning; If Logan was returned from Naples, as he has been already Once in Holland, I should think best to send him over, and If he is somewhat cured of his drinking fault, it would be so much better — We are now since eight days in this place and think to reside here during summer, I could not yet wholly leave Paris and France, therefore this place being so near that Capital and certainly â very desirable summer residence, the Countrij and the Promenades being uncommonly pleasant, the air dry and very healthfull, and not plagued with that dirt or dust as in and about Paris, have induced us to fix upon it; we have here â very good apartment in the best and pleasantest part of the town, and not far from the Castle and Park, and find everything verij much to our liking; after having enjoyed for ten months the bustle and fracas of that very large, not smokij but terrible dirtij town of Paris; this serves us very well for an agreeable retirement; and as you know, we can at everij moment in one and a half hours ride, be transported to the great Town when wanted; — please to direct your letters for me to the former direction of Mess^{rs} Van den Yver freres & C^{ie} at Paris; to given our best respects to M^{rs} Watt, M^r Boulton and family and believe me always

Dear Sir

Your m^t Sincere Friend
J:D:Huichelbos van Liender

JW to HvL 1791-05-05

AoS ref. MS 3147/3/88/41

Birm^m May 5th 1791

M^r Van Liender

Dear Sir

I am favoured with yours of the 16th Ap^l I wrote to you on my return from London, approving of the alteration of the height of the building, which hope you have rec^d. We attend to the extreme height you give us of 18 feet 7½ inches english, and 17 ft 6 mean height with a standing pump of 48 inches, with a larger barrel for the first 10 or 11 feet which shall be ordered as soon as we receive the lowest height of the river Amstel — Drawings of the foundations & for the boiler seatings shall be made and sent to M^r Smits.

Logan is still at Naples and we have not heard from him for a long time but understand that he is a great favourite with the King there. We have no person about us who is capable of superintending the erection of the building, that very seldom falling within our province in this country, as most masons understand working to a drawing. We should hope Mr Smits has some foreman that he could depend upon, who from seeing the Batavian Societies engine could perfectly comprehend what was to be done & could direct the workmen better than a stranger and would also (.....) extraordinary expence or if any doubts are entertained of any thing not being well understood if a workman or rather foreman who understands English french or German is sent here we shall show him Engines & give him the necessary information concerning preparing the house for the Engine, which we do not consider a matter of much difficulty, such person might be useful afterwards in similar undertaking. When the Engine comes to be put together we shall send a workman for that purpose, at present we are very much straitnd for hands having many Engines now erecting.

M^r Boulton & M^{rs} Watt join me in best wishes for you and miss Van Liender, and are glad you are so pleasantly situated at Versailles, which we had the misfortune to see in bad winter weather & filled with a court, which made every thing disagreeable, especially when you add to that our being obliged to reside at very dirty & rapacious inn

I remain

Dear Sir

Your obliged humble serv^t
James Watt

HvL to JW 1791-05-16

AoS ref. MS 3147/3/505/41. Docket: MDT (Ed.Note: = Mijdrecht).

In the correspondence the Working Barrel, Clack and Bucket are discussed on several occasions. The working barrel is the pump cylinder; the bucket is the pump piston; the cylinder valve or clack can either be at the bottom end of the cylinder or (as here) at the top end. The latter is more convenient for maintenance, but in order for the pump to operate reliably it must always be completely covered with water, so that various conditions regarding the position of the clack and working barrel with respect to the river level must be considered. In the Mijdrecht engine these problems are slightly alleviated by making not a single or dual large clack, but a somewhat lower cover structure with numerous (8 or 10) small clacks around its circumference.

M^r James Watt
at Birmingham

Versailles 16th of Maij 1791

Dear Sir !

I was in due course favoured with both your esteemed letters of 14th of April and 5th instant; and saw by the first of them that you approved th'alteration, which M^r Smits has proposed to make in the height of the Engine House at Meydrecht; as likewise of the precautions I had recommended to take in thickening the walls accordingly; as everything shall remain, as you have planned it, except the height of the building, of which I have given you th'exact measure, and the pumpwell have the depth you have given to it; I do not think it absolutelij necessarij to have send you â complete Section of the building; If notwithstanding you do desire it, I shall write for it; I have since received an accurate scale and explanation of the different heights of the water In the river Amstel from Mr Smits (*Ed.Note: this is probably the scale found in the AoS with letter 1792-10-11; it has been kept & transcribed with that letter, it is not known with which letter it was actually sent*), from which I have deducted, that the whole length of the working barrel from the upper part of the wooden ring upon which it stands, to the upper part of the clack ought not to excede 18 feet Rhijnland measure or 18 feet 6½ Inches English measure; when the upperside of the clack by the lowest water In the Amstel, will be about 6 Inches, and by the highest 21 Inches under Water; it appears now that the difference in height of the water in the River Amstel is never more than 15 Inches; it being kept up on purpose with sluices; and this essential measure being now fixed, I wish you will order the pumps to be cast as soon as possible; and to mention to me what diameter the suction piece shall have, which shall be wanted verij soon, and its basis readij laid upon the foundation of the pumpwell; — M^r Smits mentions that the sinking or digging out of the hole, keeping it up firm and in good order, and drij for driving the piles, laying the foundation etc has been contracted the 15th March last for the sum of about 500 £St: and if this happily succeeds, then the greatest danger of the undertaking may be reckoned over but If the contrarij, it will expose us to great expenses, and very disagreeable difficulties; the bottom of this hole being 24 feet lower or rather more than the water In the river Amstel; and the ground weak and spungij; the 5th of this month theij will have contracted for the piles and timber necessarij for the foundation, and the driving of them and the laying of it, as likewise for doing the masons work by the thousand bricks; M^r Smits has abundantly thickened the walls of the building, taking for the lever wall 12 Utrecht bricks, for the other walls 7 ditto bricks and for the pumpwell walls 9 ditto bricks, being of 8¼ Inches length, being just equal to 8½ Inch English measure, so that the pumpwell walls shall be 76½ Inches English measure thick, which is 4½ Inches thicker, than in the drawing; They shall certainly have stipulated to employ a good number of hands for driving the piles verij Quiklij, and laying the foundation on them directly, when the masons shall begin their work instantly, so that I wish the drawings of the foundation, and for the boiler seating etc maij have been sent to him, and explained as much as possible, and that I maij receive the copies of them; to the end that the building and appurtenances may be run up without Intermission and brought under roof before winter; the only method for doing it without an English foreman, Is to make the drawings as explicit as possible, and to add copious explanations to them; because our architects are not accustomed to your manner of scaling the drawings; the Dutch are accustomed to put a scale to everij drawing, and to employ a pair of compasses; this manner is in my opinion not praeferable to yours, to whom I am verij well accustomed and which I like verij much; In the supposition that the building shall be finished before winter; it will be adviseable to have all the materials readij for to be send off for Holland about the month of September; only the Suction pipe must be sent of as soon as readij, because that may be put up as soon as the pumpwell is finished and readij to receive it; If the three parts of the working barrel, viz^t the Suction pipe, and the two different pump pieces, are to be cast at the same time, theij may be sent of together as soon as finished, but the Standard pump piece will not be wanted for a long while, it was therefore better to differ (*Ed. Note: defer*) the casting of this; — They have resolved to make the lever after the same method as that of the Batavian Society so that no particular drawing therefore of that piece shall be wanted; If the cold water Cistern could be made of â circular or oval shape, I think it should be made at a less expence, and easier kept

waterthight, we have been sadly plagued with the square one at Rotterdam, and our people can easilij make large round or oval liquor casks water thight;
I thank you kindly for the trouble In writing to M^r Elsevier about the copper roofs etc — As I see th'Impossibilitij of having an English foreman send over for superIntending the work, we must take patience and M^r Smits shall be obliged to make out other drawings after yours for them, to work after, and I shall write all th'Instructions I am able to give them from here. — We have likewise been formerly pleagued with dirty & rapacious Inns here, but we have already learnt, how we must govern ourselves In France to Evite those Evils, we are verij cleanlij and verij roomij Lodged, and cheaper as ever before in England or France; — Accept our best respects for you and M^{rs} Watt, as likewise for M^r Boulton & family and be assured that I remain sincerely

Dear Sir Your Very affect: friend
J:D:Huichelbos van Liender

JS to JW 1791-05-24

AoS ref. MS 3147/3/170/243-244.

M^r Watt

Birmingham 24th May 1791

Sir

I herewith send you drawings for Meydrecht. M^r Smits intends to raise the engine house 8½ feet english, there will therefore be 8½ feet to be built under what is drawn; or the piles & planking to (*be*) left 8½ feet higher than originally intended.

I would not pretend to advise which, & have therefore left that for you to speak about. I send you M^r Van Lienders letter that you may reply to any part you wish, and you may probably remind him about the gearing of the bucket.

M^r Cotes who has lately been here has informed me that he has heard that it was the intention of two several gentlemen in Hull to erect engines of B&W, but he had lately understood that they had desisted on account of the reports of the Albion mill. They understood it took fire from the friction of the fly shaft gudgeon, imagining that every engine was equally liable to the same accident have suspended their intentions at least if not dropped them altogether. I informed him that there was little doubt of its being set on fire maliciously; but at any rate that the gudgeon of any part of a mill was as likely to fire by friction whether it were turned by water or by steam; that it was an accident whenever it happened owing to negligence of the attendants, and not at all to the nature of the power.

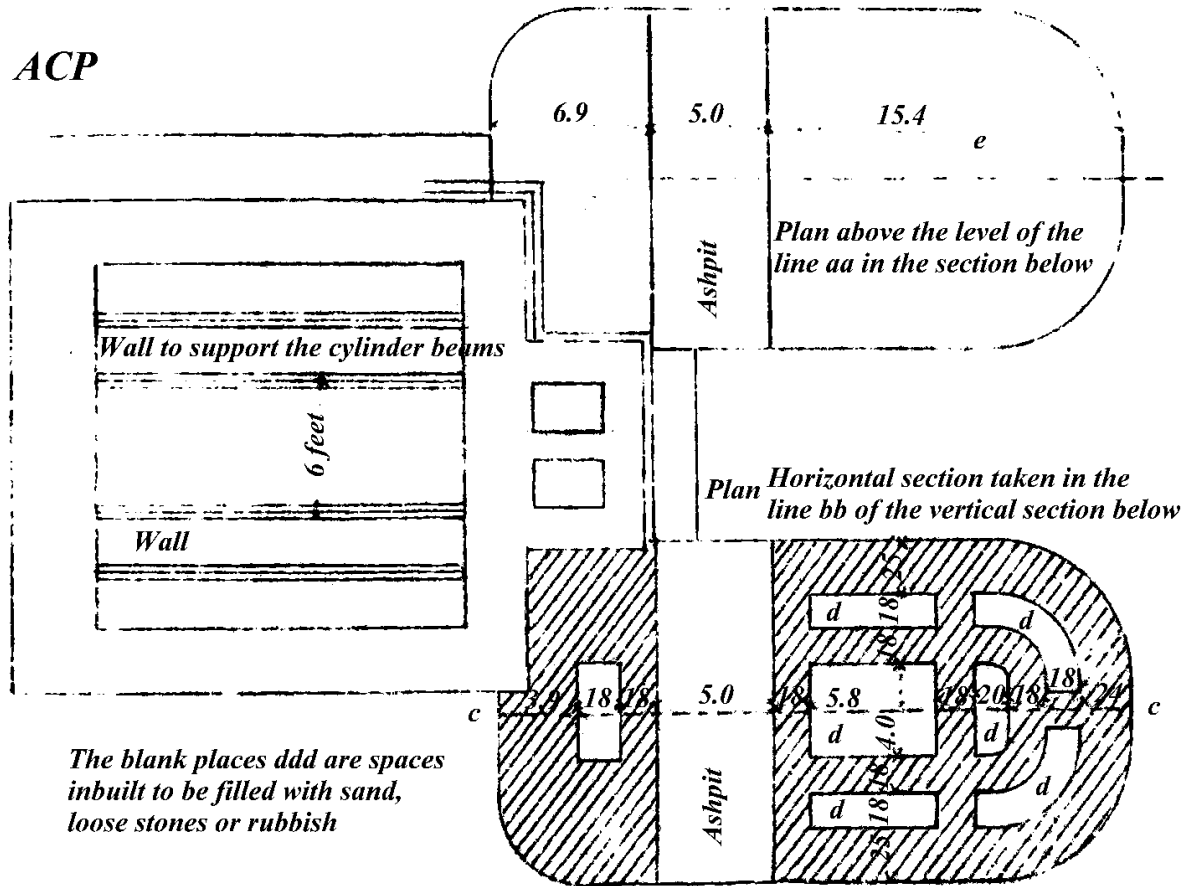
I asked him which would be the most likely method of controverting the prejudices of these gentlemen & he answered he thought the public prints by which they had been raised. One of the gentlemen he would strive to undecide as to the A.M. but the other he would not say any thing to as they were not on speaking terms.

I have thought it proper to mention this circumstance to you that you may take such steps as appear to you prudent. I apprehend that many people may from the several reports that have been circulated have formed various prejudices against the engine, which a well drawn up paragraph in the papers might very much abate. I should imagine that it would be right to state that the accident did not happen from the fire of the boilers as they were found perfectly safe & water in them, with any other parts that will tend to corroborate this assertion. That it did not happen from friction of the fly shaft gudgeon, or any other, the fire being discovered in 2 places nearly at the same time where no gudgeons were (if this be true as I fancy it is). What parts of the engine to remain unconsumed. — These & other facts & circumstances properly & clearly related I doubt not will do much good; at least I am of opinion it deserves your serious thoughts.

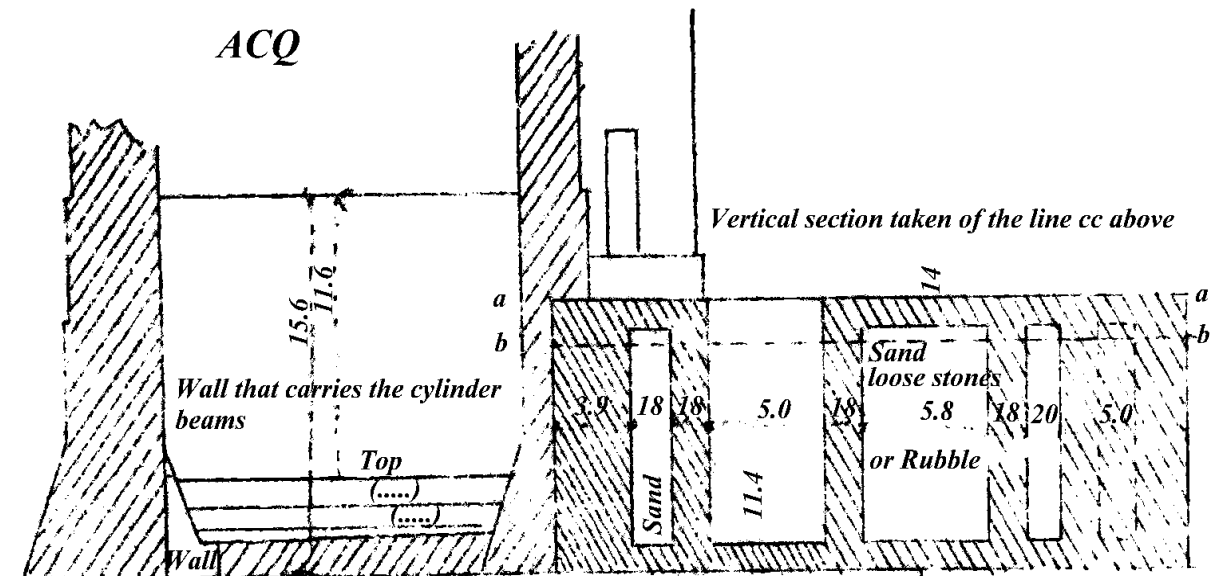
Isaac Perrins has written to his wife that he shall soon be at home; M^r Forman(?) wishes him any where rather than in the yard. might he be sent to Ockerhill instead of Varley. With respectful comp^s to M^r Boulton I remain

Sir Your mo: obed John So(*uthern*)

ACP



ACQ



This line is said to be (in the former drawing VF) the upperside of the planking above the piles

The horizontal & vertical sections of the boiler seat, shew the disposition of the walls that support it, which are to have a firm foundation, & the spaces are to be arched over to make the platform as shown, e, e, in which state it is to remain until the boiler be set.

23th May 1791

JS to JW 1791-05-27a

AoS ref. MS 3147/3/505/42. Docket: MDT cistern etc. Addressed: James Watt Esq^r, at William Matthews Esq^r, No 6 Green Lettice Lane, London.

M^r Watt
Sir

Birmingham 27th May 1791

I was favoured with yours of 25th which came too late to be observed relating MDT drawings (I having sent them on the 24th) further than what I herewith send.— I have on y^e other page drawn a scale that will apply to the drawings of the boiler seating sent you, except so far as copying may affect either one or other. The scale if cut in the midline will form two, one of which for each drawing, if you chuse to send it under the uncertainty arising from expansion &c &c of copying.

I have likewise made a sketch (to a scale) of the cyl^d air pump condenser, in an oval cistern, which, if you approve, directions may be given for, by desiring the figure to be a true oval or nearly true of 8 feet 8 by 6 feet 4 english measure & 7 feet deep; all inside dimensions. It must either be made in the house, or in pieces small enough to go in at the door, as it cannot be taken in whole. The sketch is intended for your inspection only, unless you chuse to send it likewise; — I observe what you say of Thorn H(....)

It did not escape my recollection that a letter per post would come to your hands sooner than per coach, when I wrote relating M^r Denison; but I had not time on the day he came (friday) before the post went off, as they M^r D. & M^r Stokes stay'd till near two o'clock — The next day, saturday, I also recollected that there was no post, & had I delayed till there was, it must have been monday morning before you could have had my letter. Though M^r Denison's order was positive, yet I thought that there were some circumstances attending it that merited more speedy attention, on several accounts, than a two days delay could indicate.

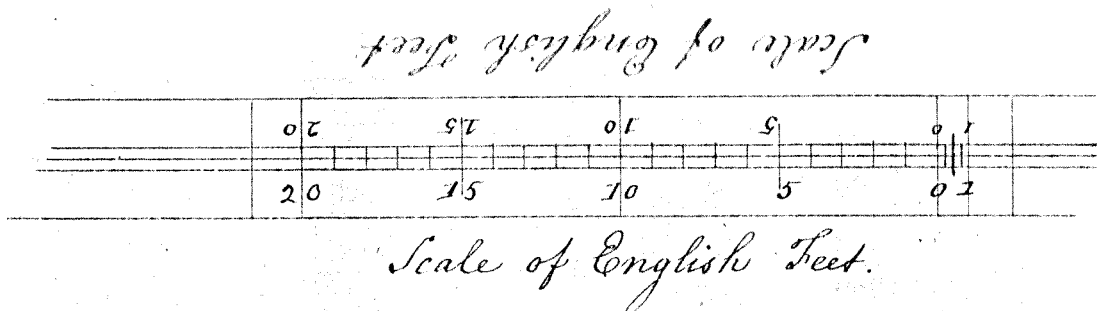
In as gentlemanly a manner as a man could do he requested an early reply or rather answers to his queries, & I was further induced on his account to send per first opportunity. Your observation being prior to the MDT drawings coming to your hand, makes it unnecessary to apologize for sending them by the Coach, as they will speak for themselves.

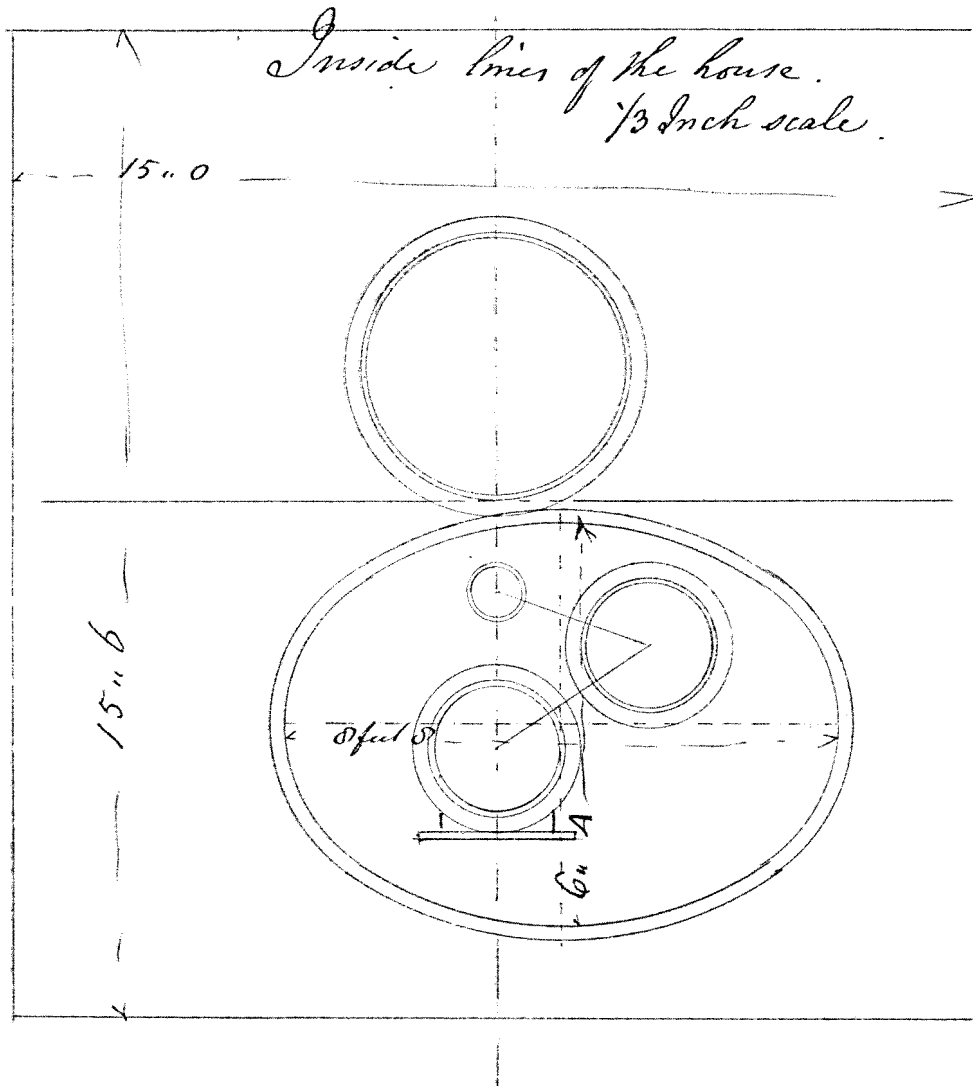
With much respect I remain

Sir

Your most obed. servant
John Southern

(Ed. Note: Below is the dual cutout scale 1/6 inch to the foot; JS's proposal for the dimensions of an oval cold water cistern for Meydrecht is reproduced on the next page)





B&W to D.Smits 1791-08-05

AoS ref. MS 3147/3/170/258; the AoS has only the first page of the letter, which was probably written by JS.

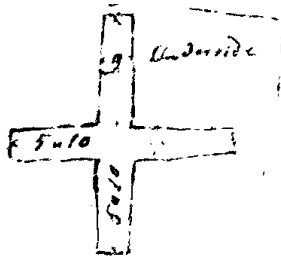
Birmingham 5th Aug^s 1791

M^r Dirk Smits

Sir.

By a letter from M^r Van Liender we are informed you will send us a drawing of the whole engine house &c of Meydrecht which we shall be thankful to receive, and likewise a proper drawing of the working beam, that we may adapt the iron work to it. M^r Van Liender informs us that he thinks the beam will do at 18 inches thick, in which case the spring beams may be nearer together than drawn - say they may be 3 feet asunder.

The suction pipe is 55 inches diam: within, whole length 7 feet - Extreme diameter of its under flanch 66 inches. The working barrels are each to be 10 feet long, & each clack 1 foot high: so that the whole height of the pumps will be 18 feet besides the joints - The cross is 9 inches high - 5 ft 10 in from end to opposite end,



& 9 inches broad on the seat. /// As these goods and some others will soon be ready we shall order them to be shipt as soon as ready, & the bill of lading deliverable to your order at Rotterdam & will thank you to give us the name of the merchant there, whom the Captain of

JW to HvL 1791-08-25

AoS ref. MS 3147/3/88/85

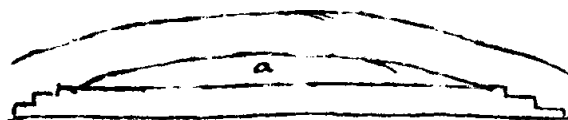
The "mob" JW refers to, is the culmination of the Birmingham riots, see General Chronology Section.

Birm^m Aug^t 25th 1791

M^r Van Liender

Dear Sir

I am duly favoured with yours of the 10th July, but having written written to M^r Smits we waited an answer before we wrote you. The suction piece & indeed most of the cast iron materials are cast & ready but, no vessel being likely to sail from Chester to Rotterdam we have written to Liverpool to know if there are any going from thence. Having no part^t direction to whom to send the goods at Rotterdam we propose to endorse the bill of lading to M^r Smits unless you order it otherwise. On receipt of yours we immediately sent Mr Smits, the dimensions of the suction pipe and Iron cross, the wooden cross &c were expressed in a former drawing. We have never received the drawing of the house as actually made, from Mr Smits, which with some uncertainty about the beam has prevented us from sending off the drawings which were ready, we had drawn the beam in the general drawings, as we commonly make them for such engines but shall make a separate drawing for it in your way, as soon as you answer the following questions. You say "if the beam has a curve of 15 inches in its whole length of 22 feet the same will be of sufficient strength, because taking the under beam of 18 inches square the whole depth will be nearly 5 feet" Upon looking at your drawing of the Rotterdam beam I find it thus



according to which the lower beam is entirely included in the depth of the curvature. I suppose therefor you mean that the distance between the two beams at (a) should be 14 or 15 inches, say we made it 16 to 18 inches it would be none too much as this beam is 24 feet long, if you will make a sketch of the beam for your own satisfaction you will see better what I mean. The whole length including the arches & half each chain will be 24 feet from centre of chain to center of chain & each chain will be about 6 inches, consequently beam & arches read 23 ft 6 inches, (...) we receive your answer we shall set about preparing the Iron work for the beam. You were so kind as to promise us a drawing of the method you hinged your bucket valves which we have not got yet & consequently have not been able to give directions about the bucket (or piston of the pump) shall therefore be obliged to you for it as soon as convenient.

We should have written to you sooner but were quite deranged by a dreadfull mob we had here who destroyed many houses, & put us in the greatest fear for our houses and manufactory, we were prepared to receive them. We fired (*coins?*) but luckily the military arrived in time to save us. The (.....) however was trouble & drives almost every thing out of our heads (.....) all now tolerably quiet but there is much faction & bad blood in the town.

I should have been glad to have accompanied you you in your tour which must have been very pleasant.

I beg my best respects may be presented to Miss Van Liender in which am joined by all here.

I remain wishing you health & pleasant times

Dear Sir

Your's sincerely

James Watt

HvL to JW 1791-08-28

AoS ref. MS 3147/3/505/44.

*Re-directed to Heathfield. With copy of [1791-07-10] (not strictly verbatim, and without final paragraph)
Chain-pump: a chain carrying transverse boards runs up a long inclined wooden channel, in which the boards fit well enough to limit the loss of water from the resulting compartments. At the top the compartments discharge, and the chain + boards returns.*

*Screw or barrel-mill: archimedean screw, enclosed in a cylindrical barrel, which turns with the screw.
The "disturbances" in Birmingham are the anti-Dissenter riots, see the General chronology section and [1791-08-25]. HvL's cursory mention of these major events is remarkable.*

Copij

Versailles 10th of July 1791

Dear Sir !

I was very glad to receive your agreeable favour of 27th May last, accompagnied by the particular drawings of the boilers seatings and walls for supporting Cylinder and cold water Cistern etc, the copies of which are well received by M^r Smits as he mentions to me. I am now able to tell you, that the floor or foundation of the whole building is laid as deep or at the same level with that of the pumpwell, there is no other way or possible method of doing these things, the foundation of the whole must absolutely be one connected piece This foundation shall be laid 23 Rhyland feet or 23 feet 8¼ Inches English below the Amstel peyl or surface of upperwater, the wooden ring shall be laid 6 Inches lower than in your drawing is designed, because it should be possible, to draw now and then, when wanted, the water in the polder to a lower level as commonly; the waterwaj below the bottom of the pump, remaining notwithstanding the same as stated by you; — by praaijng you to have the suction piece cast and send of as soon as possible, I have forgot to mention the Iron cross at the same time, as the one cannot be put up without th' other, but this will undoubtedly have occurred to you. M^r Smits desires to be informed of the length of the suction pipe, that he may be able to lay the pieces of stone, in which the beams for steadyng the suction pipe must be secured, upon their right height in the pumpwell walls; the best will be to have a sketch of it drawn, and send to him, he shall make out a distinct drawing of the whole building, with his alterations in height for your goverment; about the thickness of the beam, I should think that If the same is of 18 Inches breadth and 24 Inches deep, and upon its length of 22 feet having a curve of 14 or 15 Inches, the same will be of sufficient strength, because taking the strait underbeam off 18 Inches square, the whole depth of the beam will be nearly five feet, th' Interstices, left open by the curve being filled up with pieces of oak, and the whole well bound together with strong Iron strops; — The piles and timber necessarij for the whole foundation is contracted for the sum of about 550 £St: or f6126 and the driving of the piles and making the floor or foundation, for about 650 £St: or f7278 Dutch Currencij; all this makes a heavij increase upon the first cost of the Steam Engine, and all the danger off and keeping the hole dry, during the time it is wanted, is besides for account of the Commissioners, nobodij being willing to undertake that for less than about 900 £St: or f10,000 of which one fourth or f2500 Is already expended for remedying an accident in the beginning of the sinking of the hole; It is now a month, that I have not had any further news about it; so that I hope things may have gone forward without any other accident. —

M^r James Watt
at Birmingham

Versailles 28th of August 1791

Dear Sir !

Being without any of your favours or anij answer upon my last letter, and intending to leave this place in the beginning of next month; I have thought fit to acquaint you of this resolution and to forward you a copy of said letter; and to mention in the same time how things have gone forward with the Meydrecht Engine; — In the first place we were acquainted, to our utmost satisfaction, by a letter from Doctor Swediaur (?); that in the last shocking disturbances at Birmingham, nothing desastrous has befallen you or Mr Boulton; it is notwithstanding possible that your works may have been more or less interrupted by those Calamities, and that this may have been the reason of your Silence; the casting of the Suction pipe and Iron cross I hope may have gone forward, and been send off to Holland, as it may be wanted soon; th' undertaking here has struggled with great hardships; when the well or hole was dugged out to the depth of 16 feet, the bottom rose up and a vast quantitij of water sprung up like fountains from under it, This embarassing obstacle, has with great labour, been overcome by a chainpump and three other screw or barrelmills, worked by horses; and the hole dugged out to its wanted depth, and the driving of the piles was begun the 4th of this month, it is hoped the greatest danger is now over; all this will prevent the possibilitij of raising the building higher up this season than at the level of th' Amstel peyl; and shall greatly retard its finishing, with which the best part of next summer shall elapse; for this there is no other remedy than patience. This diminishes not in the least the merits of the Steam Engine but

is an objection in point of difficulty and expense, and shews that no man of ordinarij talents must engage in an undertaking of that importance; without M^r Smits the States of Utrecht would have been badly off; as no one of their Overseers are equal to the tax. — By some circumstances I am now obliged to go to Holland, which shall induce us to stay there next winter, we intend to go from here through Champaigne and Lorraine to lower Germanij, and along the Rhine to Holland where you will be so kind as to direct your letters to me at Rotterdam in future.

I beg to offer our best respects to you and M^{rs} Watt, M^r Boulton and family and remain very sincerely

Dear Sir

Your m^t ob^d h^s Servant

J:D:Huichelbos van Liender

JW to HvL 1791-09-17

AoS ref. MS 3147/3/88/100

Birm^m Sep^e 17th 1791

Mr Van Liender

Dear Sir

I am duly favoured with yours of aught 8th (*Ed. Note: 28th meant*) & copy of yours of July 10th annexed. Inclosed you have bill of lading of the greatest part of the castings for Mydrecht engine received to day. The freight is both in our opinion & of Mess^{rs} Thorn & Co our agents, a great deal too high, but they had some difficulty to bring the Captain over to these terms & there was only one vessel likely to sail soon. At Chester there was no likely hood of any vessel loading for Rotterdam for a very long time we therefore ordered the goods to Liverpool. One reason of the highness of the freight was the Cylinder & suction pipe, for which the Captain demanded 20 guineas extra. We have taken care of the insurance.

The working barrel is finished but as we have never received the drawings of the method you found answer for the valves of the Bucket, we detained it, that the bucket may be fitted to it. I wrote you to Paris some time ago which I expect came to hand before you left that country. In that I put some queries about the curvature of the beam, & informed you that we had never received any letter from M^r Smits in answer to those wrote to him, but from what you mention we suppose he has been too close employed to attend to it, The drawing we finished, with the working beam in the common way, but once our doubts are cleared up we shall make a separate drawing of it in your method.

We are sorry that so many difficulties have occurred in making the foundations, it is however (*what?*) we could appose no remedy to, windmills would probably have required the same care, as they also must be solidly fixt.

We should be obliged to you to mark the time as exact(*ly*) as you can when the remaining materials should be sent off & give us all the time you can, as we are quite overdone with orders so much so as to make my life very unhappy, however we shall certainly keep as near as possible to the time you fix.

We are some what uncertain whether you may be arrived in Holland, when this reaches Rotterdam. I have therefore written on the (.....) that it contains a bill of Lading that your agents may open it.

Our rioters are at present quiet, but the sore is still rankling under the skin, the town is divided into parties who are very intolerant to one another, & not likely to come into good humour soon. These matters prevent all moderate men from joining in any proposition for reform of government for who would run the risk of having a mob excited to burn his house or maltreat their persons. I shall be glad to hear from you in course — Mr Boulton & Mrs Watt beg to be kindly remembered to you and Miss Van Liender and I remain with esteem

Dear Sir

Yours sincerely
James Watt

HvL to JW 1791-10-18

AoS ref. MS 3147/3/505/45.

At this point, HvL has already taken the decision to take up residence near Meydrecht to perform/direct some of the preliminary erecting work until the B&W erector arrives. Due to the continuing problems with the foundation (which Dirk Smits handles), HvL does not actually move to the area until 1 June 1793, perhaps accelerated by Smits' sudden death in April.

M^r James Watt
Birmingham

Rotterdam 18th of October 1791

Dear Sir !

I beg then thousand pardons for not having wrote you sooner; but our Journeij hither from France has been a tedious long one, by lack of posthorses in Germanij along the Rhine; and when arrived here, so manij things fell together upon mij hands, that I did not know nearly werewith to begin first, besides I wished to go to Meydrecht before I answered your letters and having been there some daijs, I am now more able to tell you in what situation M^r Smits and I have left things there; which I shall do after having answered both your letters of 25th August received at Versailles and of 17th September found here at our arrival; the first I did not answer because I saw your intention of sending the cast materials which were ready to M^r Smits or his order, which was well, and that you had send him the dimensions of the Suction piece and Iron Cross, which was what he wanted then; about the drawing of the house to be send from here, I have already told you the needful; as what belongs the great beam M^r Smits and I have resolved to make the same with all its Ironwork here in the form as I have told you before and as you have Sketched the same in your letter taking the curved beam of 22 feet length, which with the circle pieces etc shall make it in all 24 feet as is wanted, and we shall try to get a good Oaken beam with a curve of 16 or 18 Inches If possible; that is to say that the opening at a shall remain at least 15 inches wide and even more if we can get a good piece of oak of the shape, and to have the Iron strops etc well fitted to the beam, we think it absolutely necessarij to have them made here, you may send us any other Iron work screws or pins for that value, If possible, or draw it bak from th'amount of the whole; I have not send you a drawing of the Iron hinges we have applied to two of the valves of the clack; because we have found by experience, that theij do not answer so well, as the leather hinges applied to (*Ed.Note: the underlined words are duplicated in error*) the other valves, so that I wish that you will order the buckets and pistons of the pumps in the same waij as you had ordered them for the Batav: Soc: Engine. I cannot think of any improvement in that part; Your second letter brought me the bill of lading of great part of the castings etc for the Meydrecht Engine, shipped on board of Capⁿ Carter, who is since arrived and we are now busy in discharging them; but as the States of Utrecht do desire, that we should keep those things here till the moment, they may be wanted, which is somewhat troublesome with such heavij articles; we beg, that th'other large pieces of cast Iron maij not be sent of before I shall given notice; the freight is certainlij high, but as they know that no competitors shall stand in their waij, as not every Vessel can taken in such large heavy pieces of Iron, theij prevail themselves of this circumstance, and when when we cannot get a cheaper conveyance, are obliged to submit; It seemed to me the Captain was very eager to go bak for th'other pieces, I thank you that you hath taken care of the Insurance. — M^r Smits did not answer your letters in expectation of mij approaching return to Holland and being very much employed in preparing another large drainage in Holland. — I see th'other drawings are finished; for handing those to me perhaps a good opportunity shall offer itself; a good friend of mine intending to make a trip to England, and go round to Birmingham Bristol and Bath, in which case I shall give him directions to call at Soho for them; — As to the difficulties that have occurred in making the foundations, theij are greatly discouraging, and of such a nature, that we have been obliged to take the resolution of defferring anij further proceedings till next spring, because the wet and boisterous autumnal weather made it quite impossible to overcome the quantity and power of the surrounding and heavij pressing water, even with the help of four chain pumps and 50 or 60 horses going daij and night; all the piles are driven in order, but we could not get the ground dug out deep enough, and I presume that this circumstance shall necessitate us to found the house three or four feet less deep than the pumpwell, which last must absolutely be founded at the wanted depth of 23 feet below the Amstel peyl; — the great depth below the surface of the water in the Lake, that we are obliged to sink the pit, is the reason of the great obstacles we met with, we can easily keep the water at ten feet height below this surface of the water in the Lake with one chain pump going only by day, but when we come at the depth of 20 feet below this surface, then the pressure of that high body of water is so great, that the light stuff of the earth, of which the dams are made (*Ed.Note: peat, most likely*), and upon which the dams are laid, cannot resist it, notwithstanding the spot or excavation is inclosed between the dike of the Amstel and the ring or annular dike of the drainage; the States of Utrecht having bought by Mr Smits advice, a Country house and adjacent pleasure ground (*Ed.Note: i.e. Ter Schelling estate, see glossary section*), marked with a red spot and a row of trees between the letters **A** and **B** upon the plan, which I have send you; and this place is infinitely better

calculated for erecting th'Engine upon, than the spot marked **C** first intended for it; th'Engine will be disposed in this manner, that the pump well shall be near the spot marked **DD**. — the foundations of the windmills never subject their builders to the same difficulties, as we now labour under, because they are founded gradually one after another; the foundations of the first are laid at the depth of 5 or 6 feet below the surface of the Lake, and those first or highest mills draw 4 or 5 feet water from the Lake, when another or second set of mills is founded, at the depth again of 5 or 6 feet below the then surface of the Lake which is easily done, and so on till the last, but with th'Engine we are obliged to go in once to the whole depth; and this being so very difficult shall oblige us in a following case to do it in two parts, that is to build two smaller Engines, who throw the water from one to another, and build the first for raising the water from half the depth of the Lake, and having drained the Lake to a certain depth, then found and build th'other Engine, because so as we have one now, is an increae of expence nearly as heavij as the whole Engine, besides the loss of time. by this narrative you will easily see, that we are not in want of the remaining materials, so that you maij prepare them at your leisure during this winter, that theij maij be sent of next spring; If I staij in Holland next summer I propose to reside at Meydrecht and to drive the work on as rapidly as I can, to see if I can regain the time lost and destroy the great prejudice that arises now against his undertaking by those contretemps. and shall therefore beg you to send me still more particular drawings of some parts, that I maij go on with several parts at the same time, without being obliged to wait for your foreman.

M^r Elsevier has send me this morning your letter to him and I have laid aside every other thing to make you easy and remove your solicitude; — My sister who as well as I is in perfect health joins me readily in offering our best respects to all our friends M^r and M^{rs} Watt M^r Boulton & family and I remain alwaijs

Dear Sir

Your affectionate friend
J:D:Huichelbos van Liender

P S the drawing of the Cistern shall be wanted now that we may order it to be made this winter a round one if possible, will be preferable with us in everij respect.

JW to HvL 1791-11-07

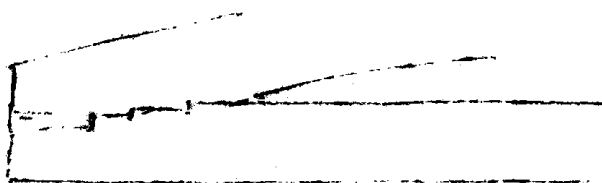
AoS ref. MS 3147/3/88/124.

Birm^m Nov^r 7th 1791

Mr Van Liender

Dear Sir

I was very glad to receive yours of the 18th — The drawings of the house are ready for delivery whenever your friend calls & they contain all the particulars except what relates to your (.....) Beam. We observe what you say in respect to its dimensions, but (.....) if the whole curvature is not more than 18 inches, and the opening in the middle is made 15 inches as we apprehend it must be, there will not be overlap enough at the two ends for the Joggles or sawtooth Joints which connect the two trees. In our opinion the curvature should be $15 + 9 = 24$ inches when it will comprehend one half of the depth of the lower log. we have seen this when drawn to a scale



The curvature of the upper log might be less if the lower one was also bent — We are very glad to hear you undertake to make the beam straps &c & (.....) knowing the weight (.....) we shall balance it by as much weight of the pump work which we are to do upon account or else we shall pay you for it.

We propose to furnish the Martingales, the Chains and the Gudgeon, which we shall get cast to suit a beam of 18 inches thick, the arch heads being 2 feet broad on the face: by which means they will project 3 inches over the beam at each side — we shall sketch our ideas of the beam in red ink on the drawings. The dimensions of the Cistern are on oval 8 feet 8 inches long & 6 feet 4 inches wide all inside measure, the depth 7 feet 6 inches the thickness of the side staves should be at least 3 inches and of the bottom 4 inches, a round or circular cistern cannot be got in of sufficient size, it seems to me that the best way will be to get the wood ready & not to make the cistern until you get the drawings

Shall be obliged to you send us the height of the highest surface of the Amstel from the bottom of the cylinder, that we may judge whether any pump will be necessary to pump out the overflowing water of the cistern, or to supply the cistern.

We are very sorry that the foundations have proved so difficult & expensive & in case of another erection mean to propose a plan which if thought practicable will prevent some part of the expence.

I meant to have written more at large but have been interrupted & find myself short of time. M^{rs} Watt & M^r Boulton join in comp^s to you & to Miss Van Liender & I remain

Dear Sir

Your obliged friend
James Watt

HvL to JW 1791-11-15

AoS ref. MS 3147/3/505/46.

Addressed to James Watt, Handsworth near Birmingham (i.e. Heathfield).

M^r James Watt
Birmingham

Rotterdam 15th of November 1791

Dear Sir !

The twelfth of this month I had the pleasure of receiving your agreeable favour of 7th instant; by which I learn that the drawings of the House for the Meydrecht Engine are ready for deliverij; and as the bearer of this is the friend I have mentioned in a former letter, and whom I have take the libertij to recommend to your kindness, being the son of my codirector of the Batavian Societij, he shall gladly charge himself with their care and transport hither; I observe what you mention about the beam, we have not yet been at the trouble of looking out for a piece of Oak of sufficient thickness and curvature, and as I do not well enough comprehend your meaning, with regard to what you call Overlap; I wish you would Join to th'other drawings, a drawing after a scale of the beam as you have it in view, either with a strait lower log, or a bent one; — I am still of opinion, that if we can find a good piece of Oak of 18 Inches breadth, and 24 Inches depth with a curvature, which shall leave an opening of 15 Inches and a strait underlog of 18 Inches square, and those well connected with strong Iron strops, That this shall make a very good beam of sufficient strength, making it in all of 57 Inches depth. — In time I shall mention the weights of those strops, and then we shall see how to manage this matter; and we shall expect the martingales, the chains, and the Gudgeon from you, suiting a beam of 18 Inches thick, and shall note the breadth of the Arch heads 2 feet on the face; — I have taken notice of the Oval Cistern, and I am fully of your opinion to get the wood ready directly and to put it together after having received the drawings; — M^r Smits being gone to Meydrecht I shall not taken upon me to mention the exact height of the Amstel Water above the bottom of the Cylinder, only please to observe that the Amstelpeijl is the highest water in the Amstel, above which mark the water never rises, this Amstelpeijl shall be 19½ feet Rhyland measure above the bottom or under rim or edge of the working barrel, when put in its place; and as we intend to place the Cylinder or rather the first floor in the Engine house 8 feet 3 Inches Rhyland measure higher, than you have planned it in your drawing **Vf** you may easily resolve this problem, at least sufficiently enough to determine If anij pump will be necessary to pump water out or in the Cistern. — If in case of another erection of Engines for a drainage, we can hit upon a plan to evite this very expensive manner of making a hole deep enough for laying the foundations, it will prove a verij acceptable circumstance, for as now it required all the skill of a verij experienced Engineer to overcome the difficulties, and which is not to be done without immense costs. — My sister and I join in compliments to you and M^{rs} Watt, M^r Boulton and family and I am always

Dear Sir

Your oblided friend

J:D:Huichelbos van Liender

P:S: prevailing myself of this opportunitij I have thought fit to send you a Rhyland foot measure at the End, that you maj always compare it to your English measure; (*Adio?*).

HvL to JW 1792-06-12

AoS ref. MS 3147/3/505/47. Stamped 15 JU

The "wheel and pinion" which HvL notes are not in the drawing, probably this refers to the rather customary hand winch on the beam floor, for handling heavy pieces.

HvL hits upon the idea of a horizontal engine, quite unheard-of at the time, with the valid main argument that the forces will be closer to the foundation; at the time an important argument against was the uneven wear of steam cylinder, piston and gland. Workable solutions only came much later.

M^r James Watt
at Birmingham

Rotterdam 12th of June 1792

Dear Sir

Without doubt you must be surprised not to have heard from me for so long a while, all mine excuse shall be, that it has not been mine fault, and that I have had no courage to write you, before I had any certain hope of proceeding, and of succeeding in our arduous undertaking; In the progress of which M^r Smits and I have been sadlij plagued with ignorant Quaks who, after we had taken in Autumn Last the resolution to let the making of the foundation of th'Engine rest till this following spring, and then to attack that ennemi with fresh vigour, and more powerful Engines, have found means to persuade the Commissioners for the States, that they were able; to clean and drain the hole for laying the foundation, in a much shorter and cheaper waij, than we intended; and which fine tale, notwithstanding all we could say to the Contrarij, has been made acceptable, and that part of the business by contract given to a man quite insufficient for the task; and who, after having expended in vain about 1800 £St: (which the States have been so good as to repaij) has been obliged to given it up, and has been sent awaij with reproach; and M^r Smits again called on, and the whole direction of the foundation anew given totally to him; and he has now, with th'approbation of the States, settled it for about 2500 £St: to 10 or 12 undertakers of good abilities; to do it after his plan, with six good chain pumps and eighty horses; and to have it readij at the middle of next month; and if we do not gain our point now, the (*scheme?*) of the Steam Engine shall be lost, and the drainage achieved with windmills; but I hope we shall not meet with so vexatious a disappointment. — mean while we learn sufficiently, that in making use of Steam Engines for drainages; we must endeavour to find out better and cheaper waijs, of making the hole, for laying the foundation in, as now have been employed, because those are to Expensive, and add to much to the cost of th'Engine; If once we got the master of the foundation, we shall proceed with graeter dispatch, as we have during this winter let made a verij accurate model after the drawings you have send us; to build the house and manij parts of th'Engine up, and to go on with that as far as possible before we shall want your Engine Man; I have observed, that in these drawings no wheel and pinion is marked out, and I think we shall want one absolutelij; — With these I send you an accurate drawing of the great Lever, so as we Intend to have it made; for which the gudgeon and th'other Iron work may be prepared; the dimensions are in Rhyndland measure; which shall given no difficultij, as you are provided with a good Rhyndland rule; this piece timber shall be verij heavij for bringing it in its place; should it not be to avoid putting it in so high a situation, in other Engines afterwards, it seems to be not impracticable to have the Steam Cylinder put in an Horizontal situation in stead of its vertical present one; which would be attended with great advantages, as all the strength of the building should be brought so much nearer the foundation, than now is the case; as much as I have thought on the subject, I do not find anij insurmountable difficulties in it; and it is quite another thing, than to have an Inverted Cylinder, I wish it should meet with your approbation.

If anij payment for the Castings or other parts of the machinerij ought to be made; please to send me th'Invoice and I shall take care to send remittances for it.

I hope to be apprised of the continuance of your good health, as likewise of M^{rs} Watt, to whom my sister as well as I offer our best respects, praying to given mij compliments to M^r Boulton;

I remain sincerely

Dear Sir

Your oblidg^d Friend

J:D:Huichelbos van Liender

HvL to JW 1792-08-24

AoS ref. MS 3147/3/505/48. Re-directed to 6 Green Lettice Lane, London.

The "Cornish Antagonist" was Edward Bull, who in 1792 brought out an engine with a separate condenser; that same year B&W issued an injunction against him, which is what the letter alludes to. The printed 1792 Batavian Society programme enclosed with this letter has not been reproduced here; most of its content (Questions covering many subjects, Answers, judgements of the latter) is irrelevant to the present compilation. The one Question HvL refers to — and which he probably proposed himself, based on the Mijdrecht foundation problems — is given below in translation.

As the erection of Engines, which must raise the water in a single step to full height for discharge into the boezem (such as are needed more and more, primarily for drainage of turfed-out lakes), to lay their foundations, often necessitates excavating pits or pot-holes of 21 or 22 feet depth below the level of the surrounding water, and as this work usually meets with numerous difficulties, because the water which due to the looseness of our peat soil presses from all sides or forcefully wells up, which does repeatedly impede the digging, draining, and keeping dry and eventually causes great difficulties, the Society asks for *the most certain and least costly way to dig, drain and keep dry the foundation pits or pot-holes for the foundation of the above-mentiones Engines to the required depth ?*

M^r James Watt Birmingham

Rotterdam 24th of August 1792

Dear Sir !

I have now the pleasure of imparting to you, that we maij flatter ourselves with the well founded hope of seeing the Steam Engine at Meydrecht Erected. The foundation of the house boiler Seatings etc Is laid, and great part of that of the Pump-pit already finished, the latter three feet lower than the former, and 26 Rhyndland feet below the Amstel peijl, this part finished, we shall begin the Masonrij of the pump-pit, raise that up to the level of the foundation of the house, connect it by strong beams and Iron strops well together and then bring up all the Masonrij equally around ; The Pressure of the surrounding water Is so great, that the six chain pumps are obliged to work constantly night and daij to keep the hole drij, notwithstanding we have had uncommonly fine hot and drij weather for about three weeks; the quantity of sand that is thrown up with the water, Is amazing.

The Waij I could advise for erecting fire Engines to effect adrainage; should be or to prepare â piece of ground some time before, by bringing great quantities of earth rubbish etc upon it, to press it down and give it a good firmness; or to take it up in two parts, as now is done by the Windmills, first to erect an Engine for draining of 8 or 9 feet, and then erect a second one, for draining the remainder, and raise the water from one Engine to another, but that method is rather too complicated, and certainly not so advantagious in regard of fuel and other Expences, as when it is done by one Engine; In the New Programma of the Batavian Societij (of which I send you one copy under this cover) we have proposed a question for the best cheapest and safest method of making and maintaining a pit or hole for laying the foundation for Engines, that raise the Water in once by drainages; I wish one or other of your Ingenious Countrymen, would given himself the trouble of studying that subject, and send us an answer to the Question. I see you find great difficulties In laying the Cylinder of a Steam Engine horizontally, I doubt not or the first would given manij difficulties but I should think, that practice would overcome them. — There is no uncommon difficultij here in laying the foundation for anij Engine at the depth of 10 or 12 feet below the water; but to go to the depth 20 or 24 feet below it, Increases the difficulty and danger amazinglij; to make use of a number of small rotative Engines for working Chain pumps, would not be a good introduction here in the beginning; when one Steam Engine shall do the business of eight windmills, as the case shall be in the drainage of Meydrecht Lake, it will given a much graeter fame, than when a number of them was employed, and now it must given so much more satisfaction; as so manij praedictions have been made that that Engine would never be erected there.

In consequence of your request (*Ed.Note: probably in the unreadable 1792-07-05*) in behalf of your friend M^r Rennie's Nephew my friends have solicited some of the most eminent Paper makers in Northholland to taken that young gentleman for apprentice; but they refuse it as peremptorilij as I have been refused the sight of a White Lead Manufactorij in London, notwithstanding I had a strong recommandatorij letter from the Proprietor. Mr Blauw certainly the most eminent of all, Is verij circumstantial in his answer upon the subject, and cites a Law, by which any apprentice after having been some time in a Manufactory of Paper, and intending to go abroad, Is liable to a severe punishment; which makes it an absolute impossibilitij for them to take a foreign apprentice; but it surprises me that when you can learn in England to make such fine paper as your letters given me to see; any young men would learn that Manufactorij In Holland; our paper may be

stronger than yours, but is not finer. — I congratulate you most heartily with your triumph against your Cornish Antagonist, In attacking your priviledge; have you had your priviledge renewed ? I thought your first priviledge was elapsed; — You have not answered upon mij remark about the wheel and pinion which we shall want in the Engine house;

My Sister joins me In giving our best Complim^{ts} to you M^{rs} Watt and M^r Boulton and I am always.

Dear Sir

Your m^t oblid^d Friend

J:D:Huichelbos van Liender

HvL to JW 1792-10-11

AoS ref. MS 3147/3/505/49.

M^r James Watt
Birmingham

Rotterdam 11th of October 1792

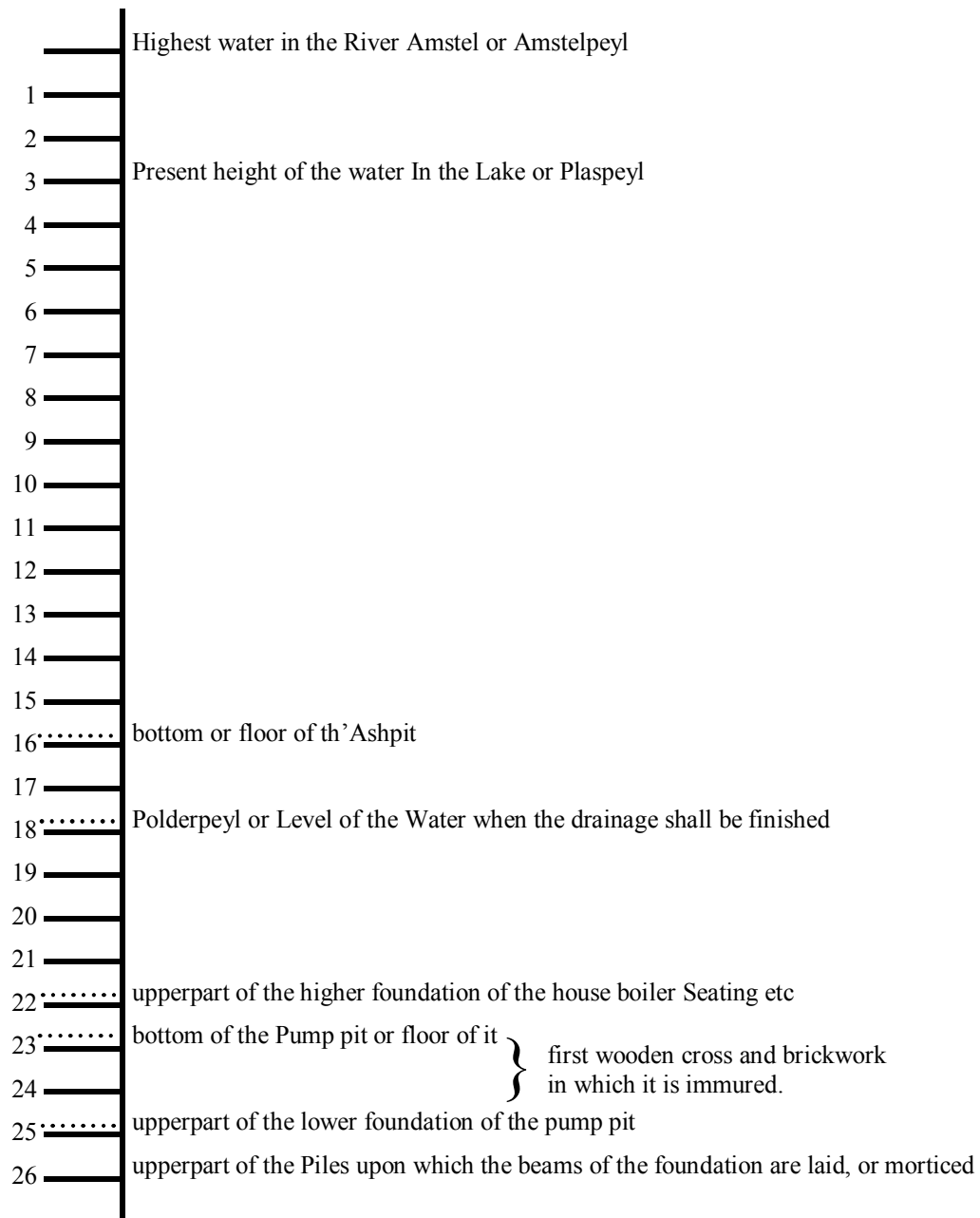
Dear Sir !

My last letter to you was the 24th of August, and till now I am without your answer; I prevail myself for these of th' opportunitij of inclosing it in another friends Letter, being desirous of acquainting you with the progress of our undertaking at Meydrecht; The whole foundation is laid, and both parts connected together in a most masterly manner; and I have seen the masons begin their work with great alacritij; and now the whole building is brought up above the pump pit at the height of 12 feet, so that the vexatious trouble of the water is so far overcome, that already half the number of the horses are sold, and in a fortnight or three weeks more we are in hopes of having raised the building at the Level of the Amstel Peyl; and there we shall let it rest till the following spring; not to expose it to the danger of being damaged by the frost; — Notwithstanding the house and boiler seating are now raised 8 feet and 3 Inches higher than you had planned them, we shall be vexed with the water in th' Ashpit for a long while, and shall be obliged to contrive the means of emptying them bij the help of th' Engine, the bottom of th' Ashpit being laid now at six feet above the foundation, which is still more than 12 feet Lower than the Level of the water in the Lake, and as there are no means to exclude this water, it must be emptied by pumping it out constantlij; according the drawing you have send us of the boiler seating it requires the height of 11 f^t 4 f^{ts} from the bottom of th' Ashpit to the plan or flat upon which the boiler is to be set; this circumstance shall make the beginning of the drainage very troublesome, and given us manij opportunities to exert our skill; what a pitij it is, that we have been frustrated to lay the foundation three months sooner, In which case the house would have been wholly finished before the Winter; — Wishing you good health and happiness I remain.

Dear Sir !

Your affection: friend
J:D:Huichelbos van Liender

Ed.Note: In the AoS with this letter has been filed a vertical scale of Rhineland feet with indications of various datums. This must be the scale HvL mentions in [1791-05-16]; it is not referenced in the present letter, but acc. to [1792-11-15] it was sent with this letter. It has been transcribed on the following page.



HvL to JW 1792-11-13

AoS ref. MS 3147/3/505/50.

The French king had been deposed two months before, and France had been declared a Republic. With all the concern for France which HvL so often shows, it is somewhat surprising that these major events are not mentioned.

The "seven provinces" are the United Provinces to the N, including the N part of Brabant; the "ten provinces" are the ones to the S, also known as the Austrian Netherlands, as they came under Austrian sovereignty. The French general Dumouriez conquered the ten provinces in November 1792.

War with the United Provinces would follow a few months later, in February 1793.

M^r James Watt
Birmingham

Rotterdam 13th of November 1792

Dear Sir !

Being without anij of your Esteemed favours in answer to mine two last letters of 24th August and 11th of October; these maij mostly serve to acquaint you, that the building, pump-pit and boiler Seatings at Meydrecht are nearly raised up to that height , at which we intend to leave them this winter, but in order to go on in the meantime, with other parts of this undertaking as well as we can; we wish to have here th' Iron work for the great Leaver, as the beams have already been squared; and likewise we wish to have the Iron grate and fire plates, as we wish to put, the nailing of the boiler plates together; in hand directlij; and to have it done upon the boiler seating, Where there will be room enough for that purpose; Those Iron materials may be sent via London for expedition sake; —

And as the rapid progress the french Army is making in Braband and Flanders, in all possibilitij shall be followed by their paying a visit to this Countrij, the consequences of which must unavoidably be verij uncertain; I like to take everij precaution for yours and mine interest, and therefore I wish to have th' Invoice or account of th' Amount of everij part of th' Engine materials to be drawn from your side; that I maij get the value of them, before anij political discord may embarrass any public paijment; — Such a number of unforeseen Events are now daily succeeding one another without interruption, that one cannot be to cautious, with one heavij blow the french have conquered the ten Provinces, and it will be an easij matter for them to conquer th' other Seven, the number of discontented Inhabitants being verij great, and in manij towns already with difficultij retained from rising to revolt; how are things altered in five years ? I give you my best compliments and remain.

Dear Sir Your oblidgeed Friend
J:D:Huichelbos van Liender.

JW to HvL 1792-11-15

AoS ref. MS 3147/3/88/204,205.

Birmingham Nov^r 15th 1792

M^r Van Liender

Dear Sir

I received your letter of the 24 aug^t at London, just before my setting out for Cornwall where M^r Boulton & myself made a long stay, in very bad weather and have not long returned; — your letter of oct^r 11th came to hand only last week. The wheels & pinions you wanted, say 2 Wheels & 1 Box directed for you, were sent off from Gainsborough for Hull to care of C.E. Broadley Esq^r on the 3rd instant, to be shipt per first vessel to Rotterdam — I sincerely wish you joy of having conquered the greatest difficulties of the foundation & have sympathized in the vexations you have had in it. I do not think we shall have any success here in obtaining an answer to the societys question concerning the best method of making excavations in your soil for Engine houses. Ec, and I agree with you that the best way will be to devise some method whereby these costly excavations may be avoided. I do not think you have fully comprehended what I meant about chain pumps, I meant them to be upon a much larger scale than you seem to think of, at the same time I must confess that I have not thoroughly (.....) my ideas on the subject nor have I had so much experience of chain pumps, as to proceed without some fear. If another opportunity offers I shall turn the matter in my mind, & communicate my ideas to you who are better experienced with the difficulties, which may occur in any way. At present I see this that the engine may be placed at any reasonable distance, say 3 or 40 feet from the pump well and the motion & power conveyed entire, with some little additional machinery; this I have practised, and had all the difficulties been seen per advance it might have been thought of for the present case, but mankind are generally wise too late — I am much obliged by your table of heights which correspond upon comparison with our drawings — In respect to the water in the ashpits it will be easy to fix a pump to be wrought by the Engine to keep them dry, and as they are very deep, some water remaining in the lower part of them, will be of no consequence
I forgot to examine (& am not now with the drawings) perhaps some part of the depth may be dispensed with so far as the use of the ashpit is concerned, I think they were made deep that the foundation of the Boiler seating might be level with the foundation of the house; but be that as it will, they are deep enough for use if they are from 6 to 7 feet below the fire bars of the grate and if it offers any convenience you may make them accordingly.

Almost all the materials for the Engine are now ready but the weather is so stormy, that that we shall not immediatly send them off, except some of the castings which being at Liverpool lying at warehouse rent we have ordered to be shipt as soon as it can be done at a reasonable freight — I return you my sincere thanks for the trouble you have taken in respect to M^r Rennies nephew I did not myself approve of the scheme we certainly have not much to learn in the paper making line except the method, industry, & attention of your countrymen, & the preservation of the morals of young men, shamefully neglected here — You were so obliging as to mention some time ago that you would remit us if necessary for some part of the materials, we have prepared, if convenient we will be obliged to you for a sum of £ 300 to £ 500 as suits, and shall send an account of what we have laid out for pumps & other extras. I assure you I was very glad to see your last letter, the troubles in your neighborhood made me uneasy for you. Where will all this end ?

M^r B. & myself are going to London next week about a lawsuit we have commenced against one of the invaders of our privilege, of whom we have too many

M^{rs} Watt is in Scotland but M^r Boulton and myself join in best respects to you and Miss Van Liender, wishing health & success. I remain with sincere esteem

Your faithful & obliged friend
James Watt

JW to HvL 1792-12-03

AoS ref. MS 3147/3/88/212

M^r Van Liender

Birm^m Dec^r 3rd 1792

Dear Sir

I have your favour of the 13th Nov^r which was long on the road, In the mean time hope you received one of mine, about the same date — Annexed we send you Invoice of Materials for the pump work bought on account of the proprietors of the Engine amount £ 786.5s.11d, which we have directly paid to Wilkinson & after(?) & for which a remittance will be acceptable

Inclosed you have a list of Materials for the Engine which we have ready & part with you part forwarded to Hull & part still here Iron Materials form almost the whole of our contract, and if agreable to the Gentlemen concerned, to make us a remittance on that account, as we have already lain out of our advance a long time it will be proper & we shall be obliged to you in the present circumstance to urge it, we refer you to our former letter, for the destination of the materials we were to furnish by contract & those we were to furnish by account. The situation of public affairs every where gives us very much concern & we cannot help wishing that the french had mixed a little more moderation & Justice with their liberty

May God bless & preserve you & yours & defend you from riot and anarchy ! time presses I therefore must reserve what I have further to say till another mail, mean while I remain with best respects to Miss Van Liender

Dear Sir

Your faithful friend
James Watt

I send enclosed bill of lading for the Crane wheels,
acc have forbid the other goods at Hull to be
shipt till we hear from you

HvL to JW 1792-12-11

AoS ref. MS 3147/3/505/51.

The final paragraph voices a general feeling and expectation of many Patriots.

M^r Watt

Rotterdam 11th of December 1792

Dear Sir !

I am now favoured with both your agreeable letters of 15th of November and 3th of this month; I thank you for your congratulations of our having conquered the so many difficulties In making the foundations of the Pumppit and Engine house at Meydrecht we have Indeed verij great reasons of satisfaction, that we have been able to proceed so far, because we are now certain that every danger on that account is past and as such an heavij mass of brickwork Is constructed upon this foundation, without apperceiving the least sign of any setting or cracking we are sure that the piles are driven full to their point; the brickwork is now raised to the height of two feet above the polderpeyl (*Ed. Note: HvL means the Plaspeyl, see encl. with 1792-10-11*) or only one foot below th' Amstelveij; and is left there since 8 or 10 daijs, and quite covered under for preserving it from the frost; the boiler pieces and stajjs are now sent thither to nail them together during the wintermonths; the Vessel from Hull with the Wheels etc Is already arrived, but I had desired to have here all th' Ironwork belonging to the Leaver or great beam, and the grate bars, bearer bars, firedoors and dead plates; and I wish still for all that send off for here by the first opportunitij; — I shall very gladly receive your further opinion about the subject of making use of chain pumps for drainages; Bij putting th' Engine at 30 or 40 feet distance from the pump well, some part of the difficulties and expences would be lessened, because the hole or excavation should be of a lesser extent but still the great depth must be obtained; which is the difficult point; — If we had a separate of the grate firework etc with its dimensions, it could be of use to determine the depth of th' Ashpit according your determination off from 6 to 7 feet below the firebars of the grate; — I understand that all the materials for the Engine are now ready, and that because the weather is so stormy, you should not Immediately send them off, except some off the castings which being at Liverpool, lying at Warehouse rent you had ordered to be shipt as soon as it can be done at a reasonable freight. If by the castings you understand the two large working barrels, I hope that no opportunity of shipping them off maij have offered before you receive this letter, because I should not know what to do with them, there Is no conveniencij to lay them by here at present, and the States of Utrecht will not have them send off to Meydrecht, not wishing to risk them there during the winter, therefore I pray you will order them to be kept at Liverpool till next spring, and we shall pay rather some Warehouse rent for them;

As you did mention what disbursements nearly you had done for the pumpwork; Your letter answered beforehand in some measure, what I had desired to know from you, and I have accordingly wrote to Utrecht and obtained an order of payment from the States upon one of their pajmasters, for the value of between 6 and 7 hundred pounds St: which sum I shall remit you on London, as soon as I have got the moneij here; which shall be next week; and shall now further take care to obtain th' amount of th' Engine materials from the Same quarters; which according your letter of 8th Julij 1790. must be the sum of = 1580 £St: onlij It is not verij clear with me; If in this sum the boiler is included, or not, because in your letter of 16th November 1790. You have expressed yourself as follows = In your letter to them, I hope you expressed yourself clearly as to the materials we were to furnish as Engine materials, say the wole Iron and brass work of th' Engine and working beam, with an Iron boiler & Its fire grates etc, comprehending the chains on the outer end of the beam but extending no further, & containing no part of the pumps or their apparatus, or any woodwork whatsoever etc. by this periode it seems as If the boiler was included In the bargain of = 1580 £St: but I find the boiler Specified in th' account of the pumps and their apparatus; please to elucidate this doubt.

I condole with you that you are obliged to go and staj at London to attend a vexatious lawsuit; nothing seems to me a more ingrate business, as one of that kind; and I wish heartily you maij soon be delivered of such a persecution.

I have taken due notice of th' Invoice of the materials of the Pumpwork, and by finding it right, shall give you Credit for it; I have likewise taken notice of the List of materials for the Engine which you have send at the same time; In th' Interim I can assure you, that there Is not the least danger of any bad pajment; but I like to guard as much as possible against anij unforeseen Accidents; and therefore It is verij well that I am provided with these papers; that I maij convenientlij demand the pajment.

We are in general very well assured, that If the french procede on to this Countrij, that their Inmarch shall not be signalised with such an Infamous treatment as that of the Prussian troops has been in 1787. who could not have treated their bitterest enemies in a worse manner than theij have done so many of th' Inhabitants of these Provinces, and who from the first Officers in rank to the meanest soldiers have plundered everij where as If theij had been in a conquered Inimical Countrij; and no bodij was permitted at that time to complain or even to mention it; It is impossible for you to conceive under what tyrannical German rod

we have been obliged to bow our necks, and that is the reason that we must consider the French as our deliverers; and we have good hopes that the necessary measures shall be taken to prevent every riotous Act and anarchical mischiefs; and that it will plainly appear, what mighty difference there is between true Patriotism and party rage; to be the partizans of the Republica or the adherents of a family.

Please to accept our best wishes for your welfare and happiness, give our best respects to M^r Boulton and family and believe me truly

Dear Sir

Your Sincere friend
J.D:Huichelbos van Liender.

HvL to JW 1792-12-18

AoS ref. MS 3147/3/505/52. Mis-docketed as Nov. Docket covers this and the letter of 11 Dec.

Forwarded to Heathfield, then passed to James Pearson (clerk).

M^r James Watt

Rotterdam 18th of December 1792

Dear Sir !

According what I had the pleasure mentioning by mine last letter of 11th Instant, to which I otherwise refer; I remit you this daij the sum of =600 £St: to your order In the following bill of exchange upon London. being a second one, the first accepted with Mess^{rs} Rich^d Muylman & Comp^{ie} of this date at two usances by Corn^s van der Hoeven & Son mine order upon Rob^t Wilson & Sons In London, of which you will procure the needful and give me credit for it; and please to advise the receipt; Having now nothing further to add than to offer you and M^r Boulton our best respects, I remain sincerelij

Dear Sir

Your oblided friend
J:D:Huichelbos van Liender

JW to HvL 1792-12-31

AoS ref. MS 3147/3/88/216.

Probably from Birmingham

Dec^r 31 1792

M^r Van Liender

Dear Sir

I am favoured with your letters of the 11th & 18th, we thank you for the remittances contained in your last — As the whole of the wrought Iron work, & some of the smaller castings are now at Hull or upon the road to it, and among the rest the articles you are in want of, we have ordered that so many of them as shall be arrived be sent off by first ship, understanding, your prohibition of shipping extending only to the heavy articles at Liverpool, those sent to Hull being can go into a common warehouse. We were the more inclined to do this as we apprehend we may be engaged soon in a war with France which will considerably affect both freight & Insurance besides the risque of losing the goods & suffering a great retard

The Boiler is not included in the sum of £ 1580 a separate charge being affixed to it as you observed in my letter of July 8th 1790, at which we were willing to undertake it & should have adhered to it, but thought it proper afterwards to make it both larger and stronger, than was originally in contemplation The account of it sent you is what it has actually cost us; however if any objection is made on that account, we must abide by our estimate of that article the Boiler & suffer the loss of the difference of its price

My letter of the 16th of Nov^r is not sufficiently clearly expressed, but my meaning was as above that the only materials we could undertake by contract was the Engine materials and Boiler. I hope if you compare the whole tenor of the correspondence you will see it in the light I have stated. The including the Boiler in the £ 1580 would cut too deep in our profits.

I have been very stupid and unfit for business this last year which has prevented me from putting the ideas I mentioned to you lately on paper, but meant to do it on my return from London, if I can.

The sinking the pit for the pumps will no doubt be troublesome & expensive, but it will make a great difference having that only to sink, to sinking the whole foundations of the building as we have done at Mydrecht, besides I am not sure if we cannot do it at twice, by having a temporary pit all the water is got out to half the depth near the house & placing the deep pit farther off.

Whatever may be expected from the French, no foreign army ever behave well, as they are not under the constraint of the native powers, therefore I continue to pray that you may not be visited by either Prussians, Austrians, Russians, French or English ! & I pray that God may send us peace in our days

All here join in comps & best wishes to you & Miss Van Liender, and I remain

Dear Sir

Your sincere
& obliged friend
James Watt

I intend going to London the end of this week
but hope not to stay long, our cause comes
on in February

JW to HvL 1793-01-03

AoS ref. MS 3147/3/88/217.

Quite badly faded.

(Birmingham Jan^y 3 1793)

M^r Van Liender

Dear Sir

I wrote you last mail acknowleging the receipt of your remittance of £ 600.- and answering your late letters. The inclosed drawing of the Boiler seating could not be got ready in time & I did not send (.....) of reception of your file(?). In the section of Boiler we said(?) the bottom of the ashpit is 12 feet 2 inches under the level of the bottom of the Cylinder in the other drawings, and about 2(?) feet higher than in the former drawing, it is 6 feet(?) (.....) what thickness of Brick (.....) you will have to use (.....) of the ashpit & the platform on which it is built (The.....) is now drawn 7 feet deep below the Barrs(?), but will do at 6 feet 6 inches, or even at 6 feet it effects(?) any great convenience though we would rather prefer the former than the latter depth (.....) by the line of cylinder Bottom because the Boiler must preserve its relative height in respect of the Cylinder. I hope the whole matter will now(?) be clear enough & wishing you & Miss Van Liender many(?) happy new year(s) I remain

Dear Sir

Your obliged friend
James Watt

JW to HvL 1793-02-04?

AoS ref. MS 3147/3/88/224

Badly faded, not copyable, decipherable portions transcribed directly from letter book in the AoS

M^r Van Liender

Birm^m Feb: 4(?) 1793

Dear Sir

Inclosed I send Bill of Lading of the materials shipt from Hull of which you have Invoice some time ago.

We have made the necessary Insurance, and (.....)ly got it done just in time as it is now 10 p^t cent. We wish the goods safe to hand, but (.....) and thus I remain with best comp^s to Miss Van Liender & yourself

Dear Sir

Your obliged friend

James Watt

HvL to JW 1793-02-15

AoS ref. MS 3147/3/505/53.

Uncharacteristically, not a word about the dramatic developments in France (where Louis XVI and Marie Antoinette had been sentenced and beheaded, and the events leading up to the Terreur begun); no further details about the French invading the United Provinces either, except the trade impediments caused by the French embargo.

M^r J^s Watt
Birmingham

Rotterdam 15th of Februarij 1793

Dear Sir

I have still to answer both your Agreeable favours of the Last of December and 3th of Januarij; by the first of them I was very glad to see you had ordered the wrought Iron and the smaller castings to be send to Hull and loaded there for here; which has been done and the ship luckilij arrived here with them, left the Humber just before th'Embargo took place; notwithstanding I am without the bill of loading from you; I learn that she has 21 boxes and 161 pieces of Iron, so that I suppose nothing left at your side, than the two great working barrels and their Buckets and clacks; which I hope we maij get this summer by one or other Neutral Vessel; we can meanwhile go on now verij well; the boiler is put upon above or on its seating, and the pieces connected, which the Smith Is now busij to nail together, but we have had complaints of the bad qualiti of the rivets the Smith having been obliged to make new ones, those send over flying in pieces when he endeavours to draw by them the plates close together in hammering; I have had some of em brought here and examined and were found of a very bad qualiti; — I have taken notice of your explanation about the cost of th'Engine and the separate charge of the Boiler; of which I have mentioned the needful to the Professor Rossyn, and has been approved by the States, and no further objection made to it; — I have since received the surplus of th'amount of th'Invoice of the Large Castings for the Pumpwork Boiler etc; and received this morning an order from the States on one of their Paymasters for ten thousand guilders being more than the half of the =1580 £St: this moneij I will get here next week but the course of th'Exchange is now so extravagant high, that if you are not absolutelij wanting the moneij directly, I wish to see If by retarding its remitting for some postdays Its course may change in our favour. — When I have got the materials brought over from Hull in the Warehouse; I shall demand for the remainder of the paijment; — I hope that everij reason of complaining about your Unfitness for business, may have been removed; — I thank you for the complete drawing of the Boiler, you have send me by your Last Letter; as it explains more plainly every circumstance and dimension, than the former received; we shall follow it strictly in building up the Boiler seating and sidewalls and the Line of the bottom of Cylinder, shall fall just with us, at the Line of the Amstelpeyl; which Is our cardinal Line of dimension;

As I see your cause or Lawsuit to come on this month these will find you apparently in London; I wish heartilij its Issue maij be in your favour and spedily.

Joining our united good wishes and best respects to you and all our good friends on your side; I remain

Dear Sir

Your M^t ob^d f^d
J:D:Huichelbos van Liender

HvL to JW 1793-06-13

AoS ref. MS 3147/3/505/54.

The unfavorable exchange rate as a result of the war is mentioned in this letter and others. B&W's goods are priced in £St: and as the problems are stressed from the Dutch side, it is more than likely that the £St: has become dearer, so that the States of Utrecht would have to pay more guilders. To B&W this does not make any difference; payment deferral would be to B&W's disadvantage (loss of interest), and to the States' advantage (gain of interest, possibly exchange rate gain).

HvL has now taken up residence near the engine site (on the opposite side of the river, but there's the Uythoorn bridge close by), as he had first planned in [1791-10-18], and is going to be supervisor, and acting erector until Watt's erector arrives.

James Watt Esq^f
Birmingham

ZorgVrij at th' Amstel at Thamen near th'Uijthoorn 13th Juin 1793

Dear Sir !

After having been in a long suspense, not knowing what maij have been the reason of your silence, I have now received M^f Southern's letter in M^f Boulton and Yours name, by which I learn than mine letter or letters have not been answered sooner, because you have not been able to send of the working barrels for Rotterdam, the Vessel that offered for that place, being to Small in her hatchwaij; and that you desire mij orders to send them to Amsterdam If no Vessel should soon offer for Rotterdam; I shall have the pleasure to answer now, that you maij send them of either for Rotterdam or for Amsterdam at the terms of mij former letter, by the first opportunitij that maij offer which I wish may be soon, as the Engine house will be built up in a few daijs, and roofed, the pump pit and aqueduct to the Amstel quite finished.

I have taken for two years a small country house and garden, just opposite the place where th'Engine is erecting, the river Amstel onlij separating us from the house ter Schellinge, and am residing there with my sister since a fortnight, and am pushing things forward as much as I can, th'undertaking having already been too long in hand; the nailing of the boiler is long ago finished, and as soon as the house shall be built up, the Brickwork round the boiler shall be done, the great leaver is quite finished so that I think you maij provide us with a proper person for erecting th'Engine as soon as you convenientlij can.

For payment of the 1580 £St: The States have paid me on your account 18,000 guilders, but as the course of th'Exchange between you and us remains still so excessivelij high, theij wish that you may not be in want of the cash but if this was the case, and that you wanted the money or a part thereof, they will submit to the necessitij;

I have done you one or more questions in my two last letters, which I wish you maij look over, and by anij leisure time give me your answer.

We have lost about two months ago poor M^f Smits who had fallen a victim to his disease, being terminated in a decided consumption; I have now with me, one off his eleves, a clever millwright, and great enthusiast of the Steam Engine.

I reside now in the Province of Utrecht not half a mile from the borders of the Province of Holland, in sight of Amsterdam, Haerlem and Utrecht's Minsters, hearing of nothing than Steam Engines and Watermills.

Please direct your answer as before to Rotterdam, and joining our best compliments to you M^{ts} Watt and M^f Boulton believe me sincerelij

Dear Sir ! Your Devoted friend
J:D:Huichelbos van Liender

JW to HvL 1793-08-01

AoS ref. MS 3147/3/88/257

Birm^m Aug^s 1st 1793

M^r Van Liender

Dear Sir

Our correspondence has been greatly interrupted of Late & I am sorry to own, much on my part. Our Lawsuit suffered many delays & was not tried until the latter end of June when after very great anxiety & exertions we got it brought to a trial, we obtained a very complete verdict from a Special Jury, who found that, my specification was sufficient to enable a Mechanick skilled in the construction of Newcomens Engines to make mine, that the Invention was novel at the time of granting the patent, & that the defendants Engine was a manifest piracy. But the Judge started a doubt whether, the invention came within the words of the act of Parliament which empowers the King to grant Patents for the sole working or making of new manufactures, to the first Inventors thereof, this question he reserved for the opinion of the court say of himself & the other 9 Judges, & which lies over till next November, and in consequence we are kept in anxiety & saddled with the expence of counsel until then, if then it ends. I returned home immediately after the trial to see my daughter who was ill with an inflammation in her lungs, of which she is not yet recovered, but was obliged after a few days to return again to London on some other perplexing business relating to our unfortunate Albion Mill which even in ruins is still a subject of persecution, and since I got home again have in consequence of exertion & vexation, found myself quite unhinged & unfit for my usual duties, so that even the writing of a letter requires a great effort this must account for my silence.

Your business however has not been neglected, on receipt of yours of 19th June (rec^d ab^t the 28th) we wrote to Mess^{rs} Ewart & Rutson, our correspondents at Liverpool, to send the goods either to Rotterdam or Amsterdam, they wrote us in answer that, they can get no vessel to take them under £ 50 freight on account of their unwieldiness, which as there is only 11 tons we do not think ourselves authorized to give, we thought of transporting them to Hull by the canals but unfortunately they are too large for their current boats & moreover the expence would be too considera^(ble).

We have desired Mess^{rs} E & R to continue their endeavours, but in the mean time wish for your advice as to freight for our government —

We have been endeavouring to agree with an Engineer to go over to erect the Engine but have not yet succeeded, it is not every one of our men who are fit for the business, & those that are have been under engagements elsewhere or will not go out of England there is (.....) a very good man who we expect to be able to send as soon as as he has finished a trial Engine at Bristol now in hand, which we hope will not be long in doing

In respect to the money, though like the rest of the world we do not overflow, yet we wish not to put the States to an extraordinary loss by exchange & will wait, besides now you have secured the money, we would rather have fulfilled all our duties towards them before we accept payment.

I am exceedingly sorry for the loss of M^r Smits, there are here too many victims to consumption, but D^r Bedd(oes) is (..... *Ed.Note: the word in this space clearly reads "not"; probably a writing error as it makes a nonsense of the sentence*) trying to cure them by making them breath a certain proportion of inflammable air (*Ed.Note: hydrogen*) & with great prospect of success. Dephlogistated air (*Ed.Note: oxygen*) only adds fuel to the flame. I intended to have wrote you a longer letter on many subjects, but cannot at present because I am not able to collect my ideas, from the state of my mind.

I congratulate you & Miss Van Liender on the acquisition of your new residence, were there a real ZorgVrij (*Ed.Note: = CareFree — here JW's knowledge of German will have helped*) in the farthest part of the earth I think I would fly to it. With affectionate remembrance & congratulations on the return of peace in your country & wishes for its extension I remain always

Dear Sir

Your Sincere friend
James Watt

M^r Boulton & M^{rs} Watt join in respects
to you & Miss Van Liender

HvL to JW 1793-08-08

AoS ref. MS 3147/3/505/55.

The letter referred to in the opening sentence, is [1793-08-01].

The war between England and France makes the trade routes unsafe, and many vessels prefer to sail in convoys.

JW's daughter Janet ("Jessy") died of consumption less than a year later [1794-09-04].

M^r J^s Watt

Thamen near th'Uythoorn 8th August 1793

Dear Sir !

I was very glad to be again favoured with a letter of your own writing, and own my obligation for it, when I reflect what pains it must have given you, after having endured so long continued an exertion, one consolation for it, must be, that the goodness of your cause must have been so clear and evident, that the verdict of the special Jurij has been so complete in your favour; the difficulty started by the learned Judge, is one of the innumerable Mazhes (*mazes?*) in which the chicanerij knows to involve the parties and to embroil matters; I wish he maij have started this doubt, to find occasion to decide it in your favour and make your triumph so much more complete for it seems to me that If ever anij invention was a complete new one, and was accepted generally as so it was Yours; and in which all Engineers and Mechanicks are and must be unanimous; ; and what even your greatest antagonist cannot denij; — I saw with much concern the Indisposition of Miss Watt, we wish heartily to hear of a complete recoverij;

My former letter seems to have been a long time on the road, quite a fortnight, this is verij uncommon, I got yours the 6th daij here; — It surprises me not that owners of Vessels endeavour to take advantage of circumstances, If Mr Wilkenson's founderij at Burshem was still under the same regulations as in 1775, when we got from there the Cylinder of the first Steam Engine Erected in Holland; those working barrels would not have been so heavij, and therefore could not haven given an opportunitij of asking so much moneij for bringing them over; I hope your correspondents may have succeeded before the receipt of these in obtaining more favourable terms; If not, I beg you will desire them to do their utmost in getting the freight as reasonable as possible, but to settle it finallij, and make everij possible dispatch, because we want now one of those pieces absolutely here; but we must not risk to send them over without convoij; If it would facilitate the business, let the greatest one with its bucket & clack, and the other small articles only be send over, because we shall not want the other in a long time; and If we do not put the Engine at work before the end of the Year, it will occasion a very material loss or damage; If your friends have it in their choice to send them to Amsterdam or to Rotterdam, let them chuse the first place, because the conveijance from there to th'Engine is much easier than from the last, but this must not be anij reason to detain them; let the biggest one or both be send off to one of the two places theij maij find occasion for; — The house has been quite finished and roofed some weeks ago, the grate laid under the boiler, the two dead plates, as likewise the fire doors and damper plate put up, next week we think to put the Suction piece in its place, and the Cylinder within the house upon its inner and outer bottoms, and then we shall hang the great beam upon its gudgeon, and the cold water cistern upon its platform; and as soon as the Working barrel is send off, I wish your Engine man may be free of his Engagement at Bristol, and send over to superintend the further compleating of th'Engine; we shall in th'interim forward things as much as we can; The crane wheels and pinions you have send over, are a double one, If we had some instruction how to put it up, without encumbering the motion of the Great Lever, we should put it up in its place, that everij thing might be lifted by it; — It gave me real pleasure to find your thinking so generous about the moneij matter; as the Erection of this Engine has cost so immensely more as it was estimated at in the beginning, the States endeavour to oeconomise as much as theij reasonablij can.

It is to be hoped that Doctor Beddous new treatment of Phtisickal (*Ed.Note: Phthisic = pulmonary consumption*) patients maij have all the good success any other specifick (*Ed.Note: one word badly readable, "enjoys", "injoys", with the j and o uncertain, from context this would be an analog of "treatment"*) for this maladij is of a very cruel nature; I think that the use of the Port wine and other strong spirituou Liquors do in general more mischief as you are aware of; Port Wine is a killer of bodij and mind; I know by experience, how even a moderate use of it has brought me down, and to what degree my blood and juices were heated by it, is inconceivable; and it is to the Use of this pernicious liquor alone, that I adscribe the more frequencij of self murder in England in comparison with other Countries, as I found (*c....ij*) in mij indisposition of it, notwithstanding I had not anij reason of complaining, I was so low spirited, I wished many times to be out of the world, which I never before or afterwards experienced; a cool diet is most salutarij in everij exertion of mind and bodij, at least I have found it always so, because all exertions naturally tend to heat the blood, and if you add to it heating liquors as is commonly the case, this disqualification of the blood must augment, and occasion indisposition, instead of counteracting it by a (*coo*)ling diet. — There is no real ZorgVrij to be found for men that have been accustomed for a series of years to exert themselves in pursuits of Studij and

Knowledge those Involve in so many circumstances of Various nature from which it is afterwards impossible to extricate themselves or to relinquish everij former favourite concern; notwithstanding growing Age renders everij exertion more and more painfull, let such men remove in what part of the world theij will, theij shall always find anij object to exert their mind upon. In mij opinion the best remedij will be, to dwell not to long upon the same subject and to have a variety of pursuits If possible and to take now and then a little tour; fifteen or eighteen years ago (*Ed.Note: late 1770s, when HvL was in his late forties, and lost his father*) when in the busiest time of our commerce I was obliged for several Years consecutivelij every summer to take a Yaunt of some weeks to refresh mijself I should not have been able to keep it out (*Ed.Note: Dutchism, meaning here "to manage"*) otherwise and this remedij I think I may recommend you as the best to reestablish yourself from your exertions; Thank you kindlij for your affectionate wishes; my Sister and I wish to be heartily remembered to you and M^{rs} Watt; M^r Boulton and family and that you will not doubt me to be

Dear Sir

Your verij Sincere friend
J:D:Huichelbos van Liender

HvL to JW 1793-09-30

AoS ref. MS 3147/3/505/56.

Forwarded to Heathfield.

M^r James Watt
Birmingham

Thamen at th'Uythoorn 30th of September 1793

Dear Sir !

By my last letter in answer to your Agreeable favour of 1st of August last, dated 8th of same month, I have desired that your friends at Liverpool, should endeavour to settle the matter of the freight of the working barrels etc we want from that place, upon as reasonable terms as possible, but that they should settle it finally; because we are so greatly in want of the large working barrel and its apparatus; and as your letter gave me to understand, that the high price the owners of the Vessel did demand for their freight was the only obstacle, of their not having been send of; I flattered myself that upon the receipt of my letter, this obstacle being removed, I should have received the bill of loading â long while ago, but to my surprise I have heard nothing about this business , these two months ago which obliges me to Inquire after the cause of your silence, not doubting of your having received mij said letter in time; — we are now as greatlij in want of the large working barrel and its apparatus, as ever, having put the suction piece upon the wooden ring and iron cross in very good order in the pump pit; the great beam with its gudgeon on the plummer bloks in its place as like wise the cold water cistern, and the Cylinder with its Outer and inner bottom brought in the house, and build up the pillar of brickwork to support the same all the brickwork under and round the boiler as far as your drawing has directed it, Is finished; and every thing readij to finish th'Engine; and as we must absolutely finish it and set it to work as soon as possible, as otherwise it will occasion a dammage to the ringdykes etc of more than 5000 £St: I wish to be acquainted, if there is anij probabilitij of getting the said barrell etc soon here; If not we must resolve to make a wooden barrell with an Iron bucket and clack, those last we can get cast at Amsterdam; — We have emptied the house of all the water mud and rubbish fallen into it, since the beginning of its construction; and have found the floor in good order, and that we can keep it drij easily, which is much more than we expected, considering how much it lays below the water; and with what difficultij we have begun to raise it up; I hope you will conceive the dilemma we are in, and how manij times the States Inquire of me, if I have not yet any advice of the sending of the desired goods and that I may soon receive your favour to help us out of it; In this expectation I remain as always

Dear Sir

Your much oblid: friend
J:D:Huichelbos van Liender

JW to HvL 1793-10-07

AoS ref. MS 3147/3/89/3.

Van Liender

Birmingham

Oct^r 7th 1793

Dear Sir

At last you will please receive enclosed Bill of Lading for the goods at Liverpool, Insurance on which we have thus(?) ordered to be made at London the ship will sail in a few days say the Charlotte Daniel Carter Master chartered to go north about, the Capt is directed to apply to your house at Rotterdam, to which you will please send directions.

James Smallman who we intend to assist in erecting your Engine is ready, we have not yet determined whether it will be better to send him by Harwich or Hull but incline to the former. We shall be obliged to you to give directions as soon as you can when he applies to your house at Rotterdam how he is to be forwarded, and and wish he could see the Engine in Rotterdam in his way, as he has never seen a pump of that kind though he understands how to do the work, he is a quiet inoffensive industrious man who we hope will give you satisfaction, as he has done wherever we have sent him. At the same time it is to be understood that though he is an intelligent workman he is no philosopher nor theoretical engineer. In these points (?) we depend upon you Sir, and the drawings & clarifications(?) we have sent.

We shall inform you in our next of his wages.

M^r Boulton & M^{rs} Watt join me in best respects & kind wishes to you & Miss Van Liender & I remain

Dear Sir

Yours sincerely
(signature obscured)

HvL to JW 1793-10-21

AoS ref. MS 3147/3/505/57. Docket: Arrival of Smallman.

"I hope your son may extricate himself..." would allude to JWj's political activities; by this time he had already left (rather fled) France and gone to Milan where he would be quite safe. He denounced the Terreur, see [1793-12-03], and would upon his return to England turn away from politics altogether, which would be to his father's wishes, but why would politically outspoken HvL applaud that?

M^r James Watt
Birmingham

Thamen at th'Uythoorn 21th of October 1793

Dear Sir !

Two days after having wrote you my former letter of Ult^o September I received M^r W^m Forman and Your letters of 21th and 26th of last month and have since been favoured with Yours of 7th of this month; the contents of those letters have given great satisfacti^on, because they convey us the well founded hope, of being able to bring this undertaking to its desired point; It seems by those letters that mine letter of 8th of August has not been received by you (*Ed. Note: it is in the AoS, though*); — Your letter to Milan is forwarded via (...)f^o frankforth the first postdaj after having got it here; — What calamities have not originated from the intestine (*Ed. Note: would HvL mean internal, or domestic?*) troubles in so manij parts of Europe, how is it not to be lamented, that the rulers of the Several States will not condescend to accommodate themselves to the feelings of an enlightened Age, we live in, which will not suffer the tyrannical mode, in which those rulers dispose of men's liberty and propertij, in the same manner as they have always done centuries ago ? It is not to be wondered, that men of probity and sentiment are incensed at this, and are not always capable to keep themselves within bounds of safetij. I hope your Son may extricate himself to your wishes from this anxietij, but when will men's minds be cooled, when your Government not only suffers, but even encourages the most virulent invectives to be published against the french nation; What an infamij that your Senators do not hesitate in your National Assembly to characterise the whole french nation as Atheist, because one man has in the french Nat: Assembly declared himself one;

I received with pleasure the bill of loading of the heavy goods sent of from Liverpool, this fine autumnal weather, I wish, may help the Charlotte through its more or less dangerous passage; As I likewise did th'advise of your intention to send us speedily an able Engineer to superintend the further erection of th'Engine; and M^r Smallman followed Your advice, arriving here only two days after your letters having had Just time enough to give the necessarij directions at Rotterdam to forward him hither; I find him more livelij than I expected from your description of his character; and I doubt not or he will give entire satisfacti^on, I have verij good expectation of his abilities; he is very well liked here; I have introduced him to two of the principal Gentlemen Directors at Meydrecht, the Sheriff and the Secretarij of that place, the last of 'em speaking a little English, he can alwaijs direct himself to in case I was obliged to be at Rotterdam, as my sister shall not staj the winter here and I propose to go off and on.

My sister joins me in offering our best respects to you and M^{rs} Watt and M^r Boulton, I heard from M^r Smallman that you and M^r Boulton enjoyed a verij good health, which did real pleasure to

Dear Sir

Your M^t Sincere friend

J:D:Huichelbos van Liender

JWj to JW 1793-12-03

AoS ref. MS 3219/4/13/2.

M^r James Watt Birm^m

Amsterdam 3 Dec^r 1793

Dear Father

I wrote to you a few lines from Dusseldorp merely to let you I was upon my road hither & have not since received any letter from you, nor have I as yet heard from M^r van Liender whom I propose visiting as soon as I have finished my business here.

(Ed.Note: observations on travel plans skipped; following is an unequivocal statement of JWj's disillusionment with the French Jacobins)

..... I should dread them *(Ed.Note: threats of prosecution)* at Cadiz, where the audire alteram partim is not always religiously observed & I have not the smallest ambition to swell the list of captive Jacobins. The less so, as I no longer hold any opinions in common with the villains who now bear that name, and indeed never did hold any which bore resemblance to theirs. My friends in France, the friends of rational liberty have most of them passed the fatal guillotine & the reigning party were always the object of my hatred as well as of M^r Coopers. —

(.....)

With best respects to Mrs Watt & love to Gregory & Jessie I remain

Dear Father

Your dutiful Son

J Watt —

JWj to JW 1793-12-06

AoS ref. MS 3219/4/13/26.

M^r James Watt, Birmingham

Amsterdam 6 Dec^r 1793

Dear Father

I wrote to you by last post and have not received any letter from you or from M^r van Liender, which makes me fear that illness or absence may have prevented him from answering me. Having finished my business here, I propose going tomorrow to Sardam (*Ed.Note: =Zaandam*) and endeavouring to procure a sight of some of the mills there. This will occupy me a couple of days & at my return I hope to meet with letters from you which will determine my future destination.

(Ed.Note: remainder of letter on JW's political/legal worries and his finances)

With best respects to M^{rs} Watt & love to Gregory & Jessy, I remain Dear Father
Your dutiful Son
James Watt

JWj to JW 1793-12-13a

AoS ref. MS 3219/4/13/24. Partial transcription by R.Hills.

The notes below summarize the data on JWj's stay in Holland.

With [1793-11-05] JWj writes to JW from Frankfurt that he may go to stay with HvL. On [1793-12-03] he writes from Amsterdam that he has finished his business there and has not heard from HvL. On [1793-12-06] he still has not heard from HvL and decides to go see some (wind)mills in Zaandam. C.1703-12-10 he goes to Uithoorn, HvL is not there, so he returns to Amsterdam (as he writes on [1793-12-13]). On [1793-12-17] he writes from Amsterdam that he has got JW's letters from HvL, and that he is going to see HvL "tomorrow" to attend the engine. On [1793-12-22] he writes from Uithoorn that he lodges at the inn, c.1 mile from the engine, HvL has a little room at a farmhouse close to the engine

(Ed.Note: this is at variance with what HvL writes [1793-06-13], about renting a small country estate Zorgvrij on the W bank just opposite the Engine; the location of that estate is not known, but that of the engine is Ter Schelling on the E bank, and via the Uithoorn bridge it would be a 3-4 km walk to the engine. The estate would be close to the Thamen church on the W bank of the river; would there have been a ferry there? JWj probably stayed at the (still existing) "Rechthuis" inn in Thamen)

JWj is happy to have made HvL's acquaintance, which he shall "cultivate assiduously". He intends to wait here (Uithoorn) until the engine be set agoing, which will be in February. On [1794-01-07] JWj writes JW from Amsterdam that the Engine is making good progress, being finished except for the placing of the pumps & fitting the buckets. Smallman is very diligent but he cannot get the Dutch workmen on with their work as he would wish. (Ed.Note: by this time blacksmith J.Duister would be assisting with the erection [Lieburg & Snelders, 1989 p73], would he be the "lazy hand"?). Severe frost for this week past. Apparently JWj leaves for home soon after this, without seeing or notifying HvL, who is disappointed, see e.g. [1794-01-16] and others [AoS ref.MS3219/4/13 fol.19, 20, 21, 23, 27, from R.Hills].

Altogether, JW appears to have been in Uithoorn/Thamen from 18 or 19 December 1793 to 5 or 6 January 1794; he is likely to have advised HvL about supervising the erection of the engine, but not in any planned manner — he may have been more of an interested and knowledgeable visitor. By this time the putting together of the engine was in the hands of erector Smallman, who apparently could be entrusted with it, in view of HvL's long absences. The week of severe frost reported would probably have brought the work to a virtual standstill.

Amsterdam 13 Dec^r 1793.

Dear Father

At my return from North Holland, three days ago, not finding any letter from M^r van Liender I went to Zorgvry, where I learnt he had not been for three weeks, but was expected that evening, I left my direction with the Engineman and a Note at the inn in Amsterdam where he puts up, to request he would forward me your letter, but being still without any intelligence from him, I have written to him at Rotterdam, being apprehensive that my former letters have miscarried & that he has delayed his design of coming to Zorg Vry.

The Engine house is finished and the Beam, Cylinder, Airpump, Condenser & boiler in their places. The Working gear is not yet put up nor are the pumps fixed; these last indeed did but just arrive as I was there. The Buckets not being fitted up, it will take as Smallman says a couple of months to get them into order, for there is but one smith at work & he a lazy hand. I hope proper precautions have been taken to secure the foundation of the house, for as I suppose you know, it is all turf land and they are obliged to lay out immense sums at Amsterdam to secure even common dwelling houses. I was not a little surprized to find one of your engines here, not having heard of it before. —

I am in anxious suspense to receive your letters and hope no new accidents will now retard them.

With respects to M^{rs} Watt & love to Gregory & Jessy, I remain

Dear Father
Your dutiful Son
James Watt

Please in future address to me, at Mess^{rs} Ambroggio & Sawyer's Amsterdam. —

HvL to JWj 1793-12-15

AoS ref. MS 3219/6/2/L/191. Copy from J.L. Meijer. Addressed to 'Monsieur — Mons^r Jaq^s Watt Le Jeune — Amsterdam'. Docket: J.D.H. Van Liender — Thamen at Uithoorn 15 Decr. 1793 — Recd. Amsterdam 16 Dr. — Ansd. (illegible).

Drawboat = track boat (horse-towed, Du. "trekschuit"), common mode of public transport in 18th century Holland.

M^r James Watt Junior
at Amsterdam

Thamen at th'Uythoorn
15th of December 1793.

Sir!

Being arrived here yesterday night I was favoured this morning with your agreeable letter of 13th instant. it gave me great concern to see your former favours from Dusseldorp and Amsterdam did not reach me, which could not be otherwise as all letters send here by post must be postpaid to Utrecht or Amsterdam or Gouda; If your letter from Dusseldorp had been directed to me at Rotterdam, or been postpaid to Utrecht or Amsterdam, I should have received it here; but now it certainly lays at the post office at Utrecht. Your father has directed all his letters to me at Rotterdam from where they are send me here. Your letter from Amsterdam must have been send by the drawboat, as (*no?*) mail from any place go this way. I did always suppose you should have proceeded from Francforth to Rotterdam and therefore when I left Rotterdam last Monday; I gave two letters from your father for you to my sister; to deliver them to you should call for em; I have now writed today to my sister, to send those letters by the post to Messrs. Ambroggio & Sawyer, where you will find them next Tuesday morning. - Some circumstances obliged me to Lodge at Amsterdam at the Swan Inn on the Newdike; instead of going to our ordinary lodging there. which was the reason of your not finding me there.

It vexes me very much of not having had the good fortune of meeting you here or at Amsterdam; and as I intend to stay here for some time I shall be very glad to see you here; and if possible, to be of any service to you in this country; If you have anything to write to me here from Amsterdam, you may direct it with the common drawboat of this place, who goes Monday Wednesday and Friday from here to Amsterdam and back again; or otherwise every day with the night drawboat from Amsterdam to Gouda, to be left for me at the Bridge at th'Uythoorn; every letter will come by both ways safe to my hands.

I remain with every esteem,

Sir Your m^t ob: H^e Serv^t
J.D. Huichelbos van Liender

JWj to JW 1793-12-17

AoS ref. MS 3219/4/13/21.

Amsterdam 17 Dec^r 1793

Dear Father

My last letter to M^r Van Liender at Rotterdam has been more fortunate than its predecessors at Zorg Vry and in consequence of it I have just received your two favours of the 25th Nov^r & 1 Dec^r which have been forwarded by M^r Van Liender's sister, he being actually at the Engine where he arrived the day after I was there, and as he accidentally put up at an inn, different from his usual one at Amsterdam, did not receive the note I had left for him. It seems we have been playing at cross purposes. My two former letters have miscarried, owing as I suppose to Mr V.L.'s not being known in the neighbourhood; for if it had not been for the Engine I should not have found him out myself.

(Ed. Note: the next section has not been transcribed; it is mainly about JWj's anticipated legal trouble in Spain and in England, due to his being seen as a supporter of the French Jacobins. JWj also reports news he has heard - via Smallman and a Spanish captain - about Murdock advertising himself in Cadiz as the only competent engine erector, and he warns against this "rascal").

I shall answer the other parts of your letter by next post from Uithorn, whither I shall remove myself tomorrow in order to see M^r Liender & to attend the Engine. —

With best respects to M^{rs} Watt & love to Gregory & Jessy

I remain Dear Father

Your dutiful Son

James Watt

JWj to JW 1793-12-22

AoS ref. MS 3219/4/13/20.

HvL himself has written [1793-06-13] that he and his sister stay at a small country estate which he has rented.

Uithorn 22 Dec^r 1793

Dear Father

(Ed. Note: The first part of this letter is about JWj's less than enthusiastic readiness to start soliciting orders for Boulton's Soho Manufactory products, mainly a new type/pattern of buckles)

You will see by the Date of this letter that I am now at Uithorn where I am lodged in the inn, about a mile from the Engine & from M^r Van Liender who has a little room in a farm house close to it. There were no lodgings to be got nearer. I am extremely happy to have made his acquaintance, which I shall cultivate assiduously during my stay here.

My plan is to wait here until the Engine be set a going which will probably be in February & then either to solicit orders for the buckles if the patterns are sent me, or to visit Mr Rheinhard & wait the events of Mr W's trial or come to England & wait that event in London, which I think is the most adviseable of (.....) The occurrences of the moment must determine me.

I shall endeavour to find out something which will be acceptable to Jessy & not fail writing to her, in the meantime I beg my love to her & best respects to M^{rs} Watt, being

Dear Father

Your dutiful Son
James Watt

(Ed. Note: There follows a longish PS about customs duty on his maps & prints, and on business propositions for buckles)

JWj to JW 1794-01-07

AoS ref. MS 3219/4/13/19.

Amsterdam 7 January 1794

Dear Father

(Ed. Note: The first few sections of this letter discuss the military situation, the legal problems concerning a Mr W—, and his activities in trying to find customers for Boulton's Soho Manufactory products, mainly buckles, all without much interest for this compilation; only the last paragraph has been transcribed below)

The Engine is making good progress, being finished except the placing of the pumps & fitting the buckets. Smallman is very diligent but he cannot get the Dutch workmen on with their work as he would wish. — The weather is changed to a very severe frost for the week past. Inclosed a letter for Jessy I shall send her some little keepsake by Smallman.

Being with best respects to Mrs Watt Dear Father

your dutiful son
J Watt

JW to HvL 1794-01-09

AoS ref. MS 3147/3/89/28.

Date completely faded, inferred from ref. in [1794-01-23].

Birm^m Jan^y 9th 1794

M^r Van Liender

Dear Sir

(.....) of your acc^t current as it stands in our books balance in our favour £ 1820.17.7 which we hope you will find right according to the contract & Invoices. If it was convenient to make us a remittance it would prove very agreeable at present, as we are rather short of cash. The Engine materials have cost us more than we estimated & having been long paid for must form our excuse for (.....ing) you at present.

I am glad to hear from my son that Smallman continues to give satisfaction & I hope he will be able to have(?) the Engine soon complete, for which if the weather is as mild with you as here it is extremely favourable

I thank you for your obliging attentions to my son who I hope will (.....) to merit your esteem (.....) my attention has been & will continue so much engaged with our Lawsuit that the approaches of age are accelerated especially in what regards the exertion of the mind & I have thereby been prevented from writing to you so often as I intended which I hope you will excuse, accept the comp^{ts} of the season & present them to Miss Van Liender

D^r Sir

I remain Sincerely
Your obliged friend
James Watt

(Ed.Note: following was added in left margin)

I owe you for a cask of wine & there is also a matter of commission which I shall continue in another letter

HvL to JWj 1794-01-16

AoS ref. MS 3219/6/2/L/192. Copy from J.L. Meijer. Addressed to 'James Watt Junior Esq^r. — Amsterdam'. On the address page also the names Mr. Stolcker — Boompjes (a street in Rotterdam) and Mr. Gibson. Docket: Regrets my departure from Uithoorn. Inclosed letters of introduction to Leyden & Rotterdam.

On 1794-01-17 JWj writes to his father (AoS ref. MS 3319/4/13/19) that he has taken his leave from Uithoorn, and will proceed to return to England by way of Leiden, Den Haag, Rotterdam, notwithstanding his apprehension that legal and other difficulties may await him at home. He probably toyed with the idea of emigrating to America.

M^r James Watt junior

Dear Sir !

Your sudden departure has struck me; I was already so accustomed to your good compagnij in my lonely situation, at this season of the year, that I found all th'Inconveniencij of it was gone - but as I may not wish for my own private emolument, that you were banished here, I will hope you shall not be disappointed in your endeavours of revisiting your mother Country. I wish sincerely you may find things there infinitely better than you seem to expect, and above all I wish you may not be induced to change it for America, which in my opinion is not a theatre where mens talents may be sett off with sufficient lustre.

I send you by these the desired introductory letters. The first for Leyden is for a cousin of mine the only man I am acquainted with now in that Cittij, my good friend Professor Damen being dead since five or six months; my cousin has been with me, my sister, and his two daughters in England for ten weeks in 1788, his eldest daughter speaks English, and he speaks French; he is a good kind of man, and will be serviceable to you, he is a patriot and If he can introduce you to Professor Voorda (as I think he may) you will see one of the firmest and most sensible Patriots in Holland. my cousin will certainly give you an introductory letter to any body at the Hague; the following letter is for my sister; and now to get you moneij at Rotterdam; give yourself the trouble to applij to M^r Pieter Stolker, to whom I shall write, to provide you with what cash you shall want. and the last letter is for mij good friend Doctor Ten Haaff, who I am sure will be delighted in making your acquaintance he is a staunch Patriot, and you may freely tell him what you think of political circumstances; If you can spare the time; I wish that you would see the rooms of our Society, the collection of Physical instruments models etc. and if the time permits you to pay a visit to Doctor Bicker one of the Directors of our Society and who has made your fathers personal acquaintance in 1788 in London, you shall do well, he shall receive you with pleasure. And now Sir, what shall I further add, as that I most heartily hope, that never a Western Ocean may intervene our reciprocal letters, and that you maij enjoij all the happiness you may desire in that happij Island which after mij own Countrij I like the best. With the good God's blessing I conclude and remain,

Dear Sir!

Your oblided friend

J.D. Huichelbos van Liender

Thamen at th'Uythoorn 16th Januarij 1794.

P.S. as I always write in french to my sister, I have followed the same method in th'Enclosed.

P.S. after having finished my letter, I received one from your father, who complains still over the fatigue, that vexatious Lawsuit gives him, and that it accelerates th'approaches of Age; I wish to hear he has been triumphant in it; he mentions nothing about public affairs. do not take it amiss, that I ask you, if Mr. Pieter Paulus' tract about the rights of man, is gone with you to Amsterdam; if so, be so kind as to give it to my sister, that I may render it to Mr. de Jongh.

HvL to JW 1794-01-23

AoS ref. MS 3147/3/505/58. Docketed in error as 25 Jan; Docket: With remittance.

M^r Watt
Birmingham

Thamen at th'Uythoorn 23th of Januarij 1794

Dear Sir !

In due course I was favoured with your esteemed letter of 9th this month, including th'extract of your account curr^t with me, which I have found right and booked accordinglij; As your demand for anij remittance is verij proper, I have ordered mij banker at Rotterdam to remit you in one or more bills of exchange one thousand pound.

Mr Smallman gives certainly Satisfaction, he thinks to start th'Engine within three weeks time; the weather has been this winter as fine and Agreeable as could be wished; about a fortnight frostij, but not severe. — Your Son's entertaining compagnij here has been extremelij acceptable to me in this season of the year, and this part of the Countrij; I pithy only that his stajj has been so short, and that he has been oblidge^d to leave this place when we became a little acquainted together. — I hope this spring will make a honourable and favorable end of your tedious lawsuit nothing certainlij will preij more upon a man's mind, than the continued anxietij about th'issue of an interesting concern, and I have great reason to complain, because it deprives me of your valuable correspondence.

I own mij obligation for your kind compliments in the renewed season, as my sister (to whom I have participated them) does likewise; I return them gratefullij and solliciting mij kind remembrance to M^{rs} Watt M^r Boulton and family I am alwaijs very sincerely

Dear Sir

Your oblidge^d friend.
J:D:Huichelbos van Liender.

HvL to JWj 1794-01-30

AoS ref. MS 3219/6/2/L/193. Copy from J.L. Meijer. Addressed to 'James Watt Jun^r. Esq^r. — Manchester'. On cover written 2/8 (postage ?) and stamped FE3 (date received?) plus another illegible stamp. Docket: Wishes to hear from me. Has settled all my acct^s. Given my (Maps?) to the (care?) of Smallwood (Ed.Note: should be James Smallman, Watt's erector at Mijdrecht).

Thamen at th'Uythoorn 30th January 1794

(Dear) Sir

By your letter from Amsterdam I had your promise of writing me more fully from Rotterdam. I was in hopes of receiving your pointed remarks upon the towns of this province you have visited in going from Amsterdam to Rotterdam and particularly I wish to know how you like Rotterdam; I remember M^r Southerne asked me once, If carriages were kept at Rotterdam as at Birmingham, If you see him you may tell him that I have told 'em the truth that more carriages are kept at Rotterdam than at Birmingham, but that the Country around the first-mentioned place; is not so pleasant than around the last. I hear you left Holland with last Saturday's mail, and I have not seen any of your letters, you must have had time enough, while the Storm kept you within the port of Hellevoetsluisch, to write me a long letter, which would have been very agreeable; Mons^{rs} Ambroggio & Sawyer send me th'enclosed, telling me that as I know your direction, I will forward 'em, I shall pay the Schoolmaster according your desire. I have paid M^r Van Gelder all his demands. I am now burried here under the Snow; which promises another diversion that of the Snow sledges. as you have not given me any direction, I send you these at Manchester where I hope you may have arrived safe; I remain

Dear Sir Your oblid^d friend
J.D. Huichelbos van Liender

JWj to HvL 1794-04-05

AoS ref. MS 3219/6/7.

The referenced letter 1794-03-26 has not been found.

M^r J.D.Huichelbos Van Liender
Rotterdam

Soho 5th April 1794

Dear Sir

I thank you for your obliging letter of the 26th Ult^o and in return I lose no time in communicating the happy issue of my friend Walker's trial. It came on the 3^d Inst^t before a special Jury at Lancaster, where the celebrated Erskine was Counsel for my friend. After a hearing of Witnesses & Counsel for seven hours, the Prosecutor for the crown threw down his Brief and declared it was not in his power to support the facts stated in the indictment; Walker was of course fully & honorably acquitted. The principal witness against him was immediately put under arrest and will be tried for perjury. Knowing as you do, my attachment for this gentleman, you will easily conceive the pleasure I feel upon this occasion. —

My father is again in London about his lawsuit, which I am happy to inform you, is in a most favourable state; Injunctions have already been issued to Bull not to make any more engines and to those who have any of his engines not to use them without the leave of B&Watt. This you see is going a great way towards gaining our cause but the Lawyers must squeeze some more money out of our pockets, before they bring the cause to a final termination.

I am glad to find that your Engine succeeds so well, and hope as soon as the rainy season is over, to hear good accounts of the progress it has made. What you mention about Hennema surprizes me, as I had really entertained a very different opinion of him, however it is not the first time that I have been mistaken in my opinion of mankind.

I thank you for the Note of my Debit, but wish you to mention at what exchange you have charged it, as I must settle that account with Boulton & Watt.

I feel myself extremely comfortable & happy at home, after all my rambles and probably shall never quit this country any more, particularly as I find all my friends, D^r Priestley excepted, determined to remain here. Indeed, bad as this country may be, it is the best I know. — I beg my best respects to your Sister & all friends at Uithoorn & am respectfully

Dear Sir

Your sincere friend
J Watt Jun^r

HvL to JW 1794-05-06

AoS ref. MS 3147/3/505/59. Docket: With remittance and statement of account. Performance of Mydrecht engine.

The referenced letter 1794-04-18 has not been found in the AoS; as JW responds to it in [1794-05-07], it must have been received, and gone missing later. No copy was sent.

“39β8d per £St.” clearly represents an exchange rate, but which? 39β8d interpreted as Dutch money would appear to be “39 stuiver 8 groot” or nearly two guilders (12 groot to the stuiver, 20 stuivers to the guilder), whereas the exchange rate at the time was a little under 12 guilders to the pound (as the f 445.14. to £ 37.9.1 seems to confirm). If, instead, 39β8d is interpreted as “39 schelling 8 penning” (16 penning to the stuiver, 6 stuiver to the schelling), the calculation seems to work out. HvL’s use of this “schelling & penning” coinage is unusual, however — he normally uses “stuiver & groot”.

M^r James Watt
at Birmingham

Rotterdam 6th of Maij 1794

Dear Sir !

It was the 18th of last month, that I had the pleasure of writing you circumstantially, on which I expect dailij to receive your verij agreeable answer; And as the course of exchange between your Country and Holland suffered some diminution, I remit with these to your associated firm nearly the Balance I due you; In a first of exchange drawn 2nd of Maij at two usances by W^m & J^s Murdo(c?)h to mine order on G.F.Kinloch Esq^r & Sons for the sum of

St:£ 400

and another first of Exchange drawn at the Same date and at two usances by myself to the order of Messrs Boulton & Watt on the same Gentlemen for

St:£ 88

together St:£ 488

of which remittances please to procure the needfull, and after being paid give mine account Credit for the same; these with the former remittances of £ 600 and of £ 1000 making

St:£ 1600

St:£ 2088

by which is to be added for account of M^r Matthew Boulton his yearly allowance to M^{rs} Zwellingrebel of 50 £St: for the years 1791.92.93 & 94
for mine Commision allowed at 5prc^t on 1580 £
for f 445.14.- Dutch Currencij paid to M^r James Watt Junior at 39β8d per £St:
for f 102.3.- Dutch currencij paid for one hogshead Bourdeaux wine and freight from here to Duynkerken
In 1790 for account of M^r James Watt at 39β8d per £St: „

„ 200

„ 79

„ 37.9.1

„ 8.11.10

Amount in all £ 2413.//.11

Which I beg you will have examined, and If found right, to have it booked accordinglij, and as certainly some moneij will be due to M^r Smallman, it shall be best to have it paid by you to him, as to give it to him here in Dutch moneij, and then our mutual account can be closed finallij.

Meydrecht Engine continues to go on in verij good order and lowers the water constantly in the Lake The 28th last I had a letter from th’Engine man (*Ed.Note: almost certainly Mr.Duister*), who mentioned the water to be sunk by th’Engine 13 Inches, which is verij well; Yesterday I have wrote to Utrecht to see if I can get Smallman released, which I hope shall be allowed.

I beg to offer our best respects to you and M^{rs} Watt and M^r Boulton and remain alwaijs

Dear Sir !

Your oblidge friend

J:D:Huichelbos van Liender

JW to HvL 1794-05-07

AoS ref. MS 3147/3/89/51.

Apparently HvL has inquired after a steam engine for a hammer mill for iron; the inquiry dated 1794-04-18 has not (yet) been traced, it is probably lost.

M^r Van Liender

Birm^m May 7th 1794

Dear Sir

I ought to have answered yours sooner but have been prevented from various causes. It gives us much pleasure to find that you are going on so well with your drainage & we should have been well pleased to have let J. Smallman continue with you for a longer time, but we are very short of hands, having had one disabled by an accident lately & another sediced away from our service by some of our pretended friends, we must therefore request that you will permit him to come away by the end of this month, hoping that by that time one of your own people will be in condition to attend the Engine & keep it in order.

In respect to your friends queries; to take the matter in its most simple form, that is an independent Engine with its own boiler & fire place working one hammer of from 5 to 6 Cw^l about 120 blows p^t minute & rising 18 inches each blow, will require an Engine of 12 horse power which would cost delivered at Hull

The metal materials with our premium	£ 750.-.-
including an Iron boiler	}
The wooden framing would cost about	85.-.-
The erection or putting together would cost here about	55.-.-
	£ 890.-.-

The Engine house we cannot compute nor the pump for supplying the Engine with water — The Engine house need not be large nor very strong as we should rest the working beam on a wooden frame which we either supply or send drawing. On this head you will please advert that the Iron work of that framing is not included in Metal Materials of Engine but in the framing. The metal materials comprehend the Rotative Motion, a very heavy fly wheel & a strong shaft or axis, which carries the cammring containing the teeth which lift the hammer, as well as all the Materials of the Engine & boiler, but they do not include the camm ring itself, the leg which supports it nor any part of the hammer work (these things being prohibited to be exported as well as workmen from hence to erect it)

Such an Engine when at work would consume about 1¼ bushels of newcastle coals per hour, when going its ordinary pace & kept in good order.

If there are more hammers than one wanted, you will readily see that if wrought by the same Engine at same time whatever their respective velocities are when one is accelerated or retarded all must be so in the same ratio any one may indeed be stopt without stopping the others. Your friend must consider how this would suit his work. The blowing the bellows is another (.....) As they require to be always blowing & the Engine commonly stops between the heats besides they disorder the working of the hammer which in its turn disorders (.....).

If more hammers than one are used at once it is evident the Engine must be larger but how much we do not know(?) untill we are informed of the perpendicular lift of each of the hammers as well as of the desired number of blows p^t minute, the 85 lb hammer may from its velocity require a larger engine than that of 5 Cw^l.

In respect to working the Engine by the Glass house fire (*Ed. Note: without having the inquiry, it is difficult to see where glass comes in*) we apprehend that would be inconvenient, but by using a reverberatory furnace to heat the Iron, bellows may be avoided & the spare flame employed to heat the boiler as is now practised at Rotherhithe Iron works, we are informed to the saving of the whole coals which would be required by the Engine, we do not answer for the truth of this, but believe there is considerable saving made — I have now given you some data to make your friend to judge how far we can serve him, & shall answer any farther questions arising(?) in future but think he should set about no such enterprize without first coming here & seeing with his own experts some of the Iron works where such Engines are used.

Mr Boulton is now in London about our law affairs which grow more and more perplexed though the Chancellor is very favourable to us in this department. Mrs Watt joins in compliments to Miss Van Liender & I remain

Dear Sir

Your obliged friend
James Watt

B&W to HvL 1794-05-12

AoS ref. MS 3147/3/89/53.

M^r Van Liender

Birm^m May 12th 1794

Dear Sir

We have received your favour of the 6th covering Bills value £ 488.- which at maturity shall go(?) to your credit. The said Bills with those already received & the several payments you state form in all the sum of £ 2413.0.11 to your credit.

In respect to Smallman whatever ballance is due to him for paying his charges with you & (.....), should be placed to our credit, as we pay his wife a certain allowance weekly & are beside in advance to him, your order upon us in his favour shall regulate the settlement with him.

We are happy to hear you get on so satisfactorily with the Engine & hope your success will continue, until you rout your aquatic enemy We refer to JW^s letter of last week for an answer to your former one. writing now in haste not to lose the mail

We remain

Dear Sir

Your obliged friends
Boulton & Watt

HvL to B&W 1794-09-04

AoS ref. MS 3147/3/505/60. Docket: Smallman allowed to depart. State of Smallman's account. Mydrecht engine. Observations on the war.

With copy of [1794-07-31]. The loss referred to in the opening sentences of that letter, concerns the death, of consumption, of the Watts' daughter Jessy [Dickinson 1935, p.183].

For this time, [Schama] does not mention a state of war between England and the United Provinces; however, British and Austrian troops are defending the United Provinces, and particularly the Stadholder regime, against the French invaders (whom HvL would regard as liberators), and France and England are at war — so trade and post are difficult.

Copij M^r James Watt at Birmingham

Thamen Ult^e Julij 1794

Dear Sir.

By M^r John Southern's letter of 12th last we received the melancholy news of yours and M^{rs} Watts truly lamentable loss, for which we condole sincerely with you, hoping th' Almighty goodness of God may have given you both the wanted strength and forces for bearing such an afflicting accident and to find your consolation in his further paternal care and support.

I have send a copij of what M^r Southern mentioned in M^r Boulton and Your name about M^r Smallman's longer Stay in this Countrij, to the members Commissioned of the States, in Consequence of which they have given M^r Smallman his leave, with the end of this month, so that he will now soon be with you. where he shall be able to give you a detail of our proceedings, and that we were obliged to stop th' Engine, by lack of water; the mean ditch to convey the water to th' Engine, not being undertaken soon enough, further interruptions of this nature I hope now to prevent by my presence here; as I have demonstrated, what irreparable detriment, such an interruption of this undertaking must occasion; I send you a Copij of M^r Smallman's bill, by which you shall see, that its amount in all is f 1033.16.- that he has received f 600.- on account and that the remaining f 433.16.- shall be paid me, to remit you the same — I am obliged for your answer upon my querij, about the wind Watermills in the fens.

More than one corporation have made enquiries about the power and effect of Mydrecht Steam Engine, where our public affairs not in so dubious a circumstance, as they are at present, I am certain, I should very soon be in the case of ordering one or more Steam Engines.

Your Ministrij have Involved our Republic in a very ruinous and unhappy War, of which nobody can foretell the consequences, they are likely to be disastrous in the extreme, If we are obliged to defend this fine Province, by having it overflowed with salt water, what a terrible alternative? England by its happy situation, and by being an Island, can easily venture to engage in quarrels, but Holland is most unhappily situated, when th' Events of war turn out unhappily, as is now the Case.

I wish you health and happiness; joining my sisters compliments with mine to you M^{rs} Watt M^r Boulton I remain

Account of James Smallman

Travelling Expences Outwards	f 74.14.-	
his salarij for 271 days at 12/8st	560.1.-	(see Ed.Note below)
for extra salary 16 weeks	76.7.-	
His extra premium of 20 guineas	248.-	
travelling expences homewards	74.14.-	

f 1033.16.-

Ed.Note: The subdivision of the guilder is similar to that of the pound: one guilder is 20 stuiver of 12 groot each. The extra salary for 16 weeks comes to f 4.15.5 per week. The normal salary appears to be f 12.8.-, presumably per 6-day week — which would bring the total for 271 days (45 weeks + 1 day) to f 570.-. Close, but not exact; maybe another interpretation is needed.

Mess^{rs} Boulton & Watt
at Soho

Thamen 4th of September 1794

I was greatly surprised by the receipt of your agreeable favour of 16th Last, to see that Smallman was not at that time arrived at Birmingham, he left this place the last of July, was at our house at Rotterdam the following day, took with him the Case with M^r Watt's Junior maps, the box with fossils, and a few books and set off the

following daij with the Paquet for Engeland as I Suppose, in which case he could have been with you verij early in August, where he has stopt on the road I can tell (*Ed.Note: HvL probably means "cannot"*) besides the 600 guilders Smallman got from the States, I have paid him six and thirty guilders which must be deducted from his Balance.

As I am rather in a hurrij you will allow me to postpone any further reply, and believe me very sincerely

Dear friends

Your m^t obl: f^{el}

J:D:Huichelbos van Liender

B&W to HvL 1794-09-10

AoS ref. MS 3147/3/89/73.

M^r J.D.H. van Liender
Rotterdam

Soho 10th Sep^r 1794

Dear Sir

You favour of the 4th Instant has caused us much uneasiness respecting the fate of poor Smallman of whom we have not yet heard a single word.

We beg of you to make every possible enquiry after him and inform us of the result. We can scarcely suppose that if he had fallen ill in Holland he would have neglected writing to you, or to us, and we do not remember having seen upon any of the Newspapers an account of any Vessels from Holland being captured about that time; but it is not impossible that to save expence, he has embarked on one of your smacks and that the insignificancy of the vessel has prevented notice being taken of it. — By making the necessary inquiries at Rotterdam & Hellevoetsluys you may surely learn on board what vessel he embarked. Upon the whole, we rather conjecture that he has been picked up by some of your Dutch or some of our English Crimps or Pressgangs, as being a strong ablebodied man such as the present circumstances require. The custom here is to force them immediately on board a tender, where they are kept under the hatches, until they can be conveyed on board of some Man of War ready to sail, by which means they are kept from all communication with the shore. But if we knew the Vessel in which he sailed, we could make such inquiries as would throw light upon any transactions of that kind which happened in England, and perhaps if we could trace him out, we might be able to make interest to get him off. —

We hope you will be successful in your inquiries and we in the mean time shall endeavour to get some intelligence about him here, as we are really under very great concern for him. In expectation of your early answer, we remain with respect & esteem

Dear Sir

Your ob^d h^{ble} Serv^{ts}
for Boulton & Watt
James Watt Jun^r

P.S. My maps are only a secondary consideration, tho' a great loss to me, they are probably involved in the fate of Smallman. I wish if possible to know what is become of them.

C.Stolker to B&W 1794-09-23

AoS ref. MS 3147/3/505/61. Docket: Smallman.

Mess^{rs} Boulton & Watt

Rotterdam 23 September 1794

Gentlemen.

M^r J:D:Huichelbos van Liender being still in the Country has sent me your Letter to him of 10 Instant, w^h from the irregularity of the mails he only received the 19th: — he has desired me to make all possible enquiry so as to discover the fate of poor Smallman & to communicate to you the Issue. —

It is certain that he arrived well here & took charge of the maps & Books, which were delivered him by M^r van Liender's servant. — his landlord tells me he remembers him & that he went from hence Saturday morning, which must have been the 2^d August, about 7 o'Clock, with the Brielle-Schuit (*Ed.Note: horse-towed passenger boat to the port of Brielle or Den Briel*). — the day before the servant abovementioned tells me he had on a brown mixt Coat, colour'd vest, yellow Breeches, white Stockings & a Round hat. — from M^r van Liender's information it appears his Baggage consisted, besides the Box of Maps &c. in a long, featt (*Ed.Note: = feat = neat, well-made OED*), wooden chest, & that he had about f300. value of piasters with him, of which he intended to make use at London. —

I have wrote to the Landlord of an English house in the Brielle, Hector Leslie at the Rising-Sun, where he may probably have called, & recommended to him to apply to Hutchinson the agent for the pacquets, to see whether he can find his name amongst the List of passengers, & to make further enquiry. — his answer I have not yet receiv'd, but I will mention to you probably by next post, what information he has been able to collect. —

By our Sea-List I find only the following Vessels sailed for Harwich or London, both from the Brielle & Helvoet, about that time. —

2 august	Wm Blake for Harwich	This is none of the pacquets & I don't suppose Smallman has been at helvoet time enough to go by him.
7 d ^o	Ph: Deane C: Bridge L: Bell—— for London.	}] i ^m .—
8 d ^o	G: Whennell J: Randall	}] d ^o .—
12 d ^o	Ph: Deane jun ^r A: Deane	}] for Harwich.

By applying to proper persons at London & Harwich you may probably be able to learn whether he arrived & trace him out further. — that he would have been kidnapped in this Country I can scarce think. — instances of such practices are not common here, & indeed there is scarce any danger of it in any other place but Amsterdam. — but if he has gone by any of the London Vessels, to which he may have been induced by a principle of economy, he may probably have been pressed in the River. —

You may rely on my endeavours to obtain more positive intelligence about the way in which he has proceeded, & on my communicating it to you without loss of time. —

This Country is in a truely Critical state at present. — the army in British pay has received a severe blow last week, in which the hessians & hanoverians appear to have lost above 3000 men, & the British about half that number, amongst the latter four hundred drowned. — their head quarter is now at Kranenburg in the dutchy of Cleeves, & the army encamped near Nymegen, tho' they have detached bodys to defend the passage over the Maze. — the austrians have also had a rough rub near Mاستricht, & Gen^l Kray has retired within the Town, while 30'000 french are affirm'd to have crost the Maze between Liege & Viset. — Clairfait (*Ed.Note: Austrian commander Charles de Croix Clerfait*) has transferr'd his headquarters to Juliers or Gulick. — some of our Regents (*Ed.Note: members of the ruling elite of the Stadholder era*) have disappeared, at least one of them for certain, & by all accounts the inhabitants dread the approach of the British Troops much more than that of the Enemy. — I am,

Gentlemen,

Your most obed^t Servant
Corn: Stolker

JW to HvL 1794-09-25

AoS ref. MS3147/3/89/75.

Birm^m Sep^r 25th 1794

M^r Van Liender

Dear Sir

My son advised you that Smallman had not arrived here, since then we have made all the inquiries he could on this side the water, but have been able to get no intelligence of him. The boxes with my sons maps & fossils were found at the custom house & are received, so that it is plain the vessel was neither lost nor taken, yet we cannot learn by what vessel they came. — This matter gives us the utmost pain & we must again entreat you to make every enquiry possible on your side of the water

It is needless to indulge in surmises where (.....) can give no clue, but it is possible he may have fallen ill in Holland or may have been seduced to go some where else.

We shall be glad at same time to hear how your Engine & drainage go on. M^r B. desires his compts to you & Miss Van Liender & remain always, with much esteem

D^r Sir
Your obliged friend
James Watt

(Ed.Note: in left margin following text)

My health is rather better than it was, but is still very indifferent

C.Stolker to B&W 1794-09-30

AoS ref. MS 3147/3/505/62. *Docket:* About Smallman.

Mess^{rs}. Boulton & Watt

Rotterdam 30 September 1794

Gentlemen.

I did not receive an answer to my letter to the Brielle, mentioned in mine of 23^d. Instant, until yesterday the Contents of it are thus. — “ Agreeable to your desire I have made every enquiry regarding Smallman, of M^r Hutchinson & where-ever I thought there was any possibility of collecting any information, but have as yet in all attempts been perfectly unsuccessfull” &c. —

I took the liberty of opening a letter from your M^r Watt to M^r van Liender, before forwarding it to him, knowing it by the seal. — from his Bagage having been lodged in the Customhouse, I am confirmed in my opinion that he has proceeded for London by one of the Vessels mention’d in my former, & probably pressed in the River. — Upon enquiring I find that J:Randall & L:Bell, were consigned to M^r Pieter Dubbeldemuts van Dijck, & T:Whennell to M^r Joseph Cuffs of London, & by applying to any of those gentlemen, you may possibly be able to get some intelligence about the poor man’s fate. — the former of those gentlemen I am confident will render you all the assistance you can desire & possibly it may not be ineffectual. — tho’ there are no other Vessels mentioned in our Sea-List, it is not impossible some other may have sailed about the same time. —

Capⁿ Bell is at present loading in a neighbouring port, & his Ships-Broker has promised to enquire personally of him, & if I can procure any information thro’ his means or by any other, you may rely on my communicating it to you in course. —

The news from our frontiers is more & more alarming every day, & it is thought the first part of the act will soon be closed.

I am with true regard,

Gentlemen,

Your most obed^t Servant

Corn: Stolker

HvL to JW 1794-10-02

AoS ref. MS 3147/3/505/63. Docket: Probability of Smallman being gone to America.

According to [Robinson, 1974; Flexner, 1978], Smallman did indeed go to North America, to work for Nicholas J. Roosevelt who had at Belleville, NJ, established America's first engine-building plant. Charles Stoulinger, another ex-B&W man, worked there too.

The notes about progress of the Meydrecht drainage being slower than expected, foreshadow the major problems with dike seepage experienced later, which were to be an important reason for abandoning the undertaking in 1812.


MB's proposal for investment in England (letter not found) sends HvL into a rant about the aristocracy and the damnable English "principles" they stick to, which is a slap in MB's face, and goes much further than a simple refusal. Note also HvL himself advocating French bonds in letter 1790-09-23.

M^r James Watt
Birmingham

Thamen 2^d of October 1794

Dear Sir !

The last of September I was favoured with yours mij always verij agreeable letter of 25th of the same; by which I saw you had got not the least Intelligence of Smallman at your side the water, which surprised me not; as I am of opinion, he never Intended, at the time of leaving this place, to go to England; I fear that your conjecture of his having been seduced to go somewhere else will prove the truth; mij friend Mr Stolker will have advised you, that he likewise has not been able to trace anij of his footsteps from Rotterdam towards England.— I have made here and in Amsterdam all th'Inquiries about him that I have been able. here I learn that he has got a dislike to his wife; that he has said many times that he would never return to England, nor to his wife, that he has begged his wife, to come over here; which se has refused, and that he now would not return to her. In the middle of the summer he has been two or three daijs at Rotterdam, to get moneij from me; as the first 300 guilders, he got from the States, were put in my hand by his desire. after his return, he has told the Smith or Engineman, that he has met at Rotterdam, with some American Gentlemen, who had made great offers to him, If he would go over with them to America. — at Amsterdam he has made th'acquaintance of some English; by one M^r Finch, who has resided here some weeks and was verij intimate with him; he has told me, that M^r Finch was travelling to Germanij and Italij for a house at Manchester, and that he was expecting his patterns, and not liking the Air of Amsterdam, was come to reside mean while in the Countrij; he has spoken me Several times of one M^r Taylor, who was born in the same place as he (I mean Walsall) and has put up a shop of Birmingham and Sheffield ware at Amsterdam and which Gentleman he seemed to Esteem verij much; I desired a friend of mine at Amsterdam, to Inquire after this M^r Taylor and see if he could get any information of him, mij friends answer is, that three of that name are now at Amsterdam; that one of em gave the following Information, that he did not know Smallman by name, that he had seen him once about the beginning of August, he was then in compagny and intimacij with one Clark, a Swindler of the first magnitude, and noted scoundrel, who after having got in a fraudulent manner, goods to th'amount of several thousand guilders, has decamped with his wife to Boston, and as M^r Taylor supposed, has seduced poor Smallman to go with them. What confirms me the more in th'opinion, that this shall be the real case; Is, that as soon as he got the 30th July the last 300 guilders from the States, he set off for Amsterdam, and told me it was for changing his Dutch moneij for Piasters, which he could given out with some advance in England; but being the current money of America, seems much better calculated to employ there than in England. — I saw with pleasure that he has taken the necessarij care of sending over (bij one of our London traders as I suppose) M^r Watt Juniors maps and fossils, and this shall only have been the purpose of his going to Rotterdam the last of July.

With Meydrecht Engine it goes exceeding well; M^r Duijster th'Engineman is verij clever and manages th'Engine verij dexterouslij, it works constantly night and daij; and he has made some alterations in th'Iron plates of the valves of the clack by which theij do not break so frequentlij as they did before; the water is lowered 76½ Inches below Peyl, but if there are anij leakages through the dykes or if it is the fault of the season, we do not gain so much by far, as we did in the middle of the summer, even with fine drij weather as it is now; — We are sadly plagued with the top plates of the fireplace; there were none send over from England, so we provided two of an inch and a half thickness, those were very soon burnt down; we had two others (by advice of Smallman) cast at Amsterdam of 2½ Inches thick; those are now likewise so far gone, that we have been obliged to have cast another pair, which are now ordered to be cast in this manner  to try if this figure bij bringing them farther from the heat of the fire, will keep them longer in order; In what manner is this part managed in England by Large Engines ? — I saw with satisfaction that your

health was better, hope heartily it may still improve.

What I have left unanswered in my former Letter I shall now subjoin; as for what M^r Boulton did propose about placing 3000 a 4000 £ at 5 prC^t in England, I am not in the case of promoting that scheme; not one of my friends is in the case of sending over his money to England for more security; those people that are doing that I have nor will have anything to meddle with; they are only those d.....d Aristocrates that have brought this Countrij, by their adhering to English principles, to its inevitable ruin; and are in fear, that if the French become masters of it they shall be obliged to pay for it. — And what belongs M^{rs} Swellingrebel, she seems to be in a good State, but has left Vianen (*Ed.Note: town S of Utrecht*), a Lady with whom she was much connected, is gone to another small town in the Province of Overysse, where it is still cheaper to live, than at Vianen; and she is gone to live with her. but I have desired M^r van Hall, who always takes care of her; that as she is now not under his immediate Inspection I might have everij Year a Certificate of her being still in life; M^r van Hall draws twice in a year in the Spring and Autumn, upon one the half of th'amount of the sum M^r Boulton has given her; please to communicate this to M^r Boulton with my best respects. As I offer my dutij to You and remain very sincerely

Dear Sir

Your oblidge^d friend
J:D:Huichelbos van Liender

HvL to JW 1797-05-12

AoS ref. MS 3147/3/506/3. Copy from J.L.Meijer. Stamp on cover: MA D14(?)'97. Docket: Regrets th'interⁿ of ye correspond^e, success in employ^t un^d government. Drainage of a lake. State of the Mijdrecht engine. Repairs wanted. Wish^s to have our Estim. of a small engine. On address side: forwarded London 22 may 1797 Mr. van Dijck Ge(v)ers H.

Apparently this letter picks up the thread of correspondence, cut off at least 29 months earlier, due to outbreak of war.

[van Lieburg & Snelders, 1989 p73] mentions a further serious setback: when the Mijdrecht engine was restarted after the very severe winter of 1795, the main beam broke which put the engine out of action until July 1795.

The plan to supplement the Mijdrecht drainage with the Blijdorp engine never materialized. The engine was dismantled, the parts brought to Mijdrecht and put in storage at the Ter Schelling estate (on which the Mijdrecht engine stood); the entire undertaking was abandoned in 1812, and the engine parts probably went to the scrapman.

The malter/distiller mentioned is Boon.

James Watt Esq^t.
Birmingham

at the Hague 12th of May 1797

Dear Sir !

Th'interrupted correspondence between this country and England, by th'unhappy disturbances who have troubled the tranquility of Europe in so violent a manner, the during of which certainly are to be contributed (*Ed.Note: does HvL mean attributed?*) to th'obstinacij of your ministrij, have entirely prevented me writing you sooner, notwithstanding I greatly desired to be informed of manij circumstances respecting you and your family; and in the first place you will oblige me in telling me how you and M^{ts} Watt, as well as your children are doing. which I heartily hope may be very well, as my sister and I (thank God) are. - I have since the latter end of the month of January 1795 resided in this place, having first been chosen from Rotterdam as a member of th'Assembly of the Provisional Representatives of this Province and from that Assembly placed in the committy of finance, where I have been employed constantly till the month of April of last year; when I have left that department, and gone over to that of salutis publici, publicq welfare; which last department corresponds much better with mine inclinations than the first; and where I am employed in several commissions of importance; as in preparing to make great alterations and improvements in the great Dock of Hellevoetsluysch; in superintending the draining of two lakes amounting together in extent about to 20,000 acres; I am likewise placed in the commission of superintending the Seadikes and Seashores of this Province; in wich department many works of consequence are done last year; and some shall be done this year; for the preservation of our Sea remparts; and which works have been in contemplation since many years, and ought to have been done by the former Government in time of peace;-

The draining of the Lake of Meijdrecht, has not been very successfull by the bad management of the Directors, and by that of the young man who superintended it after the departure of Smallman and the dismissal of Duyster; last summer it has nearly been empty, but neglect of th'Engine, having brought it in a very deficient state; the land was in autumn for a great part again overflowed; the Iron boiler is very bad and leaky; and no time to make good reparations to it; a new copper boiler is now making to employ in its stead, as Iron does not seem to stand the brackish water.- the great Iron pump rod is broken at least three times; the great pump of 60 inches who is still employed begins to be very bad, and no possibility seems to be of draining the lake by this one Engine; where the leakage of the dikes, and the ground wells given so great an increase of the water in the lake, the commission after having received and approved an exceeding good report, given in upon the matter by Professor Rossyn; has resolved to buy from this Province the Engine constructed by the Batavian Society in the polder of Blydorp, which will be transported very soon to Meydrecht, and whit that help, I doubt not or the draining of Mijdrecht lake will be perfected.- Several plans of making use of Steam Engines for publicq purposes are in contemplation; but the circumstances of the war with your Country and the great dearth of the coals are total impediments for their execution. Only one friend of mine who has some malt kilns and gin distillerys; is in want of a mill for grinding his malt and rye for the last manufactorij; which he can have done by a horse mill; but he wishes to enquire; If a Steam Engine would not be more profitable for him, than th'employment of horses for that purpose; as he has no use for horses, when he wants not grinding his corn; and therefore has desired me to write you about his enquiry;- to know, what would be the smallest engine that would do for that business, as a mill driven by two horses, should be powerfull enough to grind his malt and rye, as that corn wants not to be broken verij fine for a distillery, nor sifted. and what such an engine would cost ? what business can be done by it ? what the consumption of coals ? and what time would be wanted to make it ready after he had ordered it ? - I hope you will not consider it as giving you too much trouble for so

small an object in sending me the desired particulars as I could not refuse my friend's request.- Please to tell with mij sincere compliments, my friend M^r. Boulton, who I hope to hear is very well M^{rs}. Swellingrebel is dead since some months; and that I have paid th'annuity he has desired me to do for his account, till this year; — You will certainly have seen , the second volume of M^r Proni's nouvelle architecture hydraulique, the whole of which, serves to give an entire explanation of the Steam Engines of several kinds, but principally of Yours Invention, the descriptions are illustrated by very fine and good copper plates; I fi(*nd it*) a most complete work.

And now I have only to add, that I hope soon to hear from you, and to be informed of your and your family's good health, to whom all I desire my best compliments and will remain always

Your oblid^d Friend,

J:D: Huichelbos van Liender

P.S. You may direct your letter to me here, or at Rotterdam, as you please —

Van Liender

Birm^m June 14th 1797

Dear Sir

It gave me great pleasure to learn of your welfare by yours of the 12th May & to find you are placed in a department in which you are so well qualified to serve your country. In answer to your friends queries we make at present no Engine smaller than 4 horses power, say that of four horses acting together, The metal materials of such an Engine cast, delivered here is £ 420.- and the wooden framing Cistern &c will cost £ 60.- at these prices the Engine will be all fitted together here so as to require very little work in putting up upon the spot. The time of execution will be about 6 months from the receipt of the order — The freight to Hull & your commission must be added, as the above is our current price to our customers here, payment in 3 mo^s after sending off the goods by bill on London at 2 months. Such an Engine will grind about 100 Winchester bushels of dry Malt into Distillers Meal in one hour or will grind from 8 to 10 bushels of raw barley in the same time & would grind from 200 lbs to 240 lbs of wheat into flour in one hour — The Engines are also employed by the distillers to pump up their water & their low wines & perhaps your friend may be able to apply it to other uses The consumption of our coals here would be about 50 lb weight p^t hour or of newcastle coals rather less than half a bushel. This however is provided that the engine is kept in order & not overloaded by bad machinery — I am very sorry to hear of your Engine at Mydrecht performing so badly, but am (*sure that?*) the accidents you mention must have happened through carelessness, though some part seems to be owing to bad water; the Iron boilers commonly last from 6 to 10 years & pumps in good water 20 or 30. The measure you propose we highly approve of, There is nothing like having power enough, on great occasions.

We have now erected a very complete foundery for cast Iron where we cast, bore, turn, &c all sorts of Engine & Mill materials in the best manner & (.....). we should be glad to supply you or your friends with any thing in that way which may be executed. Notwithstanding the War we have had more business in our line than we could conveniently do, & we do twice as much as we used to do, all at fixed prices. The worst thing is that of late payments are rather backward. We have for some years associated with us our Sons M^r Robinson Boulton & J Watt Jun^r who now manage the business entirely under the old firm of B&W. & give great satisfaction both to our customers & ourselves

My own health has been very indifferent, all winter & spring, I now get rather better & am going for a week or two to Bath to recruit, We have been sadly teased with lawsuits for the protection of our property, in which we have in great measure been successful yet they are not yet finished. In the last two years I have also had the misfortune to lose both my daughters, the eldest has left a family of young children. Such things are unavoidable as well as many other of the Ills of life, but they have contri(*buted*) very much to depress my spirits & to render me inactive — M^r Boulton & his son & daughter are well & he has just now entered into a contract with government for a large quantity of copper coins, he desires to be kindly remembered to you & to express his thanks for the trouble you have taken in poor M^{rs} S.^s (*Ed.Note: Swellingrebel*) affairs. The money you are in advance he will pay on your draft or order unless you prefer his making you a remittance

M^{rs} Watt & my sons desire to be kindly remembered to you & to Miss Van Liender to whom I also beg my best compliments, remaining always with great esteem

Dear Sir

Your faithful serv^t
James Watt

Dear Sir

I cannot let this letter go without expressing the satisfaction I feel from learning such good accounts of your prosperity. I hope the day is not far distant when our haughty rulers will permit the two nations to resume their accustomed relations of peace & amity and when we shall be allowed to renew our correspondence with you upon objects of mutual benefit. Space does not allow me to say more than that I am with best wishes

D^r Sir

Yours sincerely
J Watt Jun^r

HvL to JW 1797-07-17

AoS ref. MS 3147/3/506/4. Copy from J.L.Meijer. Docket: Orders a 4 horse engine — suggests the substitution of Iron for Wood in the dutch windmills

scheprad = scoopwheel

sail is a literal translation of Dutch 'zeil', i.e. canvas; HvL's 'sail arms' denote what in English are usually termed 'sails' or, in a more limited sense probably meant here, 'whips' (Dutch roede).

HvL's friend, distiller Boon, has obviously become aware of the problem of the privileges of existing grist mills and of the need to obtain permission, with the risk of refusal; he wants to shift the entire burden of that risk to B&W: they should start manufacturing rightaway to avoid losing time, but Boon should not have any obligation in case permission is refused him. HvL conveys that proposal to B&W, but in a very roundabout and repetitive way, which suggests that he himself is somewhat embarrassed by the idea.

The section about cast iron parts for drainage windmills is the start of extensive correspondence on this subject, about which B&W c.1801-12 drew up an annotated list (included in this compilation). HvL is now President of the Nieuwkoop/Zevenhoven drainage Commission; this project will use wind power. It is not clear if HvL did not consider this suitable for steam drainage, if he had been put off by the disappointing Mijdrecht project next door, or if he had campaigned and lost. HvL advances the idea of making the principal shafts in a windmill of cast iron with roller bearings to reduce cost and friction, and to extend life.

M^r James Watt
Birmingham

at the Hague 17th of July 1797

Dear Sir !

Your very agreeable letter of 14th June was received by me with the greatest pleasure, as it made me acquainted with many things; I wished to learn. as nearly three Years were elapsed I had not heard from you. I have participated to my friend your answer upon his quaeries and I have now his letter before me; by which he tells me, that your description is quite satisfactorij; that he only wished to know; If you will undertaken to prepare such an Engine on the terms you prescribed; and under this condition; that when he could not obtain the permission to make use of it you should keep it for your account; as he is in the case of being oblidged to make application to Government for obtaining leave to employ for himself such an engine; while there are windmills, who are patented for grinding the corn for brewers distillers and others; and that the building up of his distillery, shall take up some months in which time he shall make his application to Government for obtaining said permission; and if unlikely or unexpectedly he could not succeed; he should be greatly embarrassed, with such an expensive Engine; of which he could make no use; and as it will take some time, before he will be able to obtain said permission; he would not loose that unfruitfully; as you could advance greatly with th'Engine meanwhile. - his proposition therefore is, If you will engage to deliver him an Engine of your description and on the terms you have stated, and which terms he shall Engage to fulfill on his side. If he can obtain the permission of making use of such an Engine for his distillerij and for th'obtaining of which permission he shall try and employ every means possible; and that when unlikely or unexpectedly this said permission was absolutely refused him, you shall not persecute him to accept said Engine; as his only aim is not to loose time; and it certainly shall take up some time before he has made his application in order; and prosecuted it to the End. I can further assure you that my friend is a perfect honest man, a lover of science, and greatly taken in with th'Engine; and who shall do its utmost, to have the said permission granted to him; If you can Agree to this his Provisos you may begin immediately with said Engine; and I shall write you as soon as he knows th'Issue of his application; - I saw further by your letter that you have erected a very complete foundery for cast Iron where you cast, bore, trim etc. all sorts of Engine & Mill materials in the best manner, & from which you should be glad to supply me or my friends with anything in that way, which may be wanted and as I am president of the Commission for draining the Lakes of Nieuwkoop and Zevenhoven, amounting together to about 10,000 acres, for which many mills shall be wanted, of which we have contracted the 10th of this month three verij capital ones and shall contract after five weeks two other ones; I should be very glad to be acquainted, what parts of mill machinery which are now always constructed with us of wood, and by the present dearth of that article, on very expensive terms, could be made of cast Iron, with some profit. by instance, in our standing scheprad watermills, what we call the wateras, being the axis on which the large dry wheel and the scheprad or wheel is fixed, of which the part on which the schepwheel is fixed, being kept mostly wet suffers very much, and is soon decayed, and ought to be renewed often, a cast iron axis could be employed in my opinion to great advantage, by its lasting infinitely longer; and perhaps the upper or great axis on which the sail arms are fixed could likewise be made of cast iron; for which we now employ the best Oaken beams we can find; as we therefore want pieces of 22-24 feet length, and of 36 inches square; which are paid now 50 or 60 £St: and as I am told, that whit you the sail arms are laid and fixed around the axis, not through

the same as whit us; I should be very glad , to have the particulars of this method, as in that case, the top end of this axis should not be wanted to be so thick, as at present we must make em; If you were in the case of giving me these dircetions self, you should do me great pleasure, or otherwise If I could have the direction of one of your principal millwrights whom I could advise by your recommendation it should be very acceptable; - as I am convinced by experiments with models that by letting those heavy axes turn upon rollers, the friction of them would be greatly lessened. I think cast Iron rollers would be verij convenient for this purpose; and If I could introduce them here, It would be article which we should command from you; the five mills which we have and shall contract this year, must be readij to go, or as we call it be maelvaerdig next february and march; and against that time we shall contract for manij more and therefore we shall have time during next winter for thinking about, all those improvements; upon which I should wish to have your opinion; and all th' Illustrations your mill works can give; as our Commission is intended to erect the most complete mills of different kinds ever constructed in this Country; the thre mills we have contracted shall costs; one 23,000, one 23,500, and one 24,000 guilders; which are extremely high prices; never before paid; but all kind of wood is now by the war , very scarce and dear; and therefore it is now the time, for introducing cast Iron materials instead of wood; where the first can be serviceable; I should likewise greatly wish to know, which method for stopping a mill turning by a strong wind, is reckoned the best with you viz. & which kind of catch is preferred with you for this purpose. — I wish that you and M^r Boulton may always find the completest satisfaction, in the new and so much narrower association of mutual interest participated to both your sons; and that this continued bond of good friendship and common concern may last for a much longer time than the first has done already. — great pleasure gave it me to learn that your health, after having been verij indifferent all winter & spring, did go rather better, and that you were going for a fortnight to Bath to recruit but which I should think you ought to extend to six or eight weeks. If you wanted genial warmth I wish you was here with me now the thermometer standing at 86 degrees fahrenheit's scale, and the weather with a verij serene sky and South Easterly wind extremely hot, —

I saw likewise with satisfaction that M^r Boulton and both his children were very well. I beg to be kindly remembered to him, and to tell him that when I have some more leisure, I shall see what money I have been in advance for poor M^{rs} Swellingr. Our account of the Meydrecht Engine are (.....) not quite settled; I think I owe you still some balance which we may close in the same time; My Sister and I join readily our best respects to you and M^{rs} Watt, and I am in particular always

Your faithfull friend

J:D: Huichelbos van Liender

M^r James Watt Junior

Dear Sir

I am very sensible for the few lines you have added to your dear parents letter. may I take the liberty of charging you by this opportunity with a Commission ? in my staying at Birmingham in 1790 I subscribed at Mr. Pearson's for a new map of Warwickshire, and paid a guinea on subscribing. If this map is since finished and published, I beg the liberty of sending you my note of subscription for having the map taken out for me, and if I may be of any service here you will given me the pleasure of disposing freely of me; I wish you health and happiness for ever.

Yours

Huichelbos van Liender

B&W to HvL 1797-08-20

AoS ref. MS 3147/3/92/24.

M^r Huichelbos van Liender
at the Hague

Soho 20th August 1797

Dear Sir

In the absence of my father I have received your favour of the 17th July and now(?) return to your friends inquiries. I have the pleasure to inform you on the part of Mess^{rs} Boulton & Watt that they will undertake to prepare a four horse Engine upon the terms specified and liable to the condition suggested by your friend, that if he cannot obtain permission to use it, they will keep it for their own account without making him any charge.

But on the other hand, they beg leave to note to you, that if the final determination of your friend should not be made known to them by the time the Engine is ready, they shall consider themselves at liberty to dispose of it to any other purchaser who may offer.

The other parts of your letter require consideration and shall be replied to as soon as my father returns from an excursion he is now making to the South of England.

I am Dear Sir

Yours sincerely

J Watt Jun^r —

HvL to JW 1797-11-05

AoS ref. MS 3147/3/506/5. Copy from J.L.Meijer. Stamp on cover: E DE 2 (97?). Docket: Wishes answer to his last & drawings of the Engine ordered.

The significance of the date stamp is unclear. Postal? From [1798-02-24] onwards a Foreign Office date stamp often appears alongside it, usually with the same date. Were all foreign letters routed via the FO for scrutiny ?

M^r. James Watt at Birmingham

Rotterdam 5th of November 1797

Dear Sir !

Upon my last letter to you dated from the Hague 17th of July last, I had the pleasure to receive a short answer by your son only acquainting me, that you being absent, he informed me on the part of M^{rs}. Boulton & Watt; - that they will undertake to prepare a four horse Engine upon the terms specified, and liable to the conditions suggested by my friend; that if he cannot obtain permission to use it you will keep it for your own account; — this was what I and my friend desired at that time, but now I have received a letter of my friend, by which he acquaints me that he has obtained the permission to employ a Steam Engine to grind his malt, but only the malt and rye he wants for his own use as he is not allowed to grind for others. - and now my friend desires me to inform you of this permission; and that he wishes you will make all possible haste to compleat the Engine we have contracted together, and to let me know when you supposes it will be readij to send off that he shall be able to make some calculation, when he may put it up, and how to apply it to his grinding machinerij and in the meantime he wishes to know, what dimensions it will have viz^t what extent of ground it will take up, and what height it will have, with the fireplace leaver etc.

If a drawing of the plan with a scale or according a scale could be send over with some illucidations it should given the best satisfaction; — Your Sons letter informed me you was making an excursion to the South of England, which I heartily wish maij have been of great benefit to you, and I take the libertij to entreat you to read my said letter over again; and to give yourself the trouble to consider its contents about the Iron mill tools or instruments; as next summer we shall want many mills more, and I wishes to improve them as much as possible.

I shall be glad to receive your answer as soon as possible. If it was recommended to the care of Mess^{rs} Dubbeldemutz van Dijk and Gevers in London, I should receive it sooner than by the waij of Hambro only that I had your advice of (...) a Copy by the way of Hambro. I remain verij sincerely and with due regard

Your m^t. oblidg^d. Friend

J:D: Huichelbos van Liender

P.S. I wish M^r. James Watt Junior will pay some regard upon what I have desired from him, by my former Poscript.

B&W to HvL 1797-11-16a

AoS ref. MS 3147/3/92/69+70. B&W's letter to HvL which HvL calls B&W's First Memorial.

B&W later sent HvL a duplicate of this letter/memorial, of which a copy is kept in the AoS as MS3147/3/506/6; that duplicate has not been separately transcribed in the present compilation.

J.D.Huichelbos Van Liender
at the Hague

Soho Nov^r 16th 1797

Dear Sir

Various circumstances have intervencd since the return of our J.Watt to delay our promised reply to the different queries in your favour of the 17th July, respecting the substitution of Iron in many parts of the windmills. The subject has been much considered both on the present and former occasions & we fully coincide with you as to the mechanical advantage to be derived from the introduction of Iron machinery — Its general adoption in this country to the exclusion of wood evinces its superiority. A stronger instance of its superiority cannot well be had than in the case of your great Wind Mill shafts, the friction of which by using Iron shafts might be lessened on the ratio of one half of the general power of the Mill in consequence of the reductions in the diameters of the necks. — The saving in the original cost might we apprehend be considerable & unquestionably so when the greater durability of Iron is comprehended in the consideration. The circumstances of your Scheprad render it peculiarly eligible for its axis and in our opinion the rad or ladles might possibly be made with advantage of iron.

The subjoined calculations are founded upon the proportions and dimensions given in Plate 23 of the Dutch publication on Water Wind Mills viz the Groot Moolen Boek. Tho' others may be now employed our calculations will furnish sufficient data for comparison & in case it is thought expedient to order iron Materials for the Mills you have in contemplation, we should wish to be furnished with accurate drawings of the different parts as they were intended to be made in wood leaving us to make such alteration as the nature of the material may require. — upon inspection of the drawings alluded to it appears that some beneficial alterations may be made in the general disposition of the machinery. The Wheel upon the great shaft we should propose to remove nearer to the inner bearing and the diameter of that and the wheel on the shaft of the scheprad to be lessened if made of Iron. The horizontal shaft of the scheprad as the scheprad is now placed must be hollow, but if the outer bearing could be brought nearer to the wheel (& from the drawings there does not appear to be any impediment) it might be made solid and of proportionally less dimensions. — The trough or bak would be better of iron and its dimensions may be considerably reduced as the wheel which runs in it will be both of smaller diameter and narrower in the rim.

The upright shaft must be of 2 or 3 pieces to suit the floors or main timbers of the Mill, which may be marked for our regulation in the drawings you send. — The sail arms will be fixed to the main shaft by means of an iron cross with a large socket in its centre which embraces and is secured by wedges upon the end of the shaft in the same manner as is practised with our large flywheel arms. — The necessary model for this and other parts we undertake to furnish in iron are included in the prices. — it will be most eligible to make the two large wheels with iron arms and rims having sockets for wooden teeth or cogs and the smaller ones wholly of iron being found that wood and iron teeth work smoother than when both are iron. —

Upon consideration of the great detriment that would ensue from the failure of the essential parts in machines of such magnitude and power, we have stated the castings at such prices as would enable us to furnish them of the best and stronge(st) Iron & in every respect of the most perfect workmanship. —

Consistent with these requisites they cannot be afforded lower, were they made of inferior iron & with less care there might be a difference of one or two shillings per cwt, but on the other hand their dimensions(?) must be increased to render them proportionably strong and of course friction and other disadvantages would be augme(nted).

Proforma Invoice of sundry castings proposed to be delivered by us at Hull but exclusive of shipping & warehouse rents.

		cwt	qt	lb	price
The payment to be made upon delivery on a bill at 3 months.					
One great axle of iron 12 ins square at the thick end	}	58	2	-	16
and tapering to 9— & 19 feet long with bearings turned, about					
Upright shaft in 3 pieces say 6 inch diam ^r & 37 feet long	}	37	2	-	
with bearings turned	}	2	2	-	
about					
Coupling boxes for d ^e					

	cwt	qt	lb	price
Horizontal shaft for scheprad if hollow 14 in: diam ^r one inch thick 11 feet long with bearings turned ab ^t	17	-	-	
four wheels two for upright shaft with iron teeth and two upon the horizontal shaft with sockets for wooden teeth about	60	-	-	18
A cast iron trough or bak for wheel upon the Water As of the scheprad will cost about				£ 14. 8

Please to observe that the above are our own(?) net prices and your Commission must be additional.

The map of Warwickshire referred to in your note to M^r J. Watt Jun^r is published & upon receipt of your note of subscription with direction(s) for its conveyance we will take care to forward it accordingly.
(The parties) here unite in their best respects to yourself & Miss Van Liender &

we remain with great esteem

Your obedient faithful Serv^{ts}

Boulton & Watt

B&W to HvL 1797-12-11

AoS ref. MS 3147/3/92/87+88.

Soho Dec^r 11th 1797

M^r JDH Van Liender
Dear Sir

Pursuant to the instructions in your favour of the 5th Ult^o we forward the present with copy of our last to your friends in London & shall be glad to find it ties together with the Drawings we sent you in course.

You will perceive from the drawings that the framing of the Engine being unconnected with the building may(?) be (.....) in the Engine House as may best suit the situation of the Machinery to which it is to be attached & it leaves you at liberty also to make the Engine House of such dimensions & form as will best accord with the disposition of your other premises —

We have not ourselves mad(e) any drawing of the House because being unacquainted with the local it could only have been upon a (.....) no plan & it was therefore deemed unnecessary as by furnishing you with the enclosed drawing you would be a better judge of the proper disposition.

We should recommend you to place the boiler according to the drawing if it will not in other respects interfere with your convenience. In that situation the Steampipe(?) (.....) have a square End for the purpose of (.....) shaft or in what manner you intend to communicate the motion of the Engine to the Machinery — for the regulation of your Millwright we observe that the s^d rotative shaft at the usual speed of the Engine will make 30 turns p^r Min.

The principal parts of the Engine are prepared & the whole may be forwarded in a few weeks after receipt of your answer to the above questions.

We await your reply to the foregoing & our former letter & remain very respectfully

Your obed^t humb: Ser^t
for Boulton & Watt
(signature unreadable)

HvL to B&W 1798-01-07

AoS ref. MS 3147/3/506/7. Copy from J.L.Meijer. Stamp on cover: F JA 20 98. Docket: Position & other particulars respectg. his Engine — Determination to employ Iron Millwork in New Mill — some queries upon that subject — & promise of further information for our government.

The receipt mentioned was found with the copy of [1798-03-12].

scheprad = scoopwheel

Groot Moolenboek = the best known of several books with engineering drawings of windmills for various purposes, for the benefit of millwrights and of their clients. The letter seems to imply that JW had a copy.

vlugt (now spelled vlucht) = span or spread of the sails of a windmill, i.e. the diameter of the sail circle.

peil = level

roede = whip or sail arm

seaworm = ship-worm, pileworm or teredo, a pest of all wet timber structures at the time.

Mess^{rs} Boulton & Watt at Soho
near Birmingham

at the Hague 7th January
1798

Dear Gentlemⁿ,

In due course I was favoured with both your letters of 16th of November and 11th of December last; and two copies of the first and one of the last with the desired drawing; which last has given us light enough, to decide upon and answer your queries. As th'Engine is to be put up in a large Warehouse of 24 feet breadth and 90 or 100 feet length; the Chimneij ought to be put up near one of the side walls and therefore we are obliged to place the boiler; at the fore end of the Engine or before or against what is called in the drawing the end supports; and this disposition will given you the wanted illucidation to determine the length of the Steam pipe. — I am persuaded it would be preferable to put the boiler at the side, as in the drawing; but this would subject us to other great inconveniences. — Your second quaerij regards the length of the rotative shaft, or flywheel shaft; If you give to it the length of six feet measuring from the middle line of the Engine in your drawing, it will do for our purpose; its end which is to be connected with the mill work ought to have a square form for the length of two feet, which as we conceive projects beyond the framework, and upon which end; another wheel may be fixed to give what motion we please to the mill work. — These are the three questions upon which you desired to have mij answer which as above stated, I hope will be sufficient, to forward this undertaking without interruption; as my friend now greatly wishes to receive the Engine as soon as a due execution of its parts will allow; and as by your drawing and letter it seems that you leaves the making of the framework of th'Engine wholly to us; and thereby do not intend to put th'Engine together, before its sending of, as by your letter of 14th of June last, your intention seems to have been, my friend thought fit to have send of to Hull as soon as possible, what parts of th'Engine, were compleatly made up; and not to wait; till the whole was finished, and that you would given order to your correspondent in Hull, to procure there or in London th'Insurance of what value he has to send off for Rotterdam to my direction; and afterwards make another expedition, of all th'other and last parts; and as I suppose we shall receive an accurate drawing for building up the masonry of the boiler; If this was send over; we could begin with that directly, so as we now go on directly with the frame work; — Since the writing of this letter so far, there occurs to me an observation; If after having received the Engine materials, we shall have it in our power, to put the square end of the rotative shaft, at what side of th'Engine we please, because the Engine is to be placed in one of the square corners of the warehouse, with one side as near the front wall, as conveniently can be ? — th'above I hope will do for all what I have to mention, about the Steam Engine; — And now with regard to your letter of 16th November; I have put â translation in the hands of our Director General, and the two principal overseers; who have examined it, and in general approve very much of it; and have given us a memorial with their reflexions; which in the first assembly of the commission, at the 17th of this month, shall be considered, and after that you shall be acquainted with our final resolution; In the mean time, I can mention, that we are resolved to emploij Iron machinerij in one of the three mills, we shall contract, the 6th of february next; and thus I think fit to given you the dimension of the principal parts of the scheprad mills, which we build now, and who differ so greatly, with those given in the Groot Moolenboek, as you shall easily perceive by comparing them; the length of the sail arms (which we call de Vlugt) is 90 feet, the sailcloth very near 6 feet broad; the diameter of the scheprad is 20 feet, the breadth 24 inches stands at the depth of 50 inches in the polder water and raises the water from peil to peil, that is from lower to upper waterline 4 feet 6 inches. the large axis or grooten as is of 36 inches square the standard middle spil or vertical axis ought to remain in the middle of the mill, as the Cap or dome of the mill turns round upon the top end. Under the several questions inserted in the said memorial and which I shall by my following letter communicate to you Is the following; If the necks of cast Iron, you shall make to the axis of the scheprad or of the great axis; will be as hard and durable as those we make by laying long pieces of well

harded or tempered steel in the wooden necks, and by what means we shall be able to refit them, when wearied out and what measure will be the best for preserving them for rusting; - Your letter has not given us a clear idea enough of the method you would employ for fastening the sail arms (de Roeden) upon or through the axis; If the four arms must turn round in the same plain ? which is not the case with us now; this a drawing and nearer description would better explain; — I shall for now drop this matter here expecting your answer upon the above quaeries and by mij following write you more fully upon it;

I send now according your leave my note of subscription for the map of Warwickshire, begging that your James Watt Junior will be so kind as to chuse for me a good impression, as by the number of my subscription I am entitled to a first impression; and in the same times provide some Inktpowder for me and to forward one and other to Mess^{rs} Van Dyck, Gevers & Co. in London for me, or with the Engine materials If convenient by Hull; My Sister and I present our best respects to all our good friends at Soho, and its neighbourhood. and I remain with every esteem

Yours very sincerely
J:D: Huichelbos van Liender

P.S: another Question of our memorial is, If it should be possible to cast Iron footbeams (drepels or slagbalken) for sluices and gates of sluices, as that would be a capital thing, because those are so much exposed, to be eaten and ruined by the seaworms.

The number of my subscription note is 110. have paid one guinea 3d of october 1789. Upon delivery of the four sheets Atlas paper to be paid half a guinea more.

Ed.Note: attached subscription note.

No. 110 RECEIVED the 3rd Day of October 1789 of M^r Huichelbos Van Liender one Guinea being the first subscription for one Copy of a Map of Warwickshire, on four sheets of Atlas Paper, which I promise to deliver as soon as completed, upon the Payment of half a Guinea more, received the same for M^r Sharp per me, J. Wood

B&W to HvL 1798-02-01

AoS ref. MS 3147/3/92/133.

M^r J.D. Huichelbos Van Liender
Dear Sir

Soho Feb^y 1st 1798

You have inclosed sketches of the boiler seating & a general plan of the Engine made out from the directions contained in your last favour of the 7th Last(?) — We hope the drawing of the boiler seating will sufficiently explicit for the regulation of the Workmen; the general plan of the Engine is only intended to know whether we have rightly conceived your instruction(s) as to its position. More detailed drawings will be sent for the erection of the engine. It may be placed indifferently in any of the corners of your building & it will also be immaterial on which side you resolve to put the rotative Shaft. We think it would not be advisable to make the square end project so far as you mention beyond the bearing. If a square of more than 6 or 8 inches long be required to hang your wheels upon we should recommend you to have the wheels suspended between the bearings as dotted & if their distance should in that case be thought insufficient rather to Lengthen the Shaft than to make a projection of two feet long. We appose it would be found very difficult to hang your wheels with sufficient accuracy at such a distance from the bearings. The Rotative shaft is drawn in our sketch 6 f(?) long from the centerline to the farther bearing & with a square end of the usual dimensions. The wheel which communicates the Motion to your Millwork may be placed upon the square end or upon any other part of the shaft between the bearings. Please check and advise in your next if we may proceed to make the shaft as it is drawn or what alterations are desired.

We have written to our correspondent at Hull to provide for the shipment of the Materials p^d first vessel for Rotterdam with insurance as you direct. They will go from hence in the course of 10 days excepting the Rotative Shaft & Boiler & Steam pipes which shall be immediately completed upon receipt (*sic*) of your further advice.

The framework of the Engines in this country are not made by us but we have conveniences for adjusting the parts equally as well as upon its own framing & you may be assured that yours will be properly fitted before they are sent away. They must however be again taken asunder for the convenience of packing or otherwise they would be exposed to the danger of being broken in the carriage. —

We thank you for your attention in putting our letter into the proper channel. If your committee determine upon employing Iron Machinery it will be highly necessary to accompany their memorial with plans & sketches marking the dimensions of the principal parts of the Mill you propose to erect.

We shall from them be enabled to judge of the expediency of the suggestions mentioned in our letter & to prepare on our part more explicit drawings for the approbation of yourself & coadjutors. We had no intention of removing (*Ed.Note: = moving, repositioning*) the vertical axis, but only of putting the wheel on the windmill shaft so far back as to engrain on the opposite side of the wheel on the vertical axis. We propose to place the Scheprad nearer the bearing for the same reason which induced us to suggest the preceding alteration viz to remove the strain from the Middle of the Shaft. —

In wooden shafts the twist is chiefly to be guarded against, but in Iron the danger is not of twisting but of breaking. This Difference in quality of the Material requires of course diff^t precautions in its use.

The necks of the shaft will not be joined, but will be of one piece with the body of the shaft like the Main Gudgeon's of our Steam engines & as they run in brass which is a softer Material their wear is very inconsiderable. In the course of our experience we have never known it necessary to renew the shafts on account of the wear of the neck. There is therefore little danger as to their durability — When the Mill stops for any considerable time together it will only be necessary to protect the neck from the action of the air by anointing them with grease of a strong consistency, such as is employed to lubricate large Machinery in this country — The body of the Shafts we shall colour in such a manner as to preserve them from rust. —

Your note of subscription is received & we shall endeavour to procure a good impression & forward it with our drawings — With the respectful Comp^{ts} of all parties here to yourself & Miss Van Liender we remain

Dear Sir

Yours very sincerely
for Boulton & Watt
M:Rob^d Boulton

B&W to HvL 1798-02-18

AoS ref. MS 3147/3/92/149.

M^r Van Liender
at the Hague

Soho 18 Feb^y 1798

Dear Sir

Since our last of the 1st Inst^t we have received a letter from our Hull correspondent informing us that there are no neutrals now loading for Rotterdam, and not likely to be any soon as the late(*st?*) decree of the French for the confiscation of Neutrals having British property, will in a great degree put a stop to the communication between this Country & Holland. — We are also doubtful whether the late Revolution in your country may not render the importation of British goods unsafer and whether on that account it may not be your wish that we should defer sending the Goods until we hear from you again on the subject; more particularly as the whole of the articles cannot be finished until we have your answer to our last. In the expectation of hearing from you by return of post, we are very respectfully

Your ob^t Serv^t
for Boulton & Watt
J Watt Jun^r

P.S. We have got the Map of Warwickshire for you

HvL to B&W 1798-02-24

AoS ref. MS 3147/3/506/8. *Docket:* Confirming his order for rotative shaft. *Addressed to:* Mr. Southern - Messrs. Boulton & Watt - at Soho near Birmingham. *Stamps on cover:* FOREIGN OFFICE MR 14 98 and B MR 14 98. *Copy from* J.L.Meijer.

Mess^{rs} Boulton & Watt
at Soho near Birmingham

at Rotterdam 24th of february 1798

Gentlemen !

In due course I was favoured with your agreeable letter of 1st instant, and having now only the time to acquaint you our resolve about the rotative shaft; I shall postpone the further answer of your letter, till the first opportunity that shall offer; and you will be so kind as to have said shaft made, as we have directed by our former letter; If it was too long; there will alwaijs be occasion to shorten it; which could not be remedied If it was too short; and we shall always be in the possibilitij of putting an outer bearing under its end; If it was found to project to much; and therefore it may be made as you have drawn it; in the sketch you have send over; — mij residence at the Hague being finished; I shall expect your further favours here; and remain always.

Your most sincerely f^d

J:D: Huichelbos van Liender

HvL to B&W 1798-03-12

AoS ref. MS 3147/3/506/9. Docket: Upon the mode of forwarding the Materials of the little Engine — Is no longer in the Commission for the drainage of Nieuwkoop — The consideration of that affair to be postponed. Stamps on cover: C MR 25 98 and FOREIGN OFFICE MR 26 98. Copy from J.L.Meijer.

The letter of 1798-02-23 referred to, is actually dated and filed [1798-02-24]. About Anglo-Dutch trade in times of war, see [Schama]: there was a lot more of it than France liked.

Mess^{rs} Boulton & Watt
at Soho

Rotterdam 12th of March 1798

Gentlemen !

The 23th of february I wrote you only to acquaint you with our resolve about the rotative shaft which I confirm by these and have since received your favour of 18th past; which gives me to understand th'utter impossibilitij of having any goods transported directly from Hull to Holland; and your fear that th'importation of British goods in Holland should be liable to anij danger; If anij of that kind should take place, I believe it would be chiefly confined to your woollen and earthen ware manufactures; but till now no law or order is thereto published; and as th'Engine materials cannot be send of directly to Holland; they must be send of either to Hambro', Breemen, Norden, or Embden, by the first opportunity that offers for one of those places; If an opportunity offers for more than one of them; we must praefer the nearest to this Countrij and in that case stands Embden the first and so on, ranks Hambro' the last: — Insurance always to be done with you either in Hull or London. If the goods must be send of to Hambro' I wish that they may be directed to Mr. Alexander Martin there, whom I employ in the few commissions I have there. — In my former letter I have noted, that mij residence at the Hague has taken an end; this is occasioned by the late revolution of 22th Januarij; as I belong to the moderate parthij; I was dismissed from my post as member of the Provincial Committée, and have since been removed as Commissioner of the draining of the Nieuwwoopsche Poel; this subject of our correspondence must therefore be dropt, for this time; as this undertaking, I fear, shall not be prosecuted this Year; — I am now only member of the Commission for Superintending the conservation of the Seadykes and Sea remparts of this Province; but I fear I shall not long remain in this commission also; with all this I can easily take patience. If the result of the late revolution shall produce the welfare and good of my Mother Countrij; as I never had any other view than that, in all that I have done since Januarij 1795. and I can console myself to have done some good. With our best respects to all our friends on your Side I remain:

Gentlemen Your Oblidg^d friend

J:D: Huichelbos van Liender

P.S. Is it not very singular that daily vessels arrive directly from London ?

Ed.Note: Attached to the xerox of this letter was a copy of the receipt for the Warwickshire map, which was mentioned as enclosed in letter 1798-01-07, and has consequently been filed there.

B&W to HvL 1798-03-20

AoS ref. MS 3147/3/92/166.

M^r J.D.H. van Liender
Rotterdam

Soho 20 March 1798

Dear Sir

On the other side you have the copy of a letter sent you on the 18th Ult^o (*Ed.Note: that duplicate is not with the letterbook copy of this letter, but the original is present as [1798-02-18]*) to which we are as yet without your answer. We have however received your favour of the 24th Feby confirming your instructions for the Rotative shaft, which shall be executed accordingly. — The same difficulty still remains as to the sending of British goods direct to Holland; and if a neutral did offer, we presume the Insurance would be enormously high.

The road by Hamburg appears to be the most eligible and if your friend is of the same opinion we shall on receipt of your answer direct the goods to any person there whom you may please to appoint.

We are with much respect

D^r Sir

Your ob^d hble Serv^{ts}
For Boulton & Watt
Ja^s Watt Jun^r

B&W to HvL 1798-04-28

AoS ref. MS 3147/3/92/190.

M^r J.D.H. Van Liender
Rotterdam

Soho 28 Ap^l 1798

Dear Sir

Our Hull Correspondent not being able to meet with any Vessel for Rotterdam, nor for any port nearer, has shipped your goods on board the Good Intent, Richard Evans Master for(?) consigned to M^r Alexander Martin of Hamburg, for which Port she is daily expected to sail with Convoy. — We have written to M^r Alex^r Martin with Copy of the Bill of Lading, desiring him to (.....) the goods and to hold them at your disposal; he of course will expect your orders.

We shall procure Insurance for your Account in London, and when that is done, shall have the honour of addressing you again with Invoices of Goods & with Instructions respecting the Engine as appear to us necessary. —

Being very respectfully
Dear Sir

Your ob^l hble Serv^{ts}
for Boulton & Watt
J Watt Jun^r

B&W to HvL 1798-05-07

AoS ref. MS 3147/3/92/199.

J.D.H. Van Liender Esq^f
Rotterdam

Soho 7 May 1798

Dear Sir

We refer to our letter of the 28th Ult^o informing you of our having shipped your Goods in fourteen Packages, on board the Good Intent, Richard Evans Master, from Hull to Hamburg, and of their being consigned to M^r Alexander Martin of that place, according to your Orders and for your account & risk.

We have now the honour to inclose you a list of the Materials sent, with reference to the Package in which they are contained weighing altogether little more than six Tons. We wish them safe at hand & have no doubt this will further answer your friends expectations.

On the other side we take the liberty of transmitting your Account, payable in three months from delivery of the goods here (the 11th of April) in a Bill on London at 2 Mo^s. We have included the freight to Hull & Insurance which we have got done in London.

We have sent the drawings & explanations in a Box directed to the care of M^r Busch, agent to Mr Boulton at Hamburg, desiring him to forward it to you upon its arrival. It contains also your Map of Warwickshire, of which we have selected a good Impression & have debited you 10/6 for what we have advanced.

We shall send a Duplicate of this letter by another post and remain with the utmost regard & well wishes

Dear Sir

Your sincere friends
for Boulton & Watt
Ja^s Watt Jun^r

HvL to B&W 1798-05-08

AoS ref. MS 3147/3/506/10. Docket: 8 May 1798. Duplicate of 12 March — with Mr. Martin's advice of forwarding ours of 28th May. This advice from A.Martin is on the cover: I received yours 28 Ult^e & the Inclosed was forwarded to our mutual friend — Hamburg 11 May 1798 — A.M. Stamps on cover: FOREIGN OFFICE MA 21 98 and B MA 21 98. Copy from J.L.Meijer.

Probably B&W misinterpreted 28 Ult^o for 28 May; HvL mentions a B&W letter [1798-04-28] in [1798-06-30], so that is probably the letter meant here.

Starting with this letter, HvL sends a copy of his more important letters via an indirect route, usually via Hamburg. Normally both the original and the copy eventually arrived. The copy of [1798-03-12] below is not strictly verbatim and it does not cover the entire letter.

Copij

Mess^{rs} Boulton & Watt
at Soho near Birmingham

at Rotterdam 12th of March 1798

Gentlemen !

The 23th of last month I wrote you only to acquaint you with our resolve about the rotative shaft which I confirm by these and having since received your favour of 18th past; which gives me to understand th'utter impossibility of having anij goods transported directly from Hull to Holland; and your fear that th'importation of British goods in Holland should be liable to any danger; If any fear of that kind should take place, I believe it would be chiefly confined to your woollen and earthen ware manufactures; but till now no law or order thereto is published; and as th'Engine materials cannot be send of directly to Holland; they must be send of either to Hambro, Breemen, Norden, or Embden, by the first opportunity that offers for one of those places; If any opportunity offers for more than one of them; we must prefer the nearest to this Countrij and in that case stands Embden the first and so on, is Hambro the last: — Insurance always to be done with you either at Hull or London. If the goods must be send of to Hambro I wish that they may be directed to M^r Alexander Martin, whom I emploij in the few commissions I have there. — In my former letter I have noted, that mij residence at the Hague has taken and End; this is occasioned by the late revolution of 22th Januarij etc.

To the same

Rotterdam 8th of May 1798

Th'above is a copij of my Last letter to you upon which till now not having had any answer, I fear it may have been lost and now confirming its contents in every particular; I wish the desired expedition of Engine materials may be forwarded as soon as possible; In this expectation I remain sincerely yours

J:D: Huichelbos van Liender

HvL to B&W 1798-06-30

AoS ref. MS 3147/3/506/11. Docket: Mentions rectn. of letters from B&W & recapitulates their contents. — The Engine arrived — Box not. Remits the (balance?) due to B&W. Stamps on cover: FOREIGN OFFICE JY 12 98 and an unreadable date stamp. Copy from J.L.Meijer.

Mess^{rs} Boulton & Watt
at Soho near Birmingham

Rotterdam 30th of June 1798

Dear Gentlemen

I have now to answer your several verij agreeable favours of 20th of March, 28th of April, 7th and 14th of Maij; the first of these advising me the difficulty you apprehended of sending British goods directly to Holland, and that the road by Hamburg appears to you most eligible, and your following gives me to understand, that your Hull correspondent had shipped th'Engine materials on board a Vessel bound to Hamburg not being able to find anij opportunity of shipping them directly hereto. — and your third and fourth (the last being a Copij of th'other) letters confirming th'expedition of said materials from Hull to Hamburg, and their consignation to M^r Alexander Martin of that place; and by those two last mentioned letters I have well received a list of said materials, their weight, and th'account of their amount in all, shipped on board at Hull, with inland freight and insurance there; as likewise what you have paid for me for the map of Warwickshire which is booked with me in conformity with you; You mentioned in the same time, to have send of the drawings and explanations in a box directed to the care of M^r Bush at Hamburg. — And now I shall have the pleasure to inform you that the said Engine materials, after a very expeditious voyage from Hull to Hamburg, and from that place here are safelij landed in mij friends Warehouse; and that we are now very busij in driving the piles for the foundation of th'Engine and the mill; and that the scaffolding or frame work for th'Engine is much advanced; but till now, I have heard nothing of the box with drawings and explanation; wherefore I have writed last week to M^r Bush, enquiring after it; as the same, If it is come to Hamburg, ought long ago have been in my hands; and we verij soon shall be in want of them. —

And now desiring to fulfill on our Side our mutual engagements, I remit you the following two bills of exchange on London; As a Second dated Hamburg, 25th June at two Usances by E: van Son, his own order on M^r William Graves Sen^r at Southampton payable in London, the first accepted at mess^{rs} Giles & farrington in London amounting to

£ 282.15.1

A second, dated Bentheim 25th June at two usances by S: Bernelot Moens & C^{ie} to themself or order on M^r Thomas Gorman in London on the first accepted at Mess^{rs} Hon: Combault & C^{ie} in London

of the Sum of

£155.12.3

amounting together

£438. 7.4

being just th'Amount of th'Invoice of th'Engine; and both bills endorsed to me by M^r J:B: Snellen, value in account with M^r B: of these bills you will be so kind as to procure the needfull, and credit mine account for them; and hope now to receive the desired box with the drawings very soon, as we wish to go on with th'Engine as expeditious as possible. — Many eyes are in expectation of seeing its effect as this is quite a new thing, and prejudices strongly against it. I remain with every regard Dear friends Your m^t devt^d friend

J:D: Huichelbos van Liender

B&W to HvL 1798-07-15

AoS ref. MS 3147/3/92/260.

From [1798-12-25] it would appear that this letter was lost in the mail.

Soho July 15th 1798

J.H. Van Liender

Dear Sir

Your very acceptable favor of the 30th Ult^o mentions the safe arrival of the Engine Materials & covering Bills valued £ 438..7..4.& has been duly received & the am^t of its contents passed to your Credit with many thanks —

It is certainly matter of surprise that the Box of Drawings &c are not yet come to hand our friend M^r Busch had particular instructions to forward it with the greatest Dispatch. We have written to him p^r this day's Mail to know if the Box is come to hand & informed him of your impatience to receive it — If your next does not bring tidings of its arrival we shall immediately transmit copies of both drawings & directions & be pleased to mention whether we can send them more expeditiously than via Hamburg —

You have already in one instance Successfully combated the prejudices of your country men in the first introduction of the Steam Eng^e & we doubt not your effort in establishing so useful a modification of this invention will meet with equal success — we trust it is unnecessary to add that if any difficulties occur in the execution we shall use our best endeavours to remove them by any communications in our power

We remain very respectfully,

D^e Sir

Your obed^t humb. Ser^t
for Boulton & Watt

M.Robⁿ Boulton

HvL to B&W 1798-07-31

AoS ref. MS 3147/3/506/12. Docket: Has heard of the Drawings &c. — The progress of steam engines retarded by the state of things in Holland & the price of coals. — Praises of the new constitution — Beneficial effects which will probably result from it. Stamps on cover: FOREIGN OFFICE AU 14 98 and A AU 14 98. Copy from J.L.Meijer.

The political developments referred to, followed the second coup by Daendels in June. A constitution along Unitarian (centralist) lines was adopted. HvL applauds this development, particularly the now nationwide scope of his sea defenses committee.

Mess^{rs} Boulton & Watt
at Soho near Birmingham

Rotterdam Ult^o July 1798

Dear Gentlemen !

Readily acknowledging the dulij receipt of your agreeable favour of 15th instant, by its content I saw with pleasure that my last letter with the two bills of exchange upon London, were safely come to your hands, and that you should given mine account credit for their amount. — Eight days ago I had a letter from M^r Busch of Hambro, advising me, he had shipped the desired box with the drawings etc. on board a vessel destined for this place; so I am in hope to receive said box soon; which will give me pleasure, as our work is now so far advanced, that without the said drawings we are not able to go further;

I have certainly by an unwearied perseverance introduced the Steam Engine in this Countrij; but the present unhappij publicq and political circumstances are great opponents to its further introduction, as the scarcity and dearness of the coals make their use so much more expensive as otherwise: we have now only french and german coals, English coals being extravagant dear; after many vicissitudes in the direction of th'undertaking at Meydrechts drainage; a personal commission is named, consisting of the Professor Rossyn of th'university of Utrecht, the Lieutenant Collonel Krayenhoff from the Hague, of me, and of one of the former directors at Meydrecht; with full powers of employing means and persons, as we think proper; this is in consequence of that great point gained, by the now accepted Constitution; by which the whole Republicq and its administration is only one and indivisible; and this daij the now so lawfully elected legislative bodij met for the first time, to introduce said new Constitution, accepted by so great a majoritij of citizens having the full right of voting for or against it; and now times shall be no more, that one Province waged war against one another, as all of them shall be ruled by one and the same administration, have the same laws and bear the same taxes; Just as the case is with you, which undoubtedly must given more strength and power to a Countrij, as when some parts of it are ruled differently from another, and even in opposition one with another; we know now no more of the former Distinctions of the Provinces of Holland and the Province of Utrecht or Sealand and so on; we are only one and the same Batavian Republicq. — Mine Commission of inspecting the Seadyckes and Sea ramparts of Holland is now extended to the Seashores of the whole Republicq and some of those persons, who had formerlij the inspection of this part in the other Provinces; are now united with us in one bodij; and we shall assemble from time to time together to communicate our mutual ideas and complete thereby as much as possible our System of Direction, in a part of administration, which is of so much consequence for this Countrij and which requires Yearlij so Immense a sum of moneij; Certainly great good must ensue from such an alteration.

I remain very sincerely Your oblidge^d friend

J:D: Huichelbos van Liender

P:S: I have debited your account for mine Commission the Amount of the received Engine materials at 5 pect upon 420 £: for 21 £St:

Your last letter was (by mistake) directed to the Hague

B&W to HvL 1798-12-06

AoS ref. MS 3147/3/93/106.

Received 1799-01-23.

Soho Dec^r 6th 1798

J.D.H. Van Liender Esq^r

Sir

We flatter ourselves from your silence since the 30th July that the Box with the Drawings came to hand soon after your last favor & we hope before this time the Engine is completed to your satisfaction

Feeling ourselves much interested in the success of your undertaking we shall thank you at your leisure to favor us a (*sic*) with an account of the performance of the Engine

Your accession to the Direction of the Mydrecht drainage gives us much pleasure & we are persuaded your own countrymen will not have less reason to congratulate themselves upon the choice — This laudable undertaking most certainly owes its birth to you & cannot therefore be expected to succeed so well as under your care. To your zeal for the public welfare you have in this instance the additional (.....) of that partiality which every patron feels for an undertaking projected & matured by himself — When the intercourse (*se*) between our respective Countries is again freed from its present embarrassments & commerce & the arts resume their wanted prosperity we shall be hasty to reanimate the correspondance betwe(*en*) us by extending under your auspices the use of the Steam Engine in Holland.

Agreeably to your last favor we have carried to the credit of your Acc^t the commission upon the Engine & we now beg leave to hand you a Cop(y) of our statement including the balance due on Acc^t of this (.....) & which we trust will be found correct —

We remain respectfully

Sir

Your ob^t humble ser^t
for Boulton & Watt
M Rob^{ts} Boulton

HvL to B&W 1798-12-25

AoS ref. MS 3147/3/506/13. Docket: Small engine not quite compleated — Inclosing remarks upon Cast Iron Windmills — Wants drawings of their construction. Stamps on cover: FOREIGN OFFICE JA 19 99 and C JA 19 99. Postage note: 3/2. Copy from J.L.Meijer.

For erecting his engine, Boon has enlisted the help of Willem Krijgsman, the engine man of the Blijdorp and Mijdrecht engines.

It is interesting to note that this letter, written on Christmas Day, does not mention the season at all.

Mess^{rs} Boulton & Watt
at Soho near Birmingham

at Rotterdam 25th of December 1798

Dear Gentlemen !

Since I had the pleasure of writing you the last of July, I have not been favoured with any one of yours (*Ed. Note: this would indicate that HvL never got [1798-07-15]*); since that time and after having received the box with the drawings and map of Warwickshire, my friend has employed th'Engine man of the Blijdorp Engine William Krijgsman, in putting his Engine together, which is not yet quite done, as still some obscurities occurred in the directions; the drawings and the given measures not always corresponding; we hope notwithstanding to overcome every difficultij, and to bring it in order as it is the first double power'd Engine put together in this Countrij we have no model to consult. — The continuing dearth of timber wood in general and oak timber in particular makes people in this Country more and more attentive on the use of cast iron, instead of Oak timber; I send you therefore (which had been laid aside for some time) the remarks made by the Director General and the Surveyors of the drainage at Nieuwkoop, upon your memorial on that subject, which I had translated; and as the said Director is not enough acquainted with th'English language; he has written his remarks in french, as you do understand that language; next spring we propose to contract for three new wind Watermills for which we intend to employ some cast iron mill work; If said remarks will serve for our more certain illucidation of the matter. — Another friend of mine who had the superintendance of another verij extensive drainage in which more than thirty wind watermills are employed, has for the same reasons as above, desired me to do you the following questions, for which I shall only transfer his (*?sc*)heme of Enquiry, viz:

We are informed that Iron mill axles are nearly in general use in England and it is therefore that we are desirous of be made acquainted with the following circumstances. If the machinery of the windmills in England is so far equal to that of the windmills that are in daily use now in Holland that their axes could be made serviceable for the dutch windmills, and as one of the first proprieties is to know how the fore end of the axis is constructed and If the sail arms pass through the same, or are laid around the same; it would be acceptable to know nearly the weight of an iron axis; and its price. The Axes in common U(*se in Hol*)land are of 32 or 34 inches square at their fore end. the follo(*wing con*)siderations are objected against the Iron axes 1rst If their weight will not be to great for common mills. 2d. Shall cast Iron be strong enough for the several operations that such axes oughto perform; may th'Equilibrium be brought behind the neck part of such an axis.

If for more illucidation of these questions a drawing of an Iron axis as now used in England could be procured this would greatly serve us, or If any treatise was written and printed in England about those matters, be so kind as to mention it that I maij given order to my bookseller or any friend in London to provide it for me; or If any well instructed millwright would undertake to provide such parts of Iron machinery in good order we could correspond with him, If it should given you to much trouble —

Gladly Expecting your desired Answer I remain verij Sincerely
Your oblidged friend
J:D: Huichelbos van Liender

Undated draft memorandum 1798?

AoS ref. MS3147/3/506/13. Copy from J.L.Meijer .

Memorandum of the Director General (Chr. Brunings jnr.) and the Inspectors of the Nieuwkoop and Zevenhoven drainage about the use of cast iron in the construction of the windmills for the Nieuwkoop drainage project. It was first mentioned in [1798-01-07] and from that letter it is apparent that it was drawn up in January 1798 and would be discussed in the Commission on January 17. It was "laid aside" when HvL was removed from his post in January 1798 (see [1798-03-12]); the matter is taken up again with [1798-12-25], indicating that HvL had probably been reinstated by that time. There are two versions, this is likely to be the first, sent with [1798-12-25]; the second was sent to B&W with [1799-05-18]. Why "likely"? From the copies at the author's disposal it was not clear which version had been sent with which letter, but the small differences, mainly of French language usage, look as if the version put with letter 1799-05-18 is a corrected version, and thus probably the second one.

The document appears to form the basis for a memorandum by Chr. Brunings snr., a duplicate of which was sent to B&W with [1800-03-15].

The B&W document mentioned (without date) is no doubt the memorandum that B&W sent with [1797-11-16].

Remarques du Directeur General et des Inspecteurs du Desséchement de Nieuwkoop et Zevenhoven, sur certain memoire Anglois touchant l'usage qu'on pourroit faire du fer de fonte dans les moulins à épuiser l'eau.

Ces remarques sont dressées selon l'ordre du susdit Memoire.

Une Roue à palettes (Scheprad) de fer auroit l'avantage d'occuper moins d'Espace dans le coursier (krimp) qu'une Roue de Bois; elle eleveroit par consequent à chaque Revolution une plus grande masse d'eau, mais en revanche elle deviendroit beaucoup plus pesante, car — supposé que la pesanteur spécifique d'une Roue ordinaire egale celle de l'eau, il n'est pas apparent qu'il soit possible de construire une Roue de fer dont le volume soit diminué dans la raison de 6 à 7½ qui est environ celle de la pesanteur spécifique des deux matieres, d'autant moins que les palettes ne pourront être diminuée que dans une seule dimension.

Cette difficulté levée la roue devoit être garantie contre la Rouille par un vernis, ou de toute autre maniere, et l'on devoit nous mettre à même de renouveler cette vernissure quand cela seroit necessaire.

La même precaution devoit avoir lieu à l'égard de toute autre piece de fer dont on fera usage dans nos moulins. Si l'on plaçoit plus en arriere le roue Superieure et qu'on ne fit point de changement au diamètre de la lanterne avec laquelle cette roue engraine l'arbre vertical sortirot du milieu du moulin, ce que ne se peut pas puisque le toit du moulin avec son axe doit se mouvoir autour de cet arbre.

Nous ne sentons pas quelle avantage on pourroit tirer de la diminution projetée, des roues superieure et inferieure, car pour qu'il y ait même raison du nombre des revolutions de la roue à palettes au nombre des revolutions du grand axe, cette diminution devoit être proportionnelle, c'est a dire on perdra autant en force, par celle de la roue inferieure, qu'on gagnera par celle de la roue superieure, nous craindrions d'ailleurs qu'après ce changements on n'eût de la peine à faire tenir l'arrêt sur la roue superieure et que l'essieu qui porte la roue inferieure n'ait trop a souffrir et ne soit plus sujet a branler;

Il pourroit être avantageux d'employer un bac de fer et il y auroit moijen de raccourcir l'Essieu inferieur comme ce Memoire le propose, mais si l'on ne veut pas retarder la construction des moulins qui doivent être achevé l'automne prochaine, il faudra remettre cet essai à une autre occasion.

C'est surtout de l'emploi d'un essieu Inferieur, de fer dont nous attendons de grands avantages, vù que les essieus de bois humectés continuellement se pourissent et se rompent en très peu de temps, il s'agit seulement de savoir si le Hals (partie arrondie du devant de l'essieu sur laquelle il tourne) d'une pièce de fer de fonte peut acquerir la même durezza que nous donnons a cette partie de nos essieus de bois, en les garnissant de plusieurs pièces de fer bien acérés (? last syllable crossed out and replaced in an unreadable hand); et comme malgré cette precaution il est necessaire de tems à autre de faire acérer derechef ces pièces ou d'en mettre des nouvelles, il est question encore de savoir de quelle maniere on pourroit raccomoder cette partie d'un essieu de fer quand elle sera usée;

Les mêmes questions doivent se faire par rapport au projet d'employer un arbre vertical de fer, peut-être ces Messieurs jugeront-ils à propos de faire fondre à part les extremités de l'arbre avec leur pivots afin de les joindre à vis aux autres pièces que composent cet arbre, et de nous en envoyer un double nombre.

Pour ce qui regarde la maniere d'assembler les verges a un axe de fer, nous avouerons que nous n'avons pù nous en former une juste idée, d'après ce qui en est dit dans le memoire. Nous regardons ce point comme de la derniere (Ed.Note: this seems a writing error, in the later version derniere is replaced by plus grande) importance et nous serions curieux d'en être informé par un dessein et une description Ulterieure; Notre axe

ayant 32. sur 32. pouces d'équarissage, et étant traversé par les verges il est clair que le poids entier d'une verge (si l'on accepte la position verticale) est porté par une plan de 32 pouces de longueur, et l'expérience nous apprend que cette longueur suffit à peine à porter le poids, reuni à la vitesse tangentielle de toute aile qui descend les verges se courbant aux extrémités d'environ 3 pieds, d'où il suit qu'en faisant usage d'un axe de fer, on devoit tacher d'augmenter plutôt la longueur de ce plan d'appui que de la diminuer, peut-être que si ces axes étoient creux qu'on pourroit leur donner 36 ou même 40. pouces d'équarissage, et y pratiquer des ouvertures pour les verges; peut-être aussi préféreroit on de donner moins d'équarissage aux axes de fer, et de les revêtir de bois. Mais nous avons garde de vouloir devancer les projets ingénieux de ces Mécaniciens distingués. Il nous suffit de leur avoir indiqués. les écueils que l'expérience nous a fait connoître. encore seroit il tres avantageux si cet axe de fer pouroit être construit de maniere à ij employer de demi verges, au lieu de verges entières pourvu qu'on ni courroit point de risque.

Nous n'avons rien à redire au projet de ces messieurs à l'égard des roues et des lanternes à nous est même venu l'idée que si les fûsiaux des lanternes étoient construit de maniere de tourner sur leur axe, cela diminueroit de beacoup le frottement de ces fuseaux contre les dents des roues avec lesquelles ils engrainent; resteroit à savoir si les pivots des fuseaux ne s'usseroient pas trop vite par le nouveau frottement contre leur crapaudines qui devoit en resulter.

Nous sommes charmés de ce que ces messieurs se propose de faire construire toutes les pièces qu'on leur demandera, du meilleur fer et de la maniere la plus solide. En effet il seroit tres embarassant pour nous si quelques parties venoit à se rompre, et que nous ne fussions pas à même de la faire reparer dans notre pays. Pour ce qui regarde les dimensions projetées telle qu'on les trouve à la fin du susdit memoire nous craindrions que même dans un moulin pareil à celui qu'on a choisi pour Exemple elles ne soient trop petites, nous ne pouvons pas surtout nous imaginer qu'un arbre vertical de fer n'ayant que 6 pouces d'équarissage puisse avoir assez de force, et nous croyons d'ailleurs qu'il seroit difficile d'ij faire tenir les lanternes. —

En tout cas il nous paroît essentiel d'informer au plutôt ces Messieurs des principales dimensions de nos moulins; Ils sont octogones, et ressemble par consequents à celui qu'on trouve dans les planches, 24, 25 et 26 du groot Molenboek de van Zijl cité dans le memoire anglois, les verges ont 90 pieds de longueur et 14 sur 16 pouces d'équarissage dans le milieu; la partie des ailes couvertes des Voiles est large d'environ 6 pieds l'axe a 32 sur 32 pouces d'équarissage par devant, et 24 sur 24 pouces vers l'autre extrémité; la partie arrondie sur laquelle cette axe tourne à 34 pouces de diamètre et 13 pouces de longueur, la roue superieure à 10 pieds 8 pouces de diamètre, et porte 71 dents, l'arbre vertical à 17½ pouces d'ecquarissage, et environ 34 pieds de longueur, la lanterne superieure est composé de 37 fuseaux, et l'inférieure de 27, la roue inférieure à 16½ pieds de diamètre, elle est garnie de 91 dents; l'essieu de cette roue à 24 sur 24 pouces d'equarissage; la roue à palettes à 20 pieds de diamètre elle élève l'eau de 4½ pied, les palettes trempent 40 pouces dans l'eau interieure, le coursier enfin dans laquelle cette roue se meut à 26 pouces de largeur en haut et 28 pouces en bas. — le tout mesuré en pieds de Rhijnland.

Après que la Commission de Surintendance aura reçu les éclaircissements desirés et qu'elle aura fixé son choix, nous ne manquerons point de faire parvenir à ces Messieurs tous les desseins dont ils pourroient avoir besoin. —

This version, which differs little from the revised version 1799? has not been separately translated; see that revised version.

HvL to B&W 1799-05-18

AoS ref. MS 3147/3/506/14. Docket: Receipt of drawings of little Engine — Difficulty of setting it to work — Answer of the Directors of the Drainage to our Remarks on the substitution of Iron in Windmills — Money advanced to Mrs Swellingbrebel & death of that lady — Progress made by the Mydrecht Engine — Wants Expln. of large Copying machine. Stamps on cover: FOREIGN OFFICE MA 30 99 and B MA 30 99. Postage note: 3/2. Copy from J.L.Meijer.

On 1799-01-23 HvL received [1798-12-06]. HvL's letter [1798-12-25] was stamped by the Foreign Office on 1799-01-19, and probably received by B&W not long after. This shows that four to seven weeks in transit was not unusual.

The copy of [1798-12-25] is not strictly verbatim.

Both original and copy of [1798-12-25] are in the B&W archives, so the original was not lost (as HvL assumed). B&W simply did not get round to replying.

Copij

Mess^{rs} Boulton & Watt
at Soho near Birmingham

Rotterdam 25th of December 1798

Dear Sirs !

Since I had the pleasure of writing you the last of July, I have not been favoured with anij one of yours; since that time and after having received the box with the drawings and maps of Warwickshire; my friend has employed th'Engine man of the Blijdorp's Engine William Krijgsman, in putting his Engine together, which is not yet quite done, as still some obscurities occurred in the directions; the drawings and the given measures not always corresponding; we hope notwithstanding to overcome every difficulty, and to bring it in order. as it is the first double power'd Engine put together in this Country we have no model to consult. — The continuing dearth of timber wood in general and of Oak timber in particular, makes people in this Country more attentive on the use of cast Iron for millwork, in stead of Oak timber; I send you therefore the remarks, made by the Director General and the Surveyors of the drainage at Nieuwkoop upon your memorial on that subject, which I have translated; and as the said Director is not enough acquainted with th'English language, he has written his remarks in french as you do understand that language; the next spring we propose to contract for three new wind Watermills; for which we intend to emploij some cast iron mill work; If said remarks will serve for our more certain illucidation. Another friend of mine who had the superintendance of another verij extensive drainage which employs more than thirty wind watermills, has for the same reasons as above, desired me to do you the following questions; I shall only transfer his scheme of enquiry, viz.:

We are informed that Iron mill axes are in nearly general use in England and it is therefore that we are desirous of be made acquainted with the following circumstances. 1^o If the machinery of the windmills in England is so far equal to that of the windmills that are in daily use now in Holland that their axis could be made servicable for the Dutch windmills, and as one of the first proprieties is to know how the fore end of the axis is constructed and If the sail arms pass through the same, or are laid around the same. It would be acceptable to know nearly the weight of an iron axis. and its price. The Axis in common Use in Holland are of 32 or 34 inches square at their fore end. The following considerations are objected against the Iron axes 1^o If their weight will not be to great for common mills. 2^o. Shall cast Iron be strong enough for the several operations that such axis ought to perform; may th'Equilibrium be brought behind the neck part of such an axis.

You will oblige me If you would be so kind as to answer those questions explicitly, that I may impart it to my friend; If anij treatise was written and printed in England about those matters, be so kind as to mention it that I maj given order to my bookseller or anij friend in London to provide it for me. Or If any well instructed millwright would undertake to provide such parts of Iron millwork in good order we could correspond with him, If it should given you to much trouble.

Gladly Expecting your desired Answer I remain Sincerely.

Mess^{rs} Boulton & Watt
at Soho near Birmingham

at Rotterdam 18th of Maij 1799

Dear Sirs !

Since mine letter of which you have copij above, I have been favoured with yours of 6th of December last Year, which came to mij hands not earlier than the 23th of Januarij this Year, and as I was never favoured since with your answer upon mine letter above mentioned, I have supposed the same to be lost. by your said

favour I (*have received*) extract of our mutual account *current* which I have found right in all; only that you will be so kind, as to bring upon Mr. Boulton's account what sum I have paid to Mrs. Swellingbrebel since the year 1794. to the time of her decease in the beginning of 1796. having been one Year or 50 £: and have since that time never heard of any further claims from any one on her part. by this the balance of said accounts would be in mine favour £ 28.19.2. which I beg you will Examine, and if found right booke it accordingly with me. — Till now I am not able to given you a Satisfactory account of the small Engine; It has been put up wholly in order, but th'Engine man was not able to set it â going, he could very well blow out th'air from every part, but never could press the piston in Cylinder down by the steam; this was about three weeks ago, and as I am very much out of town, I have not heard since from it, my friend its owner being likewise with the feastdays out of town; — Meydrecht Engine (which I saw last week) continues still to work on very smooth and constantly night and daij; but we cannot overcome the leakage of the dikes; we are now throwing a vast quantity of sand along the same to get them thight thereby, being the only means of effecting that, and if we succeed in that operation, as we hope, and as those means have never failed in similar cases, we doubt not to bring th'undertaking to a good issue; — A friend of mine in London has procured for me one of your patent portable copijing machines, of the quarto size, which I received last week, and have found it answers my wishes and will serve me very well in my frequent excursions in the Countrij, but I wish to have some description of the larger machine for copijing the outlines of plans Sections, and other drawings, as those must be very useful instruments to for Engineers architects etc. If not very expensive; after having wish(*ed* ...) all our good friends health & happiness I remain verij Si(*ncerely*) yours J:D: Huichelbos van Liender.

Undated revised draft memorandum 1799?

AoS ref. MS 3147/3/506/14b. Copy from J.L.Meijer. Docket: Remarks of the Director General of the Drainage of Nieuwkoop.

Memorandum of the Director General (Chr. Brunings jnr.) and the Inspectors of the Nieuwkoop and Zevenhoven drainage about the use of cast iron in the construction of the windmills for the Nieuwkoop drainage project. It comments on the B&W memorandum sent with [1797-11-16]. It was first mentioned in [1798-01-07] and from this letter and the preamble it is apparent that it was drawn up in January 1798 and would be discussed in the Commission on January 17. There are two versions, this is likely to be the second; the first was sent to B&W with [1798-12-25]. Why "likely" ? From the copies at the author's disposal it was not clear which version had been sent with which letter, but the small differences, mainly of French language usage, look as if this version, which this author linked with [1799-05-19], is the corrected, and thus probably the second one.

The document appears to form the basis for a memorandum by Chr. Brunings snr., a duplicate of which was sent to B&W with [1800-03-15].

"Coursier" would from the context appear to be the structure in the watercourse in which the wheel runs; I have not found it with this meaning in any (more modern) dictionaries. The Dutch equivalent "krimp" given, is translated in Tony Yoward's dictionary of windmill terms as "spillway wall". Compared with "coursier" it seems probable that the entire spillway or watercourse is meant.

Remarques du Directeur Général et des Inspecteurs du Dessèchement de Nieuwkoop & Zevenhoven, sur certain memoire anglois touchant l'usage qu'on pourroit faire du fer de fonte dans les moulins à épuiser l'eau. (Les remarques sont dressées selon l'ordre du susdit memoire au mois de Janvier 1798).

Une Roue à palettes (Scheprad) de fer auroit l'avantage d'occuper moins d'espace dans le coursier (Krimp) qu'une roue de bois; elle élèveroit par conséquent à chaque révolution une plus grande masse, mais en révanche elle deviendroit beaucoup plus pesante, car supposé que la pesanteur spécifique d'une roue ordinaire egale celle de l'eau, une roue de fer du même volume la surpassera d'environ 7½ fois en pesanteur, & comme les palettes (bladen) ne peuvent être diminuées que dans une seule dimension, il n'est pas apparent qu'il soit possible de construire une roue de fer dont le volume soit diminué dans la raison de la pesanteur spécifique des deux matieres. — Cette difficulté levée la roue devoit être garantie contre la rouille par un Vernis, ou de toute autre maniere, & l'on devoit nous mettre à même de renouveler cette vernissure quand cela seroit necessaire. — La même chose devoit avoir lieu à l'égard de toute autre pièce de fer dont on fera usage dans nos moulins. — Si l'on placoit plus en arriere la grande roue supérieure, & qu'on ne fit point de changement au diametre de la lanterne avec laquelle cette roue engraine l'arbre vertical sortiroit du milieu du moulin, ce que ne se peut pas; puisque le toit du moulin avec son axe doivent se mouvoir autour de cet arbre. — Nous ne sentons pas quel avantage on pourroit retirer de la diminution projetée des roues supérieure & inférieure. Car pour qu'il y ait même raison du nombre des révolutions de la roue à palettes au nombre des révolutions du grand axe, cette diminution devoit être proportionnelle, & l'on perdrait autant en force, par celle de la roue inférieure, qu'on gagnera par celle de la roue supérieure. Nous craindriens d'ailleurs qu'après ce changement on n'eût de la peine à faire tenir l'arrêt (den Vang) sur la roue supérieure, & que l'essieu qui porte la roue inférieure & la roue à palettes n'ait trop à souffrir & ne soit plus sujet à branler. — Il pourroit être avantageux d'employer un bac de fer, aussi y auroit le moyen de raccourcir l'essieu inférieur comme ces Messieurs le proposent, mais si l'on ne veut pas retarder la construction des moulins qui doivent se construire l'été prochaine il faudra remettre cet essai à une autre occasion. — C'est surtout de l'emploi d'un essieu inférieur de fer dont nous attendons de grands avantages, puisque les essieux de bois, humectés continuellement, se pourissent & se rompent en peu de tems. — Il s'agit seulement de savoir si le hals (partie arrondie du devant de l'essieu sur laquelle il tourne) d'une pièce de fer de fonte peut acquérir la même dureté que nous donnons à cette partie de nos essieux de bois, en la garnissant de plusieurs pieces de fer bien acérées. Et comme malgré cette precaution cette partie s'use encore, il est question encore de savoir comment on pourroit y rémédier. —

La même question est applicable au projet d'employer un arbre vertical de fer. Les pivots de nos arbres s'usant de tems en tems on est obligé alors de les faire acérer derechef. Mais quel feroit le moyen de raccomoder les pivots d'un arbre fondu ? Peut-être ces Messieurs jugeront-ils à propos de faire fondre à part les extrémités de l'arbre avec les pivots, en sorte qu'on puisse les joindre à vis aux autres pièces, & de nous en envoyer un double nombre afin de pouvoir les changer. Pour ce qui regarde la maniere d'assembler les verges à un axe de fer, nous devons avouer que nous n'avons pu nous en former une juste idée d'après ce qui en est dit dans le mémoire. Nous regardons ce point comme de la plus grande importance, & nous serions curieux d'en être informé par un dessein & une description ultérieure. Notre axe ayant 32 sur 32 pouces d'équarissage, & étant traversé par les verges il est clair que si l'on accepte la position verticale d'une verge, son poids entier n'a pour appui qu'un plan de 32 pouces de longueur, et l'expérience nous apprend que cette longueur suffit à peine à

porter ce poids, réuni à la vitesse tangentielle de toute aile qui descend, les verges se courbant aux extrémités d'environ 3 pieds. D'où il suit qu'en employant des axes de fer, on devroit tâcher d'augmenter plutôt la longueur de ce plan d'appui que de la diminuer. Peut-être que si ces axes étoient creux qu'on pourroit leur donner 36 à 40 pouces d'équarissage, & y pratiquer des ouvertures pour les verges. Peut-être aussi qu'il vaudrait mieux de donner moins d'équarissage aux axes de fer, mais de les revêtir de bois. Mais nous ne voulons pas dévancer les projets ingénieux de ces Mécaniciens distingués. Il nous suffit de leur avoir indiqué les écueils que l'expérience nous a fait connoître. Encore seroit il avantageux si cet axe étoit construit de manière à pouvoir y employer des demi verges au lieu de verges entières pourvu que la manière de les assembler ne cause rien à craindre. — Nous approuvons beaucoup le projet de ces messieurs quant aux lanternes et aux roues. à cet égard il nous est venu l'idée que si les fuseaux des lanternes étoient construit de manière à tourner dans des crapaudines, cela diminueroit de beaucoup le frottement de ces fuseaux contre les dents des roues avec lesquelles ils engrainent, mais que d'un autre côté il en résulteroit un nouveau frottement des pivots dans leur crapaudines par lequel ils pourroient s'user trop vite. — Nous sommes charmés de voir que ces messieurs se proposent de faire construire toutes ces pièces du meilleur fer & de la manière la plus solide, car nous serions on ne peut plus embarrassés si quelque partie venoit à se rompre, sans que nous ne fussions à même de la faire réparer dans notre pays. — Pour ce qui regarde les dimensions projetées qu'on trouve à la fin du susdit mémoire nous craindrions que même dans un moulin tel que celui qu'on a choisi pour exemple, elles ne soient trop petites. Nous ne pouvons pas surtout nous imaginer qu'un arbre vertical de fer n'ayant que 6 pouces d'équarissage puisse avoir assez de force, et nous croyons d'ailleurs qu'il seroit difficile d'y faire tenir les lanternes. — En tout cas il nous paroît essentiel d'informer au plutôt ces Messieurs des principales dimensions de nos moulins. Ils sont octogones & ressemblent par conséquent à celui qu'on trouve dans les planches 24, 25 & 26 du groot Molenboek de van Zijl cité dans le mémoire anglois, les verges ont 90 pieds de longueur & 14 sur 16 pouces d'équarissage dans le milieu; la partie des ailes couverte des voiles a environ 6 pieds de largeur, l'axe a 32 sur 32 pouces d'équarissage par devant & 24 sur 24 pouces à l'autre bout; la partie arrondie sur la quelle cette axe tourne a 34 pouces de diamètre & 13 pouces de longueur. La roue Supérieure a 10 pieds 8 pouces de diamètre & porte 71 dents — l'arbre vertical a 17½ pouces d'équarissage, il est long d'environ 32 pieds, la lanterne supérieure est composé de 37 fuseaux & l'inférieure de 27, la roue inférieure a 16½ pieds de diamètre & porte 91 dents, l'essieu de cette roue a 24 sur 24 pouces d'équarissage; la roue à palettes a 20 pieds de diamètre elle élève l'eau de 4½ pieds, les palettes sont plongées 50 pouces dans l'eau intérieure. Le coursier dans lequel cette roue se meut a 26 pouces de largeur en haut & 24 pouces en bas. — le tout mesuré en pieds du Rhin. — Après que la Commission de Surintendance aura reçu les éclaircissements désirés, & qu'elle aura fixé son choix, nous ne manquerons point de fournir à ces Messieurs les desseins dont ils pourroient avoir besoin. —

English translation:

Remarks of the Director General and the Inspectors of the Nieuwkoop & Zevenhoven drainage on an English memorandum about the possible use of cast iron in drainage mills. (The remarks have been put in the order of said memorandum in January 1798)

A cast iron scoopwheel (Scheprad) would have the advantage of taking up less space in the watercourse than a timber one; it could therefore raise more water per revolution. It would, however, be much heavier as, supposing the specific weight of a timber wheel to be equal to that of water, an iron wheel of the same volume would be 7½ times as heavy, and as the boards (bladen) can only be reduced in one dimension it is not clear that it will be possible to construct an iron wheel with a volume that is reduced in proportion to the specific weights of the two materials. — If that difficulty were solved, the necessity remains of safeguarding the wheel against rust by either varnishing or by any other method, and we ourselves would have to take the trouble of re-varnishing when needed. — The same would apply to any other iron parts which would be used in our mills. — If one were to move the brake wheel backward, without changing the diameter of the lantern wheel with which it meshes, the vertical shaft would no longer be in the centre of the mill, which is not allowed, as the cap of the mill with its shaft must revolve around this axis. — We do not see which advantage would result from a size reduction of the upper and lower gearwheels. The reason is, that to have the same ratio between the number of revolutions of the scoopwheel to that of the big shaft, that size reduction must be in proportion, and the loss of force at the lower wheel would equal the gain at the upper wheel. Moreover, we fear that after this change it would be difficult to hold the brake (den Vang) on the upper wheel, and that the shaft carrying the scoopwheel and the lower gearwheel might suffer and maybe wobble. — It might be advantageous to use an iron trough, and it would also be possible to shorten the lower shaft as proposed by these gentlemen, but if the construction of the mills which must be built next summer is not to be delayed, this experiment should be postponed to another occasion. — It is mainly of the use of an iron lower shaft, that we expect great advantages, because the timber shafts, constantly moist, decay and break in a short time. — We need only know if the hals (round portion at the front end of the shaft, upon which it turns) of a piece of cast iron can have the

same hardness which we impart to that portion of our wooden shafts, by covering it with several pieces of well-tempered iron. And if, in spite of these measures, this portion wears out, the means to remedy this must be available. —

The same applies to the plan to use an iron vertical shaft. As the journals of our shafts wear out, re-tempering is needed from time to time. But how would we restore the journals of a cast shaft? Maybe these gentlemen would consider to cast the end portions of the shaft separately, in a way that they could be screw-fitted to the other parts, and to supply us with twice the number of end pieces in order to allow replacing these. As far as the fixing of the sail arms to an iron shaft is concerned, we have to admit that we have not been able to form a good idea from what is said in the memorandum. We consider this a most important aspect, and we would much appreciate further information via a drawing and a full description. Our shaft is 32 by 32 inches square and the sail arms pass through it, so it is clear that, if a sail arm is in its vertical position, its supporting plane is only 32 inches long. From experience we know that this length is barely sufficient to carry this weight, and combined with the tangential speed of the descending sail, the ends of the arms deflect about 3 feet. From this it follows, that when using iron shafts, one must attempt to lengthen this plane rather than shorten it. Maybe, if these shafts were hollow, one could make them 36 to 40 inches square, and make openings for the sail arms in them. Or maybe it would be better to make the iron shafts thinner, but encase them with wood. But we do not want to anticipate the ingenious plans of these distinguished Mechanics. It will suffice us to indicate the hurdles which we know from experience. Furthermore, it would be advantageous if this shaft were designed to take half-arms instead of full sail arms, provided that the method of fitting these is without risk. — We very much approve of the proposals of these gentlemen regarding the lantern and gear wheels. In this respect the idea has occurred to us that the pins in the lantern wheels might be made to revolve in bearings, this would greatly diminish the friction of the pins against the teeth of the gear wheel with which they mesh, but on the other hand this would result in added friction of the pins in their bearings which might cause excessive wear. — We note with pleasure that these gentlemen intend to have all these parts made of the best iron in the most reliable manner, because we would be in the direst trouble if any part would break, as we could not even have it repaired in this country. — As far as the planned dimensions, given at the end of the memorandum, are concerned we fear that these are too small, even for a mill such as the one used as an example. In particular, we cannot imagine that an iron vertical shaft of only 6 inches square could have enough force, and moreover we believe that it would be difficult to fit the lantern wheels to it. — In any case, we consider it essential, that these gentlemen will be informed as soon as possible about the principal dimensions of our mills. These are octagonal and they thus resemble those depicted on plates 24, 25, and 26 of the *Groot Molenboek* by Van Zijl, quoted in the English memorandum. The sail arms are 90 feet long and 14 by 16 inches square in the middle. The canvas-covered portion of the sails is about 6 feet wide, the shaft is 32 by 32 inches square at the front, and 24 by 24 inches at the other end; the round portion on which this shaft turns, has a diameter of 34 inches and a length of 13 inches. The brakewheel has a diameter of 10 feet 8 inches and it carries 71 teeth — the vertical shaft is 17½ inches square, it is about 32 feet long, the upper lantern has 37 pins, the lower one has 27, the lower wheel is of 16½ feet diameter and it carries 91 teeth, the shaft of this wheel is 24 by 24 inches square; the scoopwheel has a diameter of 20 feet, it raises the water 4½ feet, the boards are immersed 50 inches in the interior water. The water course in which this scoopwheel moves is 26 inches wide at the top, and 24 inches at the bottom. — All measurements are in Rhineland feet. — After the Committee for Superintendance will have received the desired clarifications, and after it will have made its choice, we will not fail in providing these gentlemen the drawings they might need. —

HvL to B&W 1799-08-16

AoS ref. MS 3147/3/506/15. Docket: Complains of having received no answer — Improvements made in Pumpwork — Our Engines likely to be wanted — Wants one of us to meet him at Hamburg — Small engine doing pretty well. Partly torn off note on cover: (Lon)don 9 Sept. 1799 (...)ble (...)Dyck Gevers & Co. On the cover are dates 25 Decr. 1798 and 18 May 1799, both dates of earlier letters of HvL. Furthermore a PS in HvL's handwriting, but with a date more than five weeks before that of the letter: Rotterdam den 6 Julij 1799 — P.S. Please tell th'abovementioned Gentlemen that the small Engine now works tolerably well; but is not able to equalize the power of four horses; being only able to drive one pair of grinding stones; in the same time. Could this have been translated from a letter which HvL received from the owner of the engine, distiller Boon ? No FO stamps, no postage notice. Copy from J.L.Meijer.

The "fenland drainage project" undoubtedly the Hellevoetsluis naval dock project, for which an engine was delivered in 1801 (with the fens mentioned as a smokescreen, to shield the military use of the engine). B&W is unlikely to be fooled, after the more explicit [1797-05-12], but censors etc. might be. HvL is not specific about the important "improvement to the pumpwork" consists of; it is probably the first reference to Jan Blanken's idea for lift/capacity trade-off, using multiple single-acting pumps on a double-acting engine, eventually implemented in the Hellevoetsluis engine of 1800-1802, and apparently also considered for the Krimpenerwaard engine of 1802-1804. The correspondence about the latter (which eventually had a single standard pump [Blanken, 1807]) starts with [1802-10-12b].

Mess^{rs} Boulton & Watt
at Soho near Birmingham

at Rotterdam 16th of August 1799

Gentlemen !

I must again trouble you with my letter, begging you earnestly to give me your answer (*Ed.Note: to which letter?*) as otherwise I shall be obliged (against my will) to address myself elsewhere.

The matter is these, that we are now very busij in devising means for draining several low fenns and marshes; and we find that the spediest way will be to Use Steam Engines for the purpose; but as we have found by considering the matter thoroughly some ways and means for th'improvement of the pumpwork wanted for that purpose; which invention will greatly promote the use of those Engines in this Country, and make their emploijment preferable above all other hydraulic machines; But all those proposed alterations with application of pumps cannot be treated so well by letters as by oral conversation; and as we are in want now directly of one engine, and the correspondence by letters is very tedious; I propose and sollicit you to send over one of the young Gentlemen Boulton or Watt at Hamborough, as soon as conveniently can be in the month of September or at th'utmost October next. and to fix nearly the time, as then I shall Engage to be there at th'appointed time. at the end that in half â day's conversation, we maij settle â matter which by letters (as the correspondence now stands) is nearly impossible to do. — The small engine for grinding corn, works now pretty well, but is not yet brought to the utmost pitch of its power; expecting your speedy and favourable answer I remain

Yours very sincerely

J:D: Huichelbos van Liender

B&W to HvL 1799-10-28a

AoS ref. MS 3147/3/94/152.

M^r J.D.H. van Liender
Rotterdam

Soho 28th October 1799

Dear Sir

We scarcely know whether the excuses we have to offer for our long silence will prove quite satisfactory, but we trust they are such as will at least convince you that it has not proceeded from any diminution of friendship & regard or want of desire to cultivate a correspondence which has at all times afforded us much gratification. — You are already apprised of the circumstances of our being involved in a tedious & harrasing lawsuit, but perhaps you may not have yet heard that it has at length terminated compleatly in our favour. — It is now more than two years since we obtained a second verdict by a Jury upon the validity of our Patent which after some interval was confirmed by the judgment of the Court of Common Pleas. But our opponents still flattered themselves that they should finally succeed in losing(?) us out or in ruining us with expence and availing themselves of legal quibbles, got the causes removed by Writ of Error to the superior Court of Kings Bench where after much argument on both sides and in very full investigations, the matter was decided in our favour by the unanimous suffrage of the four judges who preside in that Court. Thus terminating a Lawsuit, which during the long course of Seven Years, had been productive of inhibition, anxiety, loss of time and expence and (*.....ing*) to us the payments of various sums that had accumulated during that period. — You will readily conceive that such a number of accounts remaining (*.....sserated*) & unsettled during so many years, have required much time and much exertion to procure their final liquidation even after our rights were fully established. — Indeed it has required the constant attendance in Cornwall and other distant parts of me and some members of our firm, and of those in particular who have made the subject of your letters their more immediate study.

We have also much of our time engrossed by the prosecution of new experiments upon the manufacturing of the parts of the Steam Engine and new Improvements in their construction — some of which have been attended with success, particularly a new method of boring Cylinders Pumps &c, with greater accuracy & perfection than was before attained, and also a new and simplified construction of the Steam Regulators & Nozzle Gear, which is peculiarly applicable to small Engines from the power of from one to four horses. Of these we are now establishing a considerable Manufactory and have no doubt that from the simplicity of their construction and the facility of managing them, they will soon become of general application in workshops and small manufactories, as well as in farm yards for threshing Corn, Churning & other operations; indeed we conceive they will be in request in Gentlemen's houses in the Country for the above purposes, for grinding Corn and for other uses where power is required. We thought these Inventions of sufficient importance to secure the exclusive possession to ourselves by Patent, which we have lately obtained for fourteen years and have no doubt of its fully answering our expectations both with regard to the public and to ourselves.

In the midst of these avocations we have had the satisfaction to find our Orders for Engines more numerous than at any former period, which in some degree has obliged us to confine our thoughts to the execution of our home demand, rather than speculate upon improvements in machinery not so immediately connected with our business — indeed the political state of the two Countries since we have been in any degree at leisure has proved a compleat bar to commercial & almost to epistolary intercourse and made it appear eligible to defer the discussion of your windmills till more peaceful time. But the approval of your application by your letter of August 16th since by M^r Ravee, has led us to suppose that we should meet your wishes more, and should in some measure be preparing matters, by stating some further explanation of our ideas in answer to the very judicious observations which the Gentlemen your Colleag(*ues*) have been at the trouble of making upon our proposals, sincerely hoping that the time is not far distant when we our nations may renew their accustomed intercourse and jointly renew their efforts towards the improvement of the Sciences & the Arts.

With respect to the proposal you make of meeting one of our Juniors at Hamburg, they certainly would with pleasure acquiesce in your request, if the state of their avocations did not render their stay here indispensible for the present. It also strikes us, that in as far as the windmills are concerned, our ideas would be better explained by shewing the things themselves in actual practice, to any person properly qualified whom the Gentlemen of the Commission might please to send over, and in whose report they would place ample confidence; so far at least as to order one of these Machines upon trial. — With respect to the new Engine, likely to be wanted we should think that matters might be settled by letter as from the present aspect of our private & public affairs it does not appear to us likely that our correspondences will meet with similar interruptions in future. By the same means, we should hope you would be able to explain the improvements

upon Pumps to which you allude. A drawing & description of the operation and effects produced, will make that matter quite intelligible. But after all, should any difficulties remain, perhaps one of our firm may at a future period be more at liberty to comply with your proposal by meeting you in Hamburg or in Holland. — We observe what you write upon the (.....) Account & have accordingly credited you for £ 50 paid to M^{rs} Swellingrebel with which we have debited our M^r Boultons account and there now stands a balance in your favour of £ 28..19..2 which we will pay to any person you may direct.

We are sorry to learn the difficulties you have met with in putting the little Engine to work which however we are glad to find you have already in part overcome and have no doubt of your fully succeeding with a little more experience. We regret alas the circumstances which have prevented the Mydrecht Engine being attended with compleat success but are glad to find that they do not in any degree proceed from the Engine itself. —

In reply to your inquiries respecting our large Copying Machines for copying drawings, we (.....) it will be sufficient to state that the Rolls are 2 feet long & 5 or 6 Inches in Diameter and that the net price is £ 16..16.- The copy is taken upon thick paper and is a reverse of the original, which in drawings of Machines, or indeed in architectural drawings is not very material, particularly as the copy is usually for the (.....) use of the proprietor. You will naturally understand that it is only the outlines which we profess(?) to copy & that they are made with a peculiar Ink, the powder for which we sell with the Machine. All our Engine drawings have been copied in this way for the last 14 or 15 years. —

The above is all that occurs to us to say at present, and expecting to have the pleasure of hearing from you we remain with true regard

D^r Sir

Your ob^d hble serv^t
for Boulton & Watt

B&W memorandum 1799-10-28b

AoS ref. MS 3147/3/506/16. Docket: Inclosed in our letter to van Liender of 28 Oct. 1799

The memorandum is undated and unsigned; it has been assigned the same date as the letter with which it was sent. This document in the AoS is clearly a copy. The sketch mentioned, is missing. B&W require (not for the first time) some principal data "for our Government", but do not explain the reason; probably this has to do with government control over the diffusion of engineering knowledge (the shipping permission of the Privy Council, as mentioned in several letters).

In reply to the remarks of the director General & inspectors of the Drainage of Nieuwkoop & Zevenhoven, Mess: Boulton & Watt have to observe

1st That the substitution of Iron in lieu of the Wooden Scheprad, was not proposed with any view to the greater Quantity of Water which would be raised by the Iron wheel occupying less space, but on account of the greater duration of the Iron; the difference in the quantity of water to be raised is too trifling to be noticed. The Iron wheel would undoubtedly be heavier than the wooden one, the increase of friction however in consequence of this additional weight, would scarcely be perceptible in a machine of the magnitude and power proposed, this weight may also be lessened in some degree by continuing to make the ladles of wood, and only using iron arms, to which wooden ladles may be affixed; in constructing these arms Mess. B&W will keep in view this circumstance and prepare them for the reception of the wooden ladles, or in case that even the arms are thought objectional on account of their weight, the wooden wheel as now constructed may be adapted to an Iron shaft.

2^d From very long experience in this country, cast Iron Machinery has been found to suffer very little from rust, even if it has not been protected by any coat of paint or varnish. Waterwheels are frequently constructed of Iron, and after a skin of rust is once formed upon them, the corrosion does not appear to penetrate any further. The Iron Machinery furnished by us, when sent from hence, will be protected by a coat of varnish which can easily be renewed at any time; common oil paint may be employed as the preservative.

3^d It will be seen from the sketch that accompanies this, in what way the upper wheel (U.) on the inclined axis may be removed further back, without altering the position of the vertical axis; the advantages accruing from this change are mentioned in our former observations -

4th The diminution of the upper and lower wheels was proposed with a view to the reduction of their weight & not with any intention to vary their relative velocities. In machinery constructed of cast Iron it is found from the greater strength of the material, that the same power may be transmitted thro' wheels of much less diameter than when wood is used. In the wheels of the accompanying sketch we have nearly adhered to proportions contained in your memorial. you will observe that the objection made to the reduction of the upper wheel (U) as reducing the diameter of the stop or vang is there obviated, by making the bearing against which the vang acts, independent of the rim of the wheel; but they might be cast in one piece.

5th the apprehensions which are entertained of the wearing of the Iron gudgeons, very naturally occur to mechanists not accustomed to the use of cast Iron ones, and can only be removed by experience(;) reasoning apriory appears fully to justify them but B&W can fully assure the directors that in the course of their practice as mechanists, they have not observed the Iron Gudgeons of Machinery in constant action for 20 years, to be materially diminished, nor have they ever seen an instance where it has been necessary to renew them on account of the wearing from friction: for this reason the Iron shafts in this country are generally cast with the Gudgeons in one piece with the shafts, they are thereby firmer & not subject to many disadvantages which are incidental to those shafts when the Gudgeon is in a separate piece(.) B&W are sensible to the great detriment which would ensue from the wearing of the pivot or Gudgeon of the great vertical axis & will of course pay particular attention to construct it in such a manner as to have no apprehension on this head.

6th In conformity to the wish of the directors, we subjoin a drawing of the mode we propose to adopt in fixing the yards or arms to the inclined axis. As it appears desirable from the directors observations, that the length of the bearings which carry the arms should be increased, & that they should be so constructed that the arms may be used in two pieces, instead of one of the whole length as hitherto both these points have been attended to in the construction of the socket or crop we propose. The mode of joining the arms we conceive will be sufficiently intelligible for present consideration, from the drawing without further description: this plan was followed in joining the arms of a powerful windmill which was constructed under our direction for America, & we have not heard that it has been found deficient in any respect. Cast Iron sockets are now in common use in the windmills of this Country; in one which we have lately examined having yards of 76 feet diam^t & 6 feet cloths, the neck is 8 inches diam^t, and we are persuaded that 10 or at most 12, will be found amply sufficient for your largest Mills.

7th We observe you express doubt whether a vertical axis of 6 Inches would be sufficiently strong; a shaft of this dimension we are persuaded is amply sufficient for the Windmills described in the Groot Moolen Boek, & in Iron will be stronger than a wooden shaft 14 Inches square, bur whether your most powerful Mills as they are

now constructed, may require any additional strength in this part, we cannot decide till we know its greatest diam^r of yards, breadth of cloth & velocity, these particulars we shall request you to transmit to us for our Government.

8th There will not be the least difficulty in fixing the Iron wheels to a shaft of this dimension, we have frequently occasion in the Machinery of our Mills of this Country, to put the wheels upon much smaller shafts, and which is commonly practised without any difficulty.

9th From the observations which are made concerning the Lanterns, we are induced to conceive that our explanations respecting the use of Bevil Gear (*Ed.Note: bevil is a variant of bevel OED*), have not been sufficiently explicit. Where the power is to be transmitted thro' shafts lying at angles, instead of the wheel working into a Lantern as is practised in your Machines, we employ two bevil wheels (as UV) and which from their form are called bevil Gear; from the advantages which this construction has been found to possess both from Theory & practice, it has entirely superseded the use of the lanterns, and the ingenious Suggestion of the Directors will not therefore be applicable to any part of the machinery where the bevil gear is used.

We have annexed a sketch of the arrangement of the principal parts of the mill (*Ed.Note: sketch not found with this copy*), merely in elucidation of our description and observations, the dimensions are not to be considered as definitive, as they will be in a great measure regulated by the information which has been requested, in regard to the greatest velocity of their mills.

It is proper to observe also, that in consequence of a considerable advance in the price of iron since our Letter of Dec^r 1798, the prices per cw^t there stated will require Augmentation. But should it appear eligible to carry our suggestions into actual practice perhaps the preferable mode would be for B&W to undertake the delivery of the whole of the cast Iron Materials on board of a Vessel at Hull or London for a specific sum —

HvL to B&W 1800-02-01

AoS ref. MS 3147/3/506/17. Docket: Congratulates on Law Victory — Wishes estimate of small Engines — Are satisfied with the Explanatn. of iron parts in windmills — Has sent by some person a scantling of timber etc. wanted in a windmill — Orders a cast iron Bak — to send by Embden. FO stamp and two date stamps largely illegible, probably FE 14. Copy from J.L.Meijer.

Sent directly, copy sent via Hamburg with [1800-02-18]. The reference to a B&W letter of "28th last" would, at face value, refer to 28th January. As far as is known, no letter of that date exists, so this is probably erroneous, and the intended reference is probably to [1799-10-28] (as corrected in the copy sent with [1800-02-18]).

The victorious lawsuit, which HvL mentions, would appear to be the King's Bench final ruling on the validity of the 1769 patent in January 1799.

Mess^{rs} Boulton & Watt
at Soho near Birmingham

at Rotterdam first of februarij 1800

Dear Sirs !

Your very explicit favour of 28th last (*Ed.Note: this ref. likely in error, probably 1799-10-28 meant*) has entirely extinguished my discontent about your long extended Silence; and it was with the greatest pleasure that I apprised your complete triumph in that so long extended Lawsuit of which I heartily congratulate you in hope it will, be the last; that you shall be plagued with. As I do likewise of your good Success in the prosecution of several new experiments. — When your Manufactorij of small Engines from the power of one to four horses shall be completelij established, and you can communicate to me the tarif of their prices; I shall perhaps have an opportunity of placing some of the same in this country; — I doubt not of your succeeding fully in th'Expectation of an extended employment of these small Engines. — Th'Explanation of your Ideas upon th'objections we have laid before you, about the Iron machinery in Windmills, has given entire Satisfaction, and we confess to be entirely convinced of th'utilitij of their use and shall undoubtedlij make a tryall in one of the three new Scheprad Watermills; we shall offer in contract the tenth of this month; — In the end of December last, I have send you by a person going over directly from here to England; one of those contracts (bestekken) by which you may learn all the principal parts and dimensions of the mills we will employ for raising water by wind. —

But we are at this moment instantly in want of an Iron through or (bak) for the dry wheel; the through of brickwork in one of the new mills having suffered so much by the strong frost that we fear it will burst up, and in that case an Iron one would best suit us, to substitute in its place, with the less loss of time; I send you therefore with these a sketch with the true dimensions; praying you will have cast the same as speedily as possible, in five pieces; viz. the bottom, two side, and two end pieces, taking attention that one of the side pieces must go up straight, and the other sloping, and both the end pieces likewise sloping; which the different measurements will show sufficiently; — I doubt not of your contriving the connection of those pieces together; and that they may be taken easily asunder, and again put together; as otherwise we should not be able to bring the bak inside the mill; and that they may join so well together as to make the through quite watertight, and that before sending them of, you will have them put together; and try its tightness.

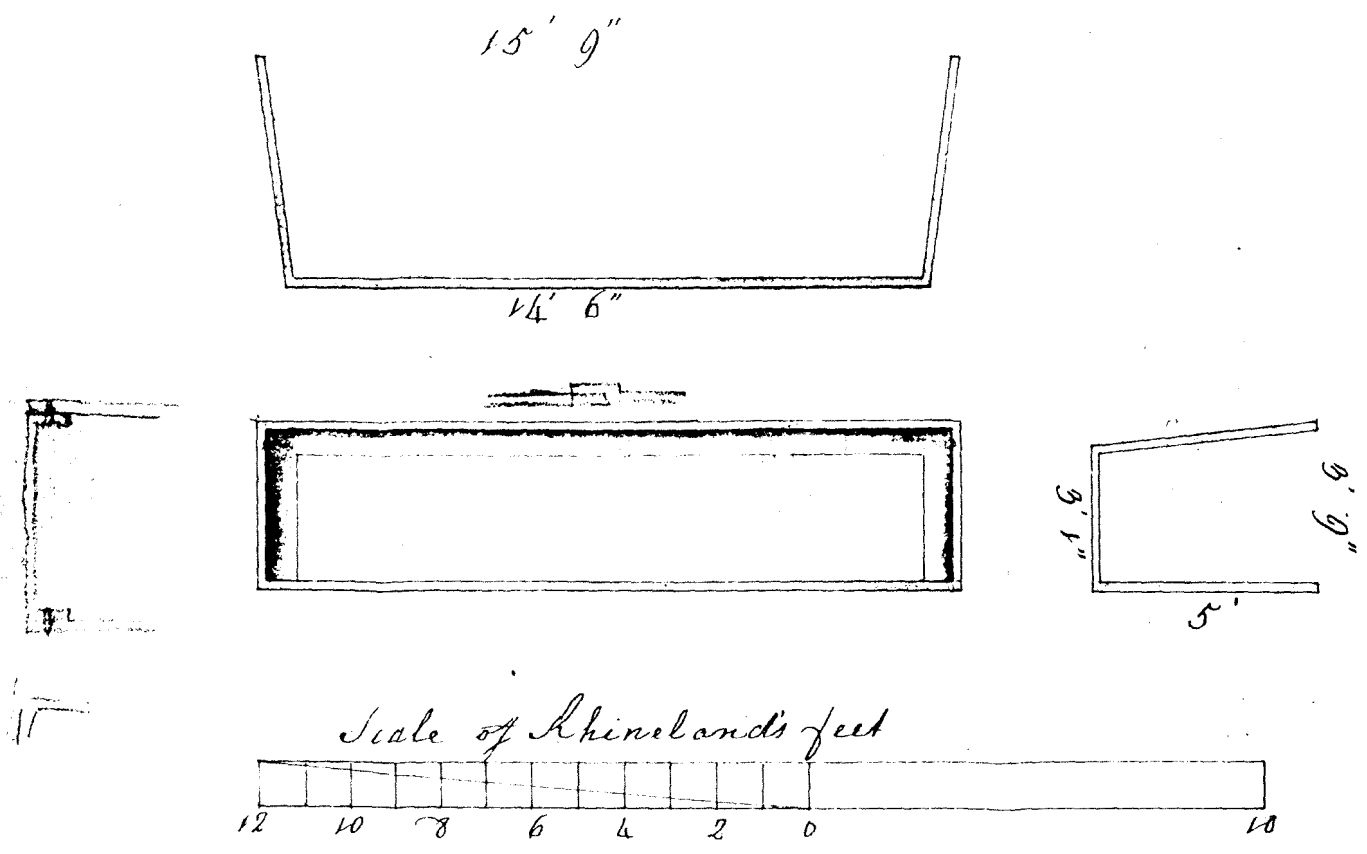
When ready it ought to shipped of for Embden, being more expeditious than Hambrough, directed to the care of Mr. Immanuel Frederick Godelmann. I doubt not or there will be at Hull opportunity of sending goods to Embden, at London there is daily, I hope you may have an opportunity of executing this commission as expeditious as possible; as we greatly wish to have this Iron through here before that of brickwork deceives us. —

With respect to our proposal of meeting anyone of the young gentlemen elsewhere, we shall leave this subject to mature further, and as to send over anyone to inspect your mills. that would not do, as those who are acquainted completely well with millwork do not understand the English tongue, and we know by experience that sending over anyone unacquainted with the language of the Country he goes to, is time and expence lost for nothing. This is wat offers at present to entertain you whit and offering you my best respects I remain with every regard.

Your oblidg^d Friend

J:D: Huichelbos van Liender

P:S: Is anywhere in England a tryall made of letting the great axis of the mill run upon rollers for lessening the friction, and If so, what has been th'issue, I shall gladly apprise?



N.B. the thickness of the cast metal is wholly left to your discretion. as likewise the method of joining the pieces together.

HvL to B&W 1800-02-18

AoS ref. MS 3147/3/506/18. Docket: Satisfied with Explanations. Order for trough. Wants Engine man. New contract entered into for Nieuwkoop Mills. Copy from J.L.Meijer.

Sent via Hamburg.

(copy of [1800-02-01] precedes the new letter, copy of sketch of trough — AoS ref. MS3147/3/506/18b — accompanied this, but has not been reproduced, being identical to that with 1800-02-01)

Mess^{rs} Boulton & Watt at Soho near Birmingham

at Rotterdam first of februarij 1800.

Copij

Dear Sirs !

Your very explicit favour of 28th October last (of which I have since received a Copij) has entirely extinguished my discontent about your long extended silence; and it was with the greatest pleasure that I apprised your complete triumph in that long extended law suit, of which I heartily congratulate you in hope it will be the last, that you shall be plagued with; as I do likewise of your good success in the prosecution of several new improvements.— When your manufacturij of Small Engines from the power of one to four horses shall be completelij established, and you can communicate to me the Tarif of their prices, I shall perhaps have an opportunity of placing some of the same in this Country.— I doubt not of your succeeding fully in th' expectation of an extended employment of these small Engines;

Th'Explanation of your Ideas upon th'Objections we have had before you about th'Iron machinery in windmills has given Satisfaction; and we confess to be entirely convinced of th'utility of their use; and shall undoubtedly make a tryall in one of the three new windmills, we intend to offer in contract the 10th of this month; — In the end of December last I have send you by by a person going over directly from here to England, one of those contracts, by which you may learn all the principall parts and dimensions of the mills we now employ for raising water by wind; but we are now instantly in want of an Iron through or bak for the dry wheel; the through of brickwork in one of the mills having suffered so much by the frost; that we fear it will burst up and in that case an iron one would be the best to substitute in its place, with the less loss of time— I send you therefore with these a sketch with the true dimensions (outside) praying you will have cast the same as speedily as possible; in five pieces vizt. the bottom, two side and two end pieces, taking attention that one of the side pieces must go up straight, and th'other sloping, and both the end pieces likewise sloping, which the different measurements will show sufficiently. I doubt not of your contriving the connection of those five pieces together; and that they maij be taken easily asunder, and again put together as otherwise we should not be able to bring the bak inside the mill and that they may Join so well together, as to make the through quite watertight; and that before sending them off you will have them put together; and try its thightness.— when ready it ought to be shipt off for Embden to the care of Mr. Immanuel Frederick Godelmann; being more expeditious than Hambrough. I wish you may have an opportunity of executing this commission as expeditious as possible; as we greatly wish to have this Iron through here before that of brickwork deceives us;— with respect to our proposal of meeting anij one of the young Gentlemen elsewhere, we shall leave this subject to mature further, and as to send over anij one to inspect the mills that would not do, as those who are completely acquainted with mill work; do not understand th'English tongue and we know by experience, that sending over anyone unacquainted with the language of the Country he goes to, is time and expence lost for nothing.— This is what offers at present to entertain you whit, and offering you my best respects I remain with every regard.

P:S: Is anywhere in England a tryall taken of letting the great axis of the mill run upon rollers for lessening the friction ? and If so, what has been the issue, I shall gladly apprise.

Mess^{rs} Boulton & Watt at Soho near Birmingham

at Rotterdam 18th of Februarij 1800

Dear Sirs !

Here above, you find the copy of my former letter to you, to which I refer myself wholly in regard of the so much desired Iron through or bak for the dry wheel of one of the windwatermills of Nieuwkoop drainage; which I hope we may depend upon of receiving in the shortest period of time possible; — Another desideratum is, to have workman capable of governing Mijdrecht Engine; as our present Engine man is so stubborn, that we can no longer do with him; and as I am sure, th'Engine is in good order; a good Engine man should work the same at advantage, which we cannot have done by the present man; the water gaining upon th'Engine in lieu of the contrary, as has been always the case; — The present Engine man earns weekly twelve guilders, and has a house rentfree; and we shall pay and give the same to the English Engine man likewise; being something more

than a Guinea weekly, and shall besides allow something for his coming over, which by the way of Embden or directly is at present easy enough; I suppose some clever young fellow will be found with you, who shall undertake this job; in which case the sooner he comes over the better it will be;

The 10th of this month we have contracted for Nieuwkoop drainage three Scheprad Mills, and two shrew or vyzel mills, one of the Scheprad Mills without machinerij; as we have resolved to employ Iron Machinerij in the Same; the surveyors are now busij in preparing the drawings of the wanted Machinerij; These five mills are contracted for the sum of 12000 £St:

In hope to receive your answer speedily I remain with due consideration

Your very good F^d

J:D:Huichelbos van Liender

HvL to B&W 1800-03-25

AoS ref. MS 3147/3/506/19. Docket: With drawing of Windmills and Order for Iron Work. Copy from J.L. Meijer.

Sent directly (by neutral vessel). The drawing has not been located.

The bundle of drawings took a long time arriving in Birmingham, and was at one time feared to be lost (see [1800-04-25; 1800-05-07]) On 1800-05-19 JWj advises JW (then in Gloucester) of the receipt of the parcel and of the order [MS 3219/4/16/25, from R.Hills].

Mess^{rs} Boulton & Watt at Soho near Birmingham
at Rotterdam 25th of March 1800

Dear Sirs !

I wrote to you the first of last month and did so again the 18th of Same month by the way of Hamburg, which letters I hope you will have received and to the contents of them I refer myself; and having now an opportunitij of Sending you these by a neutral Vessel going directly over; I have joined to it the rules of th'Engagement by which we have contracted the three Scheprad and the two Vijzel Mills for your speculation; but the letter Serves in the meantime and principally to hand you the drawing of the Iron machinery, I wish you will prepare and make ready for one of the three contracted Scheprad mills; and to do it as speedy as good workmanship will allow; which I take the liberty to recommend as much as possible as this being the first tryal of the kind, and the materials and method got from a Country; with which this Republick has the misfortune of being now engaged in war; If it did not answer, would expose our Commission to disagreeable reflexions and to those considerations I beg you will attribute â nearer inquisition, which the Director General and the two Survejors have thought to be oblinded to make about the Great Axis, before we resolve to employ this likewise of Iron; and as I have no doubt of your being able to relieve their anxiety on this subject, I beg you will do it the sooner the better; because If this first essaij succeeds it must be of great consequence; as more drainages are in contemplation; and daily and heavij complaints are made about the increasing dearness of Oakwood; hoping soon to be favoured with one of your letters, I remain very sincerely

Your affection: Friend
J:D: Huichelbos van Liender

HvL to B&W 1800-03-27

AoS ref. MS 3147/3/506/20. Docket: Has sent some drawings by a vessel to London. Copy from J.L.Meijer.

This letter probably via Hamburg

Mess^{rs} Boulton & Watt
at Birmingham

Rotterdam 27th March 1800

Dear Sirs !

a few days ago I send you by a Vessel going directly from here to England a bundle with papers a letter and a drawing which I hope you will speedily receive and In case you would answer one of my letters be so kind as to send it to the care of Mess^{rs} van Dyck, Gevers & C^{ie} London; who will forward the same as speedily as possible; mean while I remain with every Esteem

your m^t obl: f^d

J:D: Huichelbos van Liender

B&W to HvL 1800-04-15

AoS ref. MS 3147/3/95/47

J.D. Huichelbos van Liender
Rotterdam

Soho 15th April 1800

Dear Sir

We have received your favour of the 1st February, from which we learn with much pleasure that our explanations have given satisfaction, and shall be glad to receive the plans & dimensions of the Mill, you have lately contracted for; But we are sorry to say they are not yet come to hand although you mention their having been sent the end of last Year.

We hope to send off your trough in a few days, as it is completely ready & only waiting for the boats to take it. We have cast it in five pieces only, to save joints and hope it will be approved of. We shall send it to Hull & advise you further as soon as it is shipped; meantime we hope it will be satisfactory to you to learn the expedition we have used.

Friction rollers were formerly applied to the axes of Waterwheels both here and at other places, but have been generally discontinued and are not likely to be required in any large Machinery. —

We are also favoured with your letters of the 18th Feb^y & 27th of March, and are sorry it is quite out of our power to supply you with an Engineman, as we have no person whom we could recommend for that purpose; and if we had, we could not send him to Holland in time of War without rendering ourselves liable to any unpleasant consequences.

We shall remain in daily expectation of receiving the drawings & letter mentioned in yours of the 27th Ult^o & you may depend upon their meeting with the most early attention from

Dear Sir

Your ob^l hble Ser^{ts}
for Boulton & Watt
J Watt Jun^r

HvL to B&W 1800-04-25

AoS ref. MS 3147/3/506/21. Docket: Order for Iron Machinery for new Mills. Wishes further advice about the Great Axis. Refers to the channel by wch. his former letter & drawings were sent. Wishes the trough had been sent to London. Causes of failure of Mydrecht Engine. Stamp B MA 5 800 plus one unreadable stamp. Copy from J.L.Meijer.

Probably sent via Hamburg. HvL's remarks about the Meydrecht problems are based on investigations by his friend Prof.J.Th.Rossijn [see e.g.Bicker, 1800]; the Meydrecht project was eventually abandoned November 1812 due to excessive maintenance drainage effort & cost [Huet, 1885].

Mess^{rs} Boulton & Watt
at Soho near Birmingham

Rotterdam 25th of March 1800

Dear Sirs !

Copy I wrote you the first of last month and did so again the 28th of same month by the way of Hamburg which letters I hope you have received and to the contents of them I refer myself; and having now an opportunity of sending you these by a neutral Vessel going directly over, have joined to it the rules of the two engagements by which we have contracted the three Scheprad and the two Vyzel mills for your speculation; but the letter serves principally to hand you the drawing of the Iron machinery; I wish you will prepare and make ready for one of the three contracted Scheprad mills; and to do it as speedy as good workmanship will allow; which I take the liberty to recommend as much as possible; as this being the first essay of the kind, and get from a Country, with which we have the misfortune of being now engaged in war; If it did not answer, would give occasion for making reflections against our commission; and to these considerations you will attribute a nearer inquisition, which the Director General and the two surveyors have thought to be obliged, to make about the Great Axis; before we resolve to make this likewise of Iron; and as I have no doubt of your being able to relieve their anxieties on this subject, I beg you will do it the sooner the better; because If this first Essay succeeds it must undoubtedly be of great consequence; as more drainages are in contemplation; and daily complaints are made about the dearness of Oak wood; hoping soon to be favoured with one of your letters I remain etc.

Mess^{rs} Boulton & Watt

Rotterdam 25th of April 1800

Dear Sirs !

I was made happy the 23th of this month by receiving your very Agreeable favour of 15th of the same month; and the more so as I learnt by its contents the expedition with which you have satisfied my desire for having cast Iron through or drooge bak for one of the Nieuwkoop Scheprad mills; and that you intended to send it off to Hull by the first opportunity; It is a pity your Inland navigation had not permitted you to send it to London; as from there I should have received it here in a very short time and directly; from Hull it wants to go to Embden, which is a place where business is not transacted in an expeditious way; It grieved me very much to apprise by your letter that the small bundle, with my letter of the 25th of March, the memoir of the Director General of Nieuwkoop drainage, the drawing of the Iron machinery, and the two rules of engagement for contracting five mills for the same drainage was not come to your hands, it has been send off, with one of three Vessels, sailing from hence the 25th 27th and 29th of March for London, and had been directed for you to Mess^{rs} van Dyck Gevers & C^{ie} and the Vessels are all safely arrived; I shall inquire from here and If after receiving this letter, you have not yet received it, give yourself the trouble of writing to said Gentlemen in London for inquiry after the same.— I send you copy of my said letter by these, and if said bundle (or rouleau) is lost I shall send another drawing memoir etc.— I thank you for your notice about the friction rollers.— I see the difficulty of getting a workman for Meydrecht Engine from your side; and can tell you now we do not want one so much, as we have been at the trouble of making very severe tryalls about th'Effect of said Engine, and have found it works with just the same good effect in raising its due quantity of water, as it did two years ago; and that it is not the fault of th'Engineman, the drainage goes backwards; but the greater access of water from the neighbouring lakes through the grounds and dijkes; which seems vastly to increase, and which I am afraid shall oblige us to abandon that undertaking, which will be a heavy loss; I remain with everij consideration

Yours very sincerely

J:D: Huichelbos van Liender

HvL to B&W 1800-05-07

AoS ref. MS 3147/3/506/22. Docket: With duplicate of the Memorial of 15th March and references to his former letters. Copy from J.L.Meijer.

This letter is not included in the B&W list of c.1801-12.

Mess^{rs} Boulton & Watt at Soho near Birmingham

at Rotterdam the 7th of May 1800

Dear Sirs !

My last letter in answer of yours of 15th of April was of the 25th of the same month, by which I have given you a direction for enquiry after the bundle of papers accompanying my letter of 25th of March; and as now a good opportunity of speedy conveyance towards you offers itself I prevail myself of it for handing you copy or a double of the memoir drawn up by the Director General of Nieuwkoop drainage; which I beg you will take in consideration; and answer as far as can be done without having the drawing joined by the first of which a copy likewise shall be send; If your enquiry after the abovementioned bundle proves fruitless.

I remain as always with every consideration.

Your m^l oblid: friend

J:D: Huichelbos van Liender

Undated definitive memorandum 1800?

AoS ref. MS 3147/3/506/22. Docket: Containing the order for the iron work for one windmill. Copy from J.L. Meijer.

Memorandum of Director-General Chr. Brunings jnr. about the use of cast iron in the construction of the windmills for the Nieuwkoop drainage project. The documents includes an order to B&W. It was sent with HvL letter 1800-03-15 (not yet located, but mentioned in B&W's annotated list of c.1801-12).

The following documents are referred to, all without mentioning dates:

- *Earlier notes by the Director-General and the Inspectors.*
- *Reply of B&W to these (probably B&W letter of 1799-10-28, not located).*
- *Remarks of the Director-General (Chr. Brunings jnr.) and the Inspectors (sent with [1798-12-25] and [1799-05-18], see the draft memorandums 1798 and 1799 in this compilation).*
- *A drawing, which has not been located.*

For dating this document the following may be of help:

- *HvL is referred to as 'President of the Committee to supervise the Nieuwkoop drainage'. This he probably was from mid-1798, as successor to Chr. Brunings snr. who was made head of the Republic's hydraulic board around that time [Bosch, 2000].*
- *The order for iron windmill parts specifies delivery 'next August' (i.e. 1800).*
- *The document was drawn up after the above-mentioned B&W reply of 1799-10-28 (not located).*
- *Acc. to B&W list of letters (drawn up c.1801-12) it was sent with letter of 1800-03-15 (which has not been located); in [1800-04-25], however, HvL states that it was sent with [1800-03-25] (which, however, does not refer to the memorandum). A "double" was sent with [1800-05-07] (which is not in the B&W list), and this is probably that copy.*

The memorandum would thus probably be early 1800.

Double

Le Président de la Commission de surintendance du dessèchement de Nieuwkoop, M. van Liender, aijant communiqué à ses collègues la réponse faite par M.M. Boulton et Watt aux rémarques du Directeur Genr. et des Inspecteurs du dit dessèchement, et la surdite commission ayant entendu le rapport fait par ceux-ci; a arrêté de faire un essai sur l'usage du fer de fonte dans l'un des moulins qui vont être construite dans le cours de cette année. —

En conséquence le soussigné Directeur s'empresse d'en informer M.M. Boulton et Watt, les priant d'après l'intention de la commission de bien vouloir nous fournir vers la fin du mois d'Aout prochain au plus tard, les 4 roues ainsi que l'arbre vertical et l'essieu de la roue a palettes (scheprad) avec les crapaudines de métal dans lesquelles ils jugent à propos de faire tourner l'un et l'autre. Il se flatte que le dessein ci-joint, fait par l'Inspecteur Spruitenburg, satisfera à la demande de ces Messieurs: ils ij trouveront ponctué près d'A le raccourcissement de l'essieu du scheprad, tel qu'il peut avoir lieu d'après la construction actuelle des moulins; mais si le succès se trouve répondre à notre attente, et qu'à l'avenir le bac dans lequel tourne la roue inférieure se fasse pareillement de fer l'on pourroit raccourcir encore de beaucoup cet essieu.

Quant aux dimensions des ailes, le diamètre du cercle que leurs extrémités décrivent, ou la longueur des verges entieres, est de 90 piéds du Rhin, (et c'est de cette mesure que nous nous servons constamment) la largeur des voiles seules est de 67 pouces et demi, mais la largeur entiere des ailes, celle de la verge et des planches, qui sont de l'autre coté de la verge, ij comprise, est de 8 piéds. Et comme le nombre des révolutions du grand essieu est entre 10 et 20 par minute, l'on voit que les extrémités des ailes parcourent depuis $90 \times \frac{314}{100} \times 10 \times \frac{1}{60} = 47,1$ piéds jusqu'au double, ou 94,2 piéds par seconde vitesse qui surpasse celle d'un ouragan.

Je prie M.M. Boulton et Watt d'agréer nos remerciements de la peine qu'ils ont bien voulu se donner de péser nos réflexions et de nous fournir les éclaircissemens désirés. C'est avec pleine confiance qu'après les avoir luës, nous acquiesçons à leurs projets sur le déplacement de la roue supérieure; sur la maniere d'ij faire tenir l'arrêt (den vang); sur la diminution de son diamètre ainsi que de celui de la roue inférieure; et sur l'espèce de rouage, appelé le bevel gear dont nous nous formons une idée très avantageuse. En même tems nous apprenons avec plaisir que les pivots et les parties arrondies (necks) des essieux ne s'usent pas sensiblement; que la rouille n'est pas tant à craindre que nous l'avons cru; et qu'on ne rencontre point de difficulté a fixer les roues sur des essieux de peu d'épaisseur. Laissant au choix de ces Messieurs l'épaisseur qu'ils jugeront à propos de donner a l'arbre vertical, nous nous bornons à les avertir que chez nous il se fait d'une seule pièce de bois de chêne, aijant 17 pouces et demi d'équarissage, qui peut entrer aisément dans le bâtiment de nos moulins, et à la quelle nous n'oserions donner moins d'épaisseur en bois.

Mais pour ce qui regarde la maniere proposée par M.M. Boulton et Watt d'assembler les verges au grand essieu nous avouons franchement qu'elle nous paroît sujette à caution. D'abord dans la position verticale

de deux ailes le poids total de l'aile inférieure n'est porté que par le serrement seul qu'exercent sur elle les parois de la croix (of the socket) avec les platines de fer ij jointes par des boulons: au lieu que d'après la maniere usilée dans ce païjs ce poids repose sur l'axe moijennant des pièces de bois (Keerklossen) que l'on adapte aux verges. Et dans la position horizontale et oblique nous craindrions que l'action du vent sur les voiles inclinées ne pousse avec force la verge contre le bord de l'une des parois latérales de la croix, savoir contre celle qui précède, et qu'elle ne fasse entrer le bois de la verge bien avant dans ce bord, ce qui seroit un grand désavantage. Il est vrai que si la hauteur de ces parois égaloit à peu près l'épaisseur des verges, que les extrémités des 4 verges fussent jointes par des bandes de fer, croissant la tête de l'essieu, et qu'on donnât un rajon d'environ 7 pieds à la croix; — qu'alors nos craintes cesseroient: mais nous sentons bien que ces changemens rendroient apparemment l'appareil trop pèsant. M.M. Boulton et Watt en appellent à un moulin qu'ils ont faire construire pour l'Amérique, mais ils nous laissent dans l'incertitude s'il s'en trouve de pareils en Angleterre et sous leurs ijeux.

Comme cependant cette affaire est pour nous de la plus grande importance, et que d'un coté des innovations originaires d'un païjs, avec lequel la république a le malheur de se trouver en guerre, pourroient attirer de désagrémens à la Commission, en cas qu'elles ne réussissent pas, tandis que d'un autre coté nous sommes intimément convaincus des grands avantages qui résulteroient de l'emploi d'un essieu de fer et de doubles verges nous nous flattons que M.M. Boulton et Watt rendront bien ne pas prendre de mauvaise part que malgré notre confiance dans leurs lumieres, nous les prions de nous informer s'ils connoissent par leur propre expérience la bonté de la methode proposée, et supposé qu'ils ne se trouvent pas dans ce cas, d'en vouloir inventer une contre laquelle nos raisonnemens a priori ne nous fournissent point de sujets de crainte, et dont nous puissions hardiment recommander à nos supérieurs l'emploi dans le même moulin.

Quant à la roue à palettes, (scheprad) la commission à préféré à s'en tenir cette fois-ci au bois.

Enfin quant à la vitesse du scheprad relativement à celle des ailes il résulte du nombre des dents et fuseaux indiqué dans mon premier memoire, que les ailes font $37^{x91} / 71^{x27} = 1,75639...$ revolutions tandis que le scheprad n'en fait qu'une seule, et comme nous nous en trouvons bien, nous devons insister qu'il n'y soit apporté aucun changement sensible.

C. Brunings Jr.

English translation:

Copy

The President of the Commission for the supervision of the Nieuwkoop drainage, Mr van Liender, having communicated to his colleagues the response made by Messrs. Boulton & Watt to the comments of the Director General and the Inspectors of this drainage, and the above commission having heard the report of these gentlemen; has decided to perform a trial of the use of cast iron in one of the mills which will be built in the course of this year.—

As a consequence the undersigned Director hastens to inform Messrs. Boulton & Watt, requesting them, in compliance with the intention of the commission, to please furnish us late August next at the latest, the four wheels plus the vertical shaft and the axis of the scoop wheel (scheprad) with the metal bearings they think are required for these to turn in. He flatters himself that the enclosed drawing of Inspector Spruitenburg will satisfy the requirements of these Gentlemen: here they will find, near A, the shortening of the axis of the scheprad as it will be possible after the actual construction of the mills; but if the success will be according to our expectations, and if in future the trough in which the lower wheel turns can also be of iron, one could shorten this axis even more.

For what concerns the dimensions of the sails, the diameter of the circle described by their tips, or the total length of the entire whips, is 90 feet Rhineland measure, (and it is this measure which we will use throughout) the width of the sails proper is 67½ inches, but the total width of the sails, including that of the whip and the boards on the other side of the whip, is 8 feet. And as the number of revolutions of the great axis is between 10 and 20 per minute, one will see that the tips of the sails will travel from $3^{14}/_{100} \times 10 \times 1/_{60} = 47,1$ feet up to twice that, or 94,2 feet per second, which is faster than a hurricane.

I desire Messrs. Boulton & Watt to accept our thanks for the effort they have devoted to considering our reflexions and to provide us with the desired clarifications. After having read their plans for relocating the brake wheel, of the way of applying the brake (den vang), of the diameter reduction of this and of the lower wheel, and to the type of gear (called bevel gear, which we believe is very advantageous), we agree to these with total confidence. At the same time we learn to our pleasure that the pivots and the round portions (necks) of the shafts do not wear appreciably, that rust is not as much of a problem as we believed; and that fitting the wheels on the small-thickness shafts is no problem. We will leave to these Gentlemen the choice of the thickness of the vertical shaft, and we will just warn that here it is made of a single piece of oak of 17½ inches square, which can be easily brought into the mill building, and of which, in wood, we dare not reduce the thickness.

However, for what concerns the fitting of the whips to the great axis as proposed by Messrs Boulton &

Watt, we frankly think that caution is needed. Firstly, in the vertical position of the two sails, the total weight of the lower sail is only carried by the clamping action of the walls of the socket with the iron plates fitted to them with screwed bolts: whereas the common method in this country lets this weight rest on the axis through pieces of wood (Keerklossen) fitted to the whips. And in the horizontal and inclined positions we fear that the action of the wind on the sails, which are at an angle, would press forcefully against one of the horizontal walls of the socket, to wit the one which is ahead in the direction of rotation, and that it would make the wood of the whip (Ed.Note: the French is unclear here, from the entire argument the worry would seem to be that the wood of the whip, bearing against a relatively small iron surface area, would compress or wear away locally, but a literal translation of "le bois de la verge [entre] bien avant dans ce bord" does not really bear this out), which would be a big disadvantage. Admittedly, if the height of these walls would be about the same as the thickness of the whips, if the ends of the four whips would be joined by iron bands crossing over the head of the axis, and if the cross/socket would have a radius of about 7 feet, then our fears would be allayed, but we know very well that such modifications might make the apparatus too heavy. Messrs. Boulton & Watt refer to a mill they have had made for America, but they leave us in the dark whether they have seen similar ones in England. As, however, this matter is of the greatest importance to us, and as on the one hand original inventions from a country, with which the republic has the misfortune to find itself at war, could cause unpleasantness for the Commission should they fail, whereas on the other hand we are deeply convinced of the advantages which would result of using an iron axis and double whips we like to think that Messrs. Boulton & Watt will not hold it against us if, notwithstanding our confidence in their enlightenments, we pray them to inform us whether they know by their own experience the goodness of the proposed method, and in case they do not, to invent one against which our a priori reasoning does not give us any cause for worries, and of which we can unequivocally recommend, to our superiors, the implementation in this mill.

As far as the scoopwheel (scheprad) is concerned, the Commission prefers to stick to wood this time. Finally, for what concerns the speed of the scheprad relative to that of the sails, it follows from the numbers of teeth and pins given in my first memorandum, that the whips make $37 \times 91 / 71 \times 27 = 1,75639\dots$ revolutions for one revolution of the scheprad, and as we feel comfortable with this, we must insist that this should not be changed appreciably.

C. Brunings Jr.

HvL to B&W 1800-05-16

*AoS ref. MS 3147/3/506/23. Docket: Wishes the trough to be sent direct to Holland. Stamped B JU ?? 800.
Copy from J.L.Meijer.*

Mess^{rs} Boulton & Watt
at Birmingham

Rotterdam 16th of May 1800

Dear Sirs !

My former letter to you was of the 7th Inst. with a copy of the memoir drawn up by the Director General of Nieuwkoop drainage, to which letter I refer myself and these shall only serve to Inform you that as there is now opportunitij of neutral Vessels going directly from Hull to this port, we do not want to have the Iron through send off hither by the way of Embden, which is extremely tedious: — There is now a neutral Vessel loading here for Hull. The Francina Captain Johann Kohn(?) directed to Mess^{rs} Mann & Leathorn at Hull; the Captain of this vessel I have spoken to, and If the through has not been send off by a like opportunity, he has promised me to bring it over with him on his return here; hoping to receive soon any letter from you I remain very Sincerely

Your affect: friend

J:D: Huichelbos van Liender

B&W to HvL 1800-05-19

AoS ref. MS 3147/3/95/81

Badly faded.

M^r J.D.H. van Liender
Rotterdam

Soho 19th May 1800

Dear Sir

Upon receipt of your favour of 25th April we wrote to Mess^{rs} van Dijk Gevers & Co: respecting the Parcel and were informed by them it could not be found; we are however happy to add that they have since discussed it with one of their Brokers, where it had been mislaid among a number of other packages left there by one of the Dutch Captains. They request that in future such parcels may be directed to them, in which case, they say, they shall (.....) them immediately.

The Parcel is now in our possession and we shall take the earliest opportunity of examining its contents and transmitting our opinion upon them. In the mean time we presume it will be satisfactory to you to learn the arrival.

We are with much regard

D^r Sir

Your m^t ob^d hble serv^t

for Boulton & Watt

J. Watt jun^r

P.S: We have not yet had advice from Hull of the trough being shipped, but expect to hear daily. We have desired it may go direct to Rotterdam if (.....) offers —

B&W to HvL 1800-06-05

AoS ref. MS 3147/3/95/94.

In the central portion of the letter are several tentatively completed words; these portions had fallen off the right margin of the 1800 press copy of the letter, and thus are irretrievable.

M^r J.D.H. Van Liender
Rotterdam

Soho 5th June 1800

Dear Sir

We had the pleasure of writing to you on the 17th of May informing you that the Parcel with the drawings had come to hand and should undergo early consideration. We (*have also?*) received your favour of the 7th of May with Duplicate of Mr Bruning's order and Remarks.

It affords us satisfaction to find that our ideas have to a certain extent met the unqualified approbation of Yourself and Colleagues, and that a trial of Cast Iron has been resolved upon in one of the new Mills contracting for the drainage of Nieuwkoop. We shall accordingly put the Order in hand for the four wheels, the upright Axis, the Axis of the Scheprad & the Plummer blocks and brasses (les Crapaudines) belonging to the (.....), taking care to make them of sufficient strength and of such proportions as to give the exact proportional Velocity to the Scheprad which is pointed out as essential, viz one Revolution for every 1,75639 Revolutions of the Wings or Sails of the Mill.

We are concerned to state that from the Delay which has taken place in the receipt of these Drawings & Instructions and from the very great number of orders, we have now on hand, it will not be in our power execute these goods before the end of the Current Year. Entire new Patterns will have to be made for every part which alone will require a considerable portion of that time, being new made will enable us to execute future Orders with every dispatch that can be wished for. Should these circumstances milita(*te*) against your design of employing these Materials a(*t*) Nieuwkoop (as we (.....) your intent to have some of the Mills at work by October & November) we must trust to your finding some other opportunity of giving them a trial. — In the mean time we shall at all events proceed with the (..... we?) have perused(?) with attention the objections of the Gentlemen of the Commission upon the met(*hod*) proposed by us of connecting the Yards to the Great or Inclined Axis, and although we do n(*ot*) see the objections in so forcible a manner as Yourself, nor indeed entertain any apprehen(*sion*) that the plan we have pointed out would ha(*ve*) been effectual, we see no difficulty in adopting the additional securities stated by Mr Bruning of deepening the socket and connect(*ing*) the Arms together by means of an Iron Cross but we should not think it necessary to increas(*e*) the radius of the Cross beyond 5 or 5½ feet. The drawing sent you was not intended as an exact representation of the method which we proposed to employ, but only to communicat(*e*) the general idea, reserving to ourselves to make such variations in the execution as a more minute attention to the subject might point out.

We are very desirous that this part should undergo a trial along with the others, as a considerable share of the advantage to be expected from the diminution of friction, must depend upon the substitution of Iron for Wood in the Inclined Axis. And as there will now be time to receive your Answer in time to execute this with the rest of the machinery, we shall be happy to receive your instructions, not doubting that the plan we shall adopt will give full satisfaction to yourself and Colleagues.

Waiting the favour of your Answer, we have the honour to remain

Dear Sir

Your M^t hble Ser^{ts}
for Boulton & Watt
J Watt Jun^r

P.S. Your favour of the 16th May is received but too late to prevent the shipping of the trough for London as you will see by the inclosed duplicate of Bill of Lading, of which one has been sent to Mr Emanuel Frederick Godelman of Embden, with orders to hold the goods at your disposal. We shall inclose Invoice of these Goods with the shipping Charges & Insurance in our next.

B&W to HvL 1800-06-15

AoS ref. MS 3147/3/95/106.

M^r J.D.H. van Liender

to Boulton & Watt

1800		cwt	
April 23	Cast Iron (.....) in 5 pieces . . .	31..0..8(?)	£ 72..19.. 3
	(.....) Iron Pins (.....) . . .	1..0..1(?)	3..11.. 2
	(.....) 2.. 6
	2(?) Boxes C(.....)		<u>4.. 4.. 0</u>
			£ 80..16..11
May 20	Freight from Birmingham to Hull	£ 7..12..11	
	Labour on Lighter (.....)	12.. 0	
	Entries Fee(?) Bond ² (?) (.....)	13.. 0	
	Bills Lading Postage	6..10	
	Commission	10.. 6	
	Convoy duty ½ p ^t C ^t on £ 80	<u>8.. 0</u>	10.. 3.. 3
June 11	Insurance on £ 82 @ 1½ p ^t C ^t	1.. 5.. 9	
	Postage 2/6 Commission 4/	<u>6.. 6</u>	<u>1.. 12.. 3</u>
			£ 92.. 12.. 5

Dear Sir

Soho 15th June 1800.

We had the pleasure of writing to you on the (5th Inst^l) in answer to M^r Brunings Memorial and informing you that we should be going on with the Castings ordered and expect your further deliberation(?) upon the Inclined Axis (.....), but that from the pressure of business they could not be completed before the end of the Current Year.

We also inclosed Bill of Lading of the trough forwarded to Mr Emanuel Frederick Godelman of Embden and (.....) the pleasure to hand you the Invoice of these Goods with (.....). We have (.....) for making the joints which is to be (.....) in the same manner as in Steam Engines; (.....), the joints might also be made tight by usinf strips of deal timber, not more than 1/8 of an inch, wrapped in thin flannel & dipped in tar, to be screwed up between the flanches whilst hot. Any small deficiencies in this latter method may be made good by caulking with oakum or with glaziers putty.

This is all that occurs to us at present and remain with much regard

Dear Sir

Your ob^t h^{ble} Ser^t
for Boulton & Watt
J Watt Jun^r

HvL to B&W 1800-07-07

AoS ref. MS 3147/3/506/24. Docket: Agrees to the delay in furnishing the windmill castings. Has forwarded the trough from Embden. Journey to Hamburg and proposal to meet him there. Engine wanted before the end of the year. *Copy from J.L.Meijer.*

*The accompanying drawing of Blanken's pump scheme has not been located
Receipt acknowledged [1800-08-05]. The term ult^o in the first line usually means (in business correspondence at least) "the last day of the month", so its use is a bit peculiar here; most likely last would be meant, as the reference is evidently to [1800-06-05].*

Mess^{rs} Boulton & Watt
at Soho near Birmingham

at Hamborough 7th of July 1800

Dear Gentlemen !

Your last favour of 5th ult^o was duly received by me and shall now only answer upon its contents that I expect here the resultat of the deliberations th'other members of the commission shall taken upon your explication of the difficulties M^r Brunings has made in regard of the great Iron axis, and that I request you to go on a speedily as you possibly can, and good workmanship will allow, with th'other Iron materials ordered by my former letters, as we shall take patience with th'unavoidable delays the so much later delivery of the drawings etc. have occasioned. by my passing through Embden th'Iron through was shipped off for Rotterdam.

But now I proceed to give you notice that mij coming over here with M^r Blanken one of our best Hydraulic Engineers, Is solely with the peremptorij view of having â fruitfull deliberation (of which we make a verij material object) with one of your young Masters Boulton or Watt, as I have alreadij hinted at last year; and as we have come more than half waij, and in â neutral place to which we are confined by the public circumstances; I cannot in the least doubt one moment of your acquiescing in mine sollicitations, as you undoubtedly shall be convinced of th'importance of our meeting together, and as the more perfect State of the Steam Engine we intend to construct, must lay finally the foundation of their introduction for drainage and other operations of the like nature. The new mechanism proposed by M^r Blanken, and of which you will receive a design by this letter, of applying a set of nine pumps, and using a lesser or greater number of them, according the more or less height the water is to be raised to; Is a circumstance we absolutely must attend to as by this we can make the most employment of the power we put in Use; and which will given the Steam Engines the greatest Superiority over every other hydraulic Engine we now emploij. — We are then in want of an Engine double power able to raise every minute from the depth of 18 feet Rhijnland measure 120 tuns of water of 5 ¼ Cubicq feet every tun; and to the the end that the power of th'Engine may not be spilled in vain, we propose to employ, besides the middle Standard pump, eight others of diffrent dimensions, as the drawing will more plainly shew; and as we think that for the present no more explications will be wanted as I absolutely account upon your coming over; and we may in one or two daijs further more in this respect, as with ecritorial correspondence in manij weeks, we leave more elucidations after or behind. — We hope to have this Engine shall be ready to be send over to Holland before the end of this Year that in th'ensuing winter it can be put up and set next spring a going.

I shall expect your answer and advice of coming over as speedy as possible under my wonted direction of M^r Alexander Martin of this place; and in the mean time joining M^r Blanken's compliments to mine remain with every consideration

Your affect: Friend
J:D: Huichelbos van Liender

HvL to B&W 1800-07-09

AoS ref. MS 3147/3/506/25. Docket: With duplicate of his letter of 7th July 1800 and drawing of Mr Blanken's proposed Engine & Pumps. FO stamp JY 21 1800. Copy from J.L.Meijer.

The accompanying drawing of Blanken's pump scheme has not been located.

Copy of [1800-07-07] sent by courier via Cuxhaven; receipt acknowledged in [1800-08-05]. In the date an 8 has been overwritten by a 9.

Mess^{rs} Boulton & Watt
at Soho near Birmingham
Copij.

Hamburg 7th Julij 1800

Your Last favour of 5th Ult^o Was Duly received by me and Shall now onlij answer upon its contents that I expect here the resultat of the deliberations th'Other Members of the Commission shall taken upon Your Explication of the difficulties M^r Brunings has made in regard of the great Iron axis, and that I request you to go on as speedilij as you possiblij can, and good workmanship will allow with th'other Iron Materials ordered by my former Letters, as we shall take patience with the un avoidable delays the so much later deliverij of the drawings etc have occasioned; bij mij passing through Embden th'Iron through was shipped of for Rotterdam.

But now I proceed to give you notice that mij coming over here with M^r Blanken one of our best Hydraulic Engineers, is solely with the perimptorij view of having a fruitful deliberetion, of which we make a verij material object, with one of Your Young Masters Boulton or Watt, as I have already hinted at Last Year, and as we have come more than half waij, and in a neutral place, to which we are confined bij the publicq Circunstances I cannot in the Least doubt one moment of Your acquiescing in mine sollicitations; as you undoubtedly Shell be convinced of th'importance of our meeting together, as the more perfect state of the Steam engine, we intend to Construct, must laij finallij the foundation of their introduction for drainages and other operations, of the like natura; the new mechanism proposed by M^r Blanken, and of which you will receive a design bij this Letter of applying a set of nine pumps and using a Lesser or greater number of them according the more or less height water is to be raised to is a circumstance we absolutely must attend to, as bij this we can make the most employment of the power we put in use, and which will given the Steam Engines the greatest Superioritij over everij other hydraulic Engine we now emploij; we are then in want of an Engine double power able to raise everij minute from the Depth of 18 feet Rhyndland measure 120 tuns of water of 5¼ cubicq feet everij tun and to the end, that the power of th'Engine may not be spilled in vain, we propose to Emploij besides the middle standard pump eight Others of different dimensions, as the drawing will more plainly shew, and as we think that for the present no more explication will be wanted as I absolutely account upon your coming over; and we maij in one or two days further more in this respect, as with ecritorial correspondence in manij weeks, we leave more elucidations behind; We hope to have this Engine Shall be ready to be send over to Holland; before the End of this year, that in th'ensuing winter it can be put up and set next spring a going. I shall expect your answer and advice of coming over as speedij as possible, under my wonted direction here of M^r Alexander Martin of this place; and in the meantime joining M^r Blanken's compliment to mine remain with every consideration

(below this, in another hand:)

	120		
	<u>4.8</u>	English cub.feet	
	96		
	<u>480</u>		
stroke	12/576\ 48 pstroke	= 33 inch pump 8 feet stroke	
		= 33 inch cyl at 8 lbs p ² inch	

Mess^{rs} Boulton & Watt
at Soho near Birmingham
Dear Sirs !

(H)amborough 9th of July 1800

Th'above Is a copy of mine letter send you by a person who left this town Sunday night the 5th of this month for going over with (a) neutral vessel to London and who has pledged himself to further the same to Birmingham, as soon as he reaches London; and so I have nothing to add to said letter or by this coppij send over by the Paquet from Cuxhaven to Yarmouth than to renew my first instances already explicitly offered to your considerations, of sending over one of your companions, for having a Conference with us on a subject, which we consider to be of a very material importance.

I remain always

Your affection: friend
J:D: Huichelbos van Liender

B&W to HvL 1800-08-05a

AoS ref. MS 3147/3/95/166.

The writer (certainly JWj) compares the Blanken scheme to the Meydrecht approach, which for polder drainage is fair enough, but in the Meydrecht system changeover requires bodily replacing working barrel, piston & top clack. In the naval dock installation (which is never mentioned by name to BW&C!) changeover must be much quicker, almost instantaneous, and that is what Jan Blanken tries to achieve (with success, eventually).

The observation in the PS would be met by reversing the direction of rotation of the sails from the customary clockwise (viewn from the mill) to widdershins or left-handed; this appears to have been done [de Moes, 1994].

J.D.H. van Liender Esq^f
Hamburg

Soho 5th Aug. 1800

Dear Sir

Your favour of the 5th July & its duplicate of the 9th have been received in the absence of all the principal parties in our house; My father is recently gone to Scotland, M^r. Boulton is in London & his Son in Cornwall, both upon business which is likely to detain them a considerable time. These circumstances render it quite impossible for me to leave home at present to undertake so long a Journey and I cannot but much regret that you did not consult with us upon the possibility of giving you the meeting, before you set out. You may rest assured from the respect I entertain for you, that after you have been at so much trouble to give us a meeting, I would not suffer slight inconveniences to deter me from complying with Your wishes and at almost any other time than the present I should have had much pleasure in acquiescing with your proposal, although I do not feel myself perfectly competent to a discussion of the project proposed by your friend M^r Blanken, which I shall take the first opportunity of laying before my father and Mess^s. Boulton and of transmitting their opinions. In the mean time I shall only permit myself to observe that so great a complication of Machinery, will necessarily be attended with considerable difficulties both in the first adjustment and in the variations that must occur in the course of working and that the expence of it, will probably exceed any ideas you may have formed upon the subject. It has always been a principle with us to simplify the Machinery applied to the Engine, as much as lay in our power and we have seldom failed to derive advantage from it. The plan adopted at Mijdrecht of substituting pumps varying in diameter according to the height to which the water was to be raised, did at the time appear to us likely to answer all the purposes of a greater number of pumps, and we see no reason yet why it should not. Perhaps, practical difficulties may have occurred, of which we were not aware, but if fully stated to us, we should have no apprehension that it would be in our power to suggest means of obviating them.— I shall have the honour of addressing you again in the course of a few posts and in the mean time request the favour of you to present my most respectful compliments to M^r Blanken whom it would give me great pleasure to see here with you, if such a journey would at all suit your arrangements & you could, (as I think you might) obtain passports from the English Minister at Hamburg.

I am with much regard D^r Sir
Yours faithfully
James Watt Jun^r

P.S. It probably has occurred to yourself & colleagues in the drainage of Niewkoop, that by the proposed change of the place of the wheel upon the great axis the Sheprad (*sic*) will be turned in a contrary direction from what it was before. You will of course attend to this circumstance in constructing the mill. The top of the great wheel on the horizontal axis is proposed to turn towards the right, viewing it from the centre of the Mill.

B&W to HvL 1800-08-05b

AoS ref. MS 3219/4/16/24.

Verbatim duplicate of [1800-08-05a]; this was sent to HvL with [1800-08-09a]

J.D.H. van Liender Esq^t
Hamburgh

Copy

Soho 5th Aug. 1800

Dear Sir

Your favour of the 5th July & its duplicate of the 9th have been received in the absence of all the principal parties in our house; My father is recently gone to Scotland, M^r. Boulton is in London & his Son in Cornwall, both upon business which is likely to detain them a considerable time. These circumstances render it quite impossible for me to leave home at present to undertake so long a Journey and I cannot but much regret that you did not consult with us upon the possibility of giving you the meeting, before you set out. You may rest assured from the respect I entertain for you, that after you have been at so much trouble to give us a meeting, I would not suffer slight inconveniences to deter me from complying with your wishes and at almost any other time than the present I should have had much pleasure in acquiescing with your proposal, although I do not feel myself perfectly competent to a discussion of the project proposed by your friend M^r Blanken, which I shall take the first opportunity of laying before my father and Mess^{rs}. Boulton and of transmitting their opinions. In the mean time I shall only permit myself to observe that so great a complication of Machinery, will necessarily be attended with considerable difficulties both in the first adjustment and in the variations that must occur in the course of working and that the expence of it, will probably exceed any ideas you may have formed upon the subject.— It has always been a principle with us to simplify the Machinery applied to the Engine, as much as lay in our power and we have seldom failed to derive advantage from it. The plan adopted at Mijdrecht of substituting pumps varying in diameter according to the height to which the water was to be raised, did at the time appear to us likely to answer all the purposes of a greater number of pumps, and we see no reason yet why it should not. Perhaps, practical difficulties may have occurred, of which we were not aware, but if fully stated to us, we should have no apprehension that it would be in our power to suggest means of obviating them.— I shall have the honour of adressing you again in the course of a few posts and in the mean time request the favour of you to present my most respectful compliments to M^r Blanken whom it would give me great pleasure to see here with you, if such a journey would at all suit your arrangements & you could, (as I think you might) obtain passports from the English Minister at Hamburgh.

I am with much regard D^r Sir
Yours faithfully
James Watt Jun^r

P.S. It probably has occurred to yourself & colleagues in the drainage of Niewkoop, that by the proposed change of the place of the wheel upon the great axis the Sheprad (*sic*) will be turned in a contrary direction from what it was before. You will of course attend to this circumstance in constructing the mill. The top of the great wheel on the horizontal axis is proposed to turn towards the right, viewing it from the centre of the Mill.

B&W to HvL 1800-08-09a

AoS ref. MS 3147/3/95/170.

See note at [1800-08-05a].

Note that just a few days earlier, in [1800-08-05a], JWj protests that he cannot come to Hamburg as it is quite impossible for him to leave home, being the only principal party in the house, while below he excuses himself for having to leave and have his brother Gregory (who is not a partner) mind the shop.

J.D.H. van Liender Esq^t
Hamburg

Soho 9th August 1800

Dear Sir

On the other side you have copy of a letter written a few days ago. I have since that time made some calculations of the difference of expence between an engine constructed similar to that of Mydrecht and one upon the plan proposed by M^t Blanken, each being supposed equal to the raising of 120 tons of water 5¼ cubic feet to the ton, 18 feet high Rhijnland measure per Minute.

All the Metal Materials of an Engine similar to Mijdrecht including two sets of pumps and their gearing, would amount to about £ 1400 delivered here and payable in 3 months from delivery.

The same Metal Materials of a Double Engine with the extras necessary for two additional beams, 3 short beams, and nine pumps of different diameters from 20 to 41 Inch would cost at least one thousand pounds additional — And you will please to observe that this does not include the additional expence of Woodwork, Engine house and Erection which would be very considerable, as yourself may readily estimate.

I am under the necessity of leaving home for a week or ten days, but if anything should occur in my absence, my brother who now assists in the business, will have the honour of addressing you.

I remain with much regard

D^t Sir Your ob^t Serv^t

J Watt Jun^t

B&W to HvL 1800-08-09b

AoS ref. MS 3219/4/16/24.

Copy (not verbatim) of [1800-08-09a], found in the AoS; no indication that such a duplicate was actually sent to HvL in Hamburg.

J.D.H. van Liender Esq^r
Hamburg

Copy

Soho 9th August 1800

Dear Sir

On the other side you have copy of a letter written a few days ago. I have since that time made some calculations of the difference of expence between an engine constructed similar to that of Mijdrecht and one upon the plan proposed by M^r Blanken, each being calculated equal to the raising of 120 tons of water 5¼ cubic feet to the ton, 18 feet high Rhijnland measure per minute.

1° All the Metal Materials of an Engine similar to Mijdrecht including two sets of pumps and their gearing, would amount to about £ 1400 delivered here and payable in 3 months from delivery.

2° The same Metal Materials of a Double Engine upon M^r Blanken's plan, with the extras necessary for two additional beams, 3 short Beams, and nine pumps of different sizes from 20 to 41 Inch would cost at least £ 1000 additional. And you will please to observe that this does not include the additional expence of Woodwork, nor of the building, nor of the erection of the Engine, which would altogether be considerable, as you may readily yourself estimate.

(in left margin:)

I am going from home for a week or ten days, but if anything should occur in this business, my brother who now takes an active share with us, will have the honour of addressing you. I remain etc.

JWj to JW 1800-08-09c

AoS ref. MS 3219/4/16/24.

Dear Father

I inclose copies of two letters I have written to Mr van Liender in answer to the one you saw from him before you left this.

I shall thank you for hints of further objections if any occur, as matter for another letter.

I am glad to see the (.....) to water(?) continues and wishing you & M^{rs} Watt a pleasant excursion remain

D^r Father
Your dutiful Son
J Watt Jun^r

Soho 9 August 1800

HvL to B&W 1800-08-12

AoS ref. MS 3147/3/506/26. Docket: Earnestly soliciting an answer to his letter of (7?) July. Agrees to the Great Axis of the Windmill being made of Iron. Stamps C AU 20 800 and FOREIGN OFFICE AU 20 1800. Copy from J.L.Meijer.

HvL has apparently not yet received letters [1800-08-05a] and [1800-08-09a] from Soho. He further refers to his own letters of 6 & 8 July; these are actually [1800-07-07] and [1800-07-09], on the latter the date had been changed from 8 to 9.

Mess^{rs} Boulton & Watt
at Soho near Birmingham

At Hamborough 12th of August 1800

Dear Sirs !

Notwithstanding th'arrival here of th'English letters of 5th of this month from London, and 4th of Birmingham, I am till this moment without any answer from your side upon my former two letters of 6th and 8th of last month; which not only surprises me exceedingly, but I am obliged to confess, vexes me very much, as I am detained in this place for nothing; and it gives me so much more uneasiness, as I am advised, that the person with my first letter, has been in London the 20th or 21th of said month, and has forwarded said letter to its direction immediately upon his arrival there; and according the Lloyds list, my second letter or Coppij of the first must have reached you in the same time; and in consequence, I could have had a letter of advice, of your having received said letters or one of them, by the mails of 25th or 29th of July: and further by that of 1st of August, and now finally of 5th of the same month; being altogether four postdays elapsed, without hearing anij thing from you which really is inexplicable; as I am so much accustomed to your promptitude and exactness in case of business and you will consider, that our stay and voyage here, is only for the purpose I have explained by my letters abundantly; and that our waiting so long with 'utmost incertitude is nearly unsupportable; and I can in no manner find out or explain any reason for it.

Since my being here I have had a resolution of the Commission of Nieuwkoop drainage, by which they are determined, to have made a great or inclined axis of cast iron, leaving you at liberty to adopt the whole or as much, as you think proper, of th'additional securities proposed by M^r. Brunings. I have received advice from Rotterdam that th'Iron through was arrived there at the end of last month. And now I have nothing to add to these, than that I beseech you in all earnestness, to give me your answers at the receipt of these; If not send of before, or of one on your part having gone over hither. I remain meanwhile with great impatience yours affection:

J:D: Huichelbos van Liender

HvL to B&W 1800-08-19

AoS ref. MS 3147/3/506/27. Docket (on separate wrapper): Regret at our not being able to meet him at Hamburg. His motives for going thither. Advantages of Mr. Blanken's proposed construction of engine. Supposes we are going on with the engine. Account of engines erected in Germany. *Copy from J.L.Meijer.*

HvL and J.Blanken have been in Hamburg for several weeks, expecting a meeting with a B&W representative about the Hellevoetsluis Naval Dock engine planned by Blanken. As this meeting becomes unlikely, HvL attempts to start discussions in writing. He does not mention the Naval Dock by name (after all, he is attempting to buy from England an engine to upgrade a military establishment, at a time when England and the Batavian Republic are at war!), but refers to it as a "Lake, bassin, reservoir, or what you please to call it".

The reference to the engine for salt works at Salza (=Groß-Salze, today part of Salzelmen) near Schonebeek (=Schönebeck) near Magdeburg is intriguing. In [1800-09-09] HvL gives further particulars: a 40 inch (Rhineland measure) cylinder cast & bored in S.Wales by J.Humphrey (= Samuel Homfray's Penyardren foundry, S.Wales) in 1796 or 1797, all other parts made in Germany and the whole built under the direction of Oberberggrat Buckling (= C.F.Bückling). It is "an engine upon your principles", i.e. a Watt-type engine. HvL then mentions another Watt-type engine of the same cylinder size, erected in 1799 by a Mr. Wagner, engineer and overseer at Salza, for the salt works at Onna (=Unna, a few km E of Dortmund, then Brandenburg, today Westfalen); all ironwork for that engine, including the cylinder, was made in Malapana, Silesia (=Königliche Eisenhütte, Malapane, Upper Silesia - established 1753/1754, earliest manufacturer of steam engine parts in Prussia [Wagenbreth, 2002]).

Today (2003) the mining museum in Bochum has remains of a 1799 1050 mm (=40 Rhineland inch) Watt-type engine from Unna, stated on a tablet to have been built there under Oberberggrat Buckling, with cylinder cast in England. This is obviously the same engine, the cylinder provenance detail may be a confusable. This has been brought to the attention of the museum's curator.

Prussia, unlike Holland, had refused Watt an exclusive privilege, so Watt declined selling engines there. Bückling and others went to England several times to spy out details for copying the engine.

The Batavian Society Transactions volume mentioned in the PS is I (1800).

Mess^{rs} Boulton and Watt
at Soho near Birmingham

at Hamborough, 19th of August 1800

Dear Sirs !

In the heavy impatience in which we have vexed not only many days but several weeks, I have write you the 12th instant a verij urging letter, upon which I do not now expect your answer than only as to what relates to the great or inclined axis of the Nieuwkoop Watermill; as last Friday night the 15th I received your very long expected answer upon my two letters of 5th and 9th of July; by which I understand that by th'absence of all the principal parties in your house said letters remained unanswered, and that by the continued absence of M^r. Watt Sen^r. and the Mess^{rs}. Boulton, it is impossible for your M^r. Watt j^r. to leave England for any time; Which M^r. Blanken and I have apprised with great regret as we are certain that by conversation we could have been able to explain the plan, we have in contemplation, so fullij that the greatest part of your difficulties, not only should have been relieved but perhaps you could have fallen upon Ideas of improvement upon said plan;— As this is now impossible for the moment we shall endeavour, to given you by writing all th'illucidations and reasons we have for making use of the proposed mechanism.

But I shall before given you the reasons of my silence about our journey hither; our journey to this place was with the view of making our passage from Cuxhaven to Yarmouth and further to Birmingham; but on coming here and consulting persons of note and authority, to whom we were recommended, they dissuaded us absolutely to undertake it; as a passport from th'English minister here could only serve to convey us to Yarmouth; but that from that seaport, we could not enter England without having a passport from the Duke of Portland; and that as M^r. Blanken and I were in th'actual service of our Government, we never should obtain such a passport but should have been obliged to return from Yarmouth to Cuxhaven; how far this opinion is really founded or not we cannot judge, but as we had no authority to go against th'advice of those persons; we were (greatly to our disappointment) obliged to have recourse to th'expedient we have proposed in mine letters, and to solicit that of the two young partners in the house would come over hither, for having a meeting together; and as this in consequence of th'abovementioned circumstances, can have no place we are obliged to return to Holland, as our absence from there cannot be protracted longer.— I shall in course gladly know from you; If you think that, in case it was wanted, M^r. Boulton could obtain from the Duke of Portland a passport for me and M^r. Blanken to come over to England, to go to Birmingham for the purpose of having a meeting with

the Gentlemen of your house upon the subject in view !

And now going over to given you more explanations about our plan in general, please to observe that in the case we are now treating of, it is wanted that the Lake, head of water, bassin or reservoir, or what you please to call it, must be emptied from water from time to time, that is to say that the water in it must be evacuated from 0 to the depth of 18 feet below 0 and well in the shortest time possible, and filled to the former height of 18 feet; and as th'Engine is wanted merely for this purpose, it cannot escape your penetration, that the principal object we must attend to, must be to employ the power of th'Engine as advantageous as possible; to spare fuel on one side, and at th'other side do the business as expeditious as can be imagined; to knowing (*Ed. Note: Dutchism for i.e.*) some few hours. and as the subject of employing nine pumps for this purpose by alternation has been fully explored on our side, and clearly enough demonstrated by a model made for it; we feel th'inconvenience of our not having meeted together to be able to make it as plain for you Gentlemen, as it has been made for me and th'other Commissioners.— th'Expences of this construction will be of less consideration as they want only to be made once, and will serve for a long time; and we think it advisable to make the Stand and (...) middle pumps of cast iron, and all th'other ones of wood, and these last can be made afterwards of cast iron, If we think proper.— It is beyond all contradiction, that this machinery shall be more complicated than the method we have employed bij Meydrecht Engine; but as this is not a drainage for once, and afterwards a lifting of nearly always the same column of water in height as is the case at Meydrecht; it is plain that the different circumstances have led us to th'adoption of a different plan which we wish you will given yourself the trouble to consider fully and maturely; we foresee the consequences in future, If we can succeed to bring our plan to perfection. as Steam Engines will be employed in our Country to raise water from the low lands, and emptij it in rivers subject to Ebb and flood; which makes a difference in height of nearly six feet; and thereby given the machine of producing â greater effect at one time than another and that with the same power.— I shall with great pleasure receive your further remarks and rescription(?); meanwhile giving your M^r Watt jun^r M^r Blanken's and mine hearty thanks and compliments for his oblidging letters; and as you say nothing about my proposal or rather explicit order of having an engine double power able to raise a column of water of 18 feet high, and producing 120 tuns every minute, ready with its standard pumps, before the end of this year, I suppose you have alreadij given ordres for its execution; as we are now busy to build up th'Engine house for it and shall therefore gladly know at the first opportunitij th'opinion of you all, about our new proposed mechanism; as the further construction of the house ought to be adapted more or less to it.— During the six weeks we have spend in this town; having nothing else to do, we have sought the company of men of letters and knowledge, and have been introduced to several sources of learning; and the subject of Steam Engines being our favourite one they have spoken us a great deal of the fine German castings of cylinders pumps and other machinery at Breslau and of the Steam Engine erected by th'Oberbergrath Buckling zu Schonebeek by Magdenburg upon your principles without any aid from your Side; which joined to very good recommendations to that quarter received from the Professor Broodhaegen, the successor of the celebrated Professor Bush, deceased in the beginning of this month, and to whom we have paid a vizit and have been received with great alacrity, and entertained with great spirit, notwithstanding his blindness and decaying state of health being only five or six days before his death; has induced us to make a little excursion to Magdeburg on our return to Holland to see what those fine castings and other machinerij shall be.

Your observation about th'altered revolution of the Scheprad in the Nieuwkoop Watermill, I shall bring before the Commission after my return to Holland, where we hope to arrive in the first days of September.

M^r Blanken joining his sincere compliments to mine, I assure you that I do not cease to remain with every consideration.

Yours very affection:

J.D. Huichelbos van Liender

P.S. I had with me the first vol: of the new transactions of the Batavian Society containing narrative or history of the Steam Engines and their introduction in our Country, and of th'improvements found out by your James Watt Sen^r as a dutiful acknowledgement offered by the Society to said gentleman, which I hoped to transmit myself to that honoured friend and which I now shall taken back to Holland and reserve for another opportunity.

B&W to HvL 1800-08-21

AoS ref. MS 3147/3/95/176.

J.D.H. Van Liender Esq^f
Hamburgh

Soho August 21th
1800

Dear Sir

We annex copies of letters which we have written to you in reply to your late favours. We flatter ourselves that the originals have before this time reached you and released you from the solicitude you mentioned.

We sincerely regret that your detention at Hamburgh should have been productive of so much vicissitude(?) and anxiety; especially as it is not in the power of any member of our House to avail themselves of the opportunity for(?) meeting offer'd by your stay there.

We remain with sincere regard

Dear Sir your very Obed^t Serv^{ts}
for Boulton & Watt
Gregory Watt

HvL to B&W 1800-09-09

AoS ref. MS 3147/3/506/28. Copy from J.L.Meijer. Docket: Description of a Steam Engine at Salza nr. Magdebourg. Account of Engines made in Silesia. Return to Rotterdam. Order for new Engine.

*B&W registered the order (for the Hellevoetsluis engine) at 11 October 1800.
About the Salza and Onna engines, see notes with [1800-08-19]*

Ms^{rs} Boulton & Watt
Soho near Birmingham

at Rotterdam 9th of September 1800

Dear Gentlemen !

Since my former letter of 19th past directed from Hambourough, we have left said city, and have taken our way from Harbourg by Lunenbourg to Magdenbourg where we have seen at Salza near Schonebeek distant one German mile from Magdebourg a Steam Engine constructed upon your principles, and of which all th' Iron apparatus was founded in Germany, the Steam Cylinder 40 Rhijnld. Inches diameter only excepted which was cast and bored in South Wales by M^r James Humphreij three or four years ago; — but in the year 1799 a Steam Engine with a Cylinder of the same dimensions, has been erected after your principles by One M^r Wagner a very able Engineer, and overseer of the Salt works at Salsa; at Onna in Westphalia, of which everij part Cylinder as well as all th' other Ironwork has been cast and bored in Silezia at Malapana and according the testimonij of said M^r Wagner (who had been in England in compagnij of th' Oberbergrath Buckling) as perfectly as is done in England and according what th' Oberbergrath La roche at Schonebeck has assured us, there must be at this moment in the mine works of Silezia thirteen Steam Engines at work, all constructed upon your principles, of which all th' Iron Cylinders pipes etc. are cast and bored in the Royal founderies there; and of whose castings they have published a Tarif; following which the prices seem to be very moderate; after we had collected all th' Informations we could obtain upon this subject we have pushed our return home as fast as we could, and have entered the limits of the Batavian Republic in the first days of this month, and have proceeded to Haerlem there I have found your letter of the 9th of August and received the following day your Gregory Watt's letter of 21st August.— By your said letter of the 9th of this month (*Ed. Note: clearly letter 1800-08-09 is meant*) it seems your principal objection to our plan of new mechanism was mostly reduced to the difference in expences; but as we think most desirable to have in the beginning only one standard pump of cast Iron able to perform what we have always intimated; to know to lower the water in the bassin or reservoir from 0 or its full height to the depth of 18 feet; at the rate of raising or emptying 120 Tuns water of 5¼ cubicq feet per minute by a moderate movement of th' Engine viz of 11 or 12 strokes per minute and a stroke of six feet length; and which bij any urging necessity may be accelerated; and afterwards to try our intended improved mechanism, for greater production in the same time and with the same power with wooden pumps; — the difference in expences can never be very considerable; — As I have in my letter of 19th August explained our plan more fully, I am sure your following letter shall be quite satisfactorij; as the drawing I have send you, is an accurate delineation of the building and its appurtenances, and as it is now building up; you will apprise that the great beam is calculated to be of 22 feet length; we intend likewise with a view to conserve as much waterwaj as possible to suspend the large or Standard pump on strong beams and not to let it rest upon framework on the floor; wherefore said Standard pump ought to be provided with good strong nuts and supports, to suspend it by and to steadij it likewise against any movement of which I pray that a drawing may be send over for our direction. As I likewise sollicit you will given me th' exact dimensions width etc of the Steam Cylinder wanted and intended for our purpose and of the minute parts of the great beam its Ironworks parallel motion etc. and by your first answer I hope to understand what time it will unavoidably take at th' utmost, to have said Engine with its Standard pump as noted, readij this year.

I remain with every regard

Dear Gentlemen

Yours m^t affection:

J:D: Huichelbos van Liender

HvL to B&W 1800-09-30a

AoS ref. MS 3147/3/506/29. Docket: Remits £ 90 for trough. Complains of its expence. Enquiry about Cartwright. Stamps B OC 11 800 and FOREIGN OFFICE OC 11 1800. Copy from J.L.Meijer.

Note on cover: Hamburg 3 Octr. 1800 Recd. & forwd. by YMOHSt Alexr. Martin.

Mess^{rs} Boulton & Watt
at Soho near Birmingham

at Rotterdam 30th of September 1800

Dear Gentlemen !

Your letter of 15th June containing th'Invoice of th'Iron trough, and which I have found at my house upon my return from Germany; I have since examined and shall now proceed to answer and impart you mine reflexions upon the same; — This first tryall of substituting cast Iron in lieu of wood or brickwork is not very encouraging; as this Iron through comes to â verij high price in comparison, what one of wood or of brickwork would have cost.— this Iron through cost us brought here, the sum of =1185 guilders one of wood would have cost =900 guilders and one of brickwork =750 guilders which is certainly â capital difference. It is true that by the public circumstances of wartime th'Expences of transport freight insurance etc. are very high; which in time of peace would certainly make â difference; and perhaps the price of your castings would then be lower to; — when I compare the price which the tarif of the cast goods at the founderies in Silezia note; the prime cost will differ 20 pct. and th'expences of transport from there here cannot be higher than from Birmingham to Hull Embden etc.; as our Commission is answerable for all their transactions to the Government it is their duty to calculate nicely, what may be the most profitable for the public service; and I offer you these considerations, that you shall take some regard of them, in stating the prices of th'Iron machinery for the scheprad mill; and our Commission has been already strongly criticised by Insidious persons for ordering Iron castings from England in open wartime; and that of parts of a mill, which could be made of our own brickwork; and when those castings come higher than brickwork would do; the measure is not easily defended; It is the durability which must compensate the greater prime cost; and this will be â matter of experience; the probability of longer duration is certainly for the Iron, and this shall be our principal plea.

I remit you with these on account of your Invoice a first bill of exchange drawn from Embden the 26th of September at one month's time by J.D.Knox ordre Coysgarne Lloyds on M^r Sampson Coysgarne Lloyd at Mess^{rs} Robart Curtis Vere & C^{ie} the sum of 90 £St: of which you will procure the needfull, and give me Credit for th'Amount; — I am now daily expecting your answer upon my former letter, and principally upon that of 19th August;

In the commercial Agricultural & Manufacturers Magazine, of which I have now eleven numeros I find in N°8 in a memoir of the life of M^r Cartwright the following remarkable passage;

In the improvements he had made on the Steam Engine he seems to have accomplished everything that stupendous power is capable of, by taking away greatest part of its friction and making â perfect vacuum; in doing these he has so simplified the construction of the Engine, as to make it manageable by a common servant.

Pray be so kind as to tell me If these assertions are true or if they are Bombast; I do not remember ever to have heard in the Steam Engine line of this M^r Cartwright who seems to be â great Inventor in mechanics.

I remain with every consideration

Yours affect:

J:D:Huichelbos van Liender

BW&C to HvL 1800-09-30b

AoS ref. MS 3147/3/95/210.

BW&C steer clear of the full Blanken nine-pump arrangement which they defer to the future and leave entirely at HvL's and Blanken's responsibility and risk. BW&C limit themselves to a maximum of three pumps: a standard main bucket pump under the beam nose, which raises water on the down stroke of the steam piston in the usual way, and two side pumps linked to work inversely, raising their water on the steam piston up stroke. These two side pumps have the same stroke as the central pump, and they must each be of $1/\sqrt{2}$ (=0.71) times its diameter to present the same combined area.

(Mr) J.D.H. van Liender
Rotterdam

Soho 30th Sep^r 1800

Dear Sir

We have been duly favoured with your esteemed letters of the 12th & 19th Ult^o from Hamburg and of the 9th Inst^r from Rotterdam.

We conceive it is your wish that we should immediately proceed in preparing the material(?) parts of an Engine of Double power according to the data (.....) given. Those we understand to be, that the Engine should be capable of raising 120 tuns of water (5¼ cubic feet to the tun) 18 feet high Rhineland measure, Per Minute: as you have propos'd the beam to be 22 feet (*long*), so as to give a six feet stroke in the Cylinder & Pumps and to make from 11 to 12 strokes per minute. The Engine to be at a future time adapted to work nine pumps upon M^r Blankens plan, but in the mean time to work one standard pump capable of delivering the whole quantity of Water. —

(A) 40 Inch pump 6 feet stroke at the rate of 11 strokes per Minute would furnish the proposed quantity of Water and reckoning it to be raised to the extreme height of 18 feet would require a 40 Inch Cyl^r 6 feet strokes. But if a double Engine of this size was applied to work this pump only, the one half of the power (that exerted in the upstroke of the piston) would be entirely lost. It is therefore adviseab(*le*) either that the Engine should be employed to work two side pumps of 28 Inches Diameter wor(*ked*) upon M^r Blanken's plan, in the upstroke, which would make the delivery of Water doub(*le*) of what you have stated per Minute, or that the Engine, though constructed double, might upon this occasion be worked as a single Engine only which it is possible to contrive.

(If? *in*)stead of requiring the whole quantity of water to be raised by one standard pump, it would answer equally well to raise it in the first Instances by three, we should have recommended the center pump to be 28 Inches in Diameter and the two side pumps to be 28 Inches each(*Ed.Note: should be 20, this is corrected in the price note*): in which case a 28 Inch Cylinder 6 feet stroke double power would have been adequate to the delivery of the required quantity of Water per minute at the specified height. —

The other six pumps, might according to M^r Blanken's ideas, be added afterwards when wanted, but we should certainly recommend the whole to be made of Cast Iron & not of wood.

As you have probably not adverted to (*Ed.Note: = taken notice of*) the difficulties of working a single pump with a double Engine, we are left much in doubt which of the above sizes would be preferable, and though we suppose the 40 Inch would come nearer to your Ideas we are unwilling to decide until we have the pleasure of hearing from you again. Meantime we shall put your name down in our Order Book, that it may take precedence of any order we receive in the Interval so that little time will be lost by the circumstances. We are sorry to add that the state of our engagements will not permit us to undertake the erecting for these Engines (*Ed.Note: reason for plural unclear*) within the current year, or indeed in less than five or six months, which however will enable you to get it erected during the most favourable season of the coming year. —

We annex a printed list of the Materials usually furnished by us to Engines in this Country, and which we should also propose to supply you, leaving the other accessories necessary to the completion of M^r Blanken's plan to be provided upon the spot. —

We should also be willing to furnish the cast Iron pumps completely fitted with buckets &c.

The prices for what we are willing to contract would be as under.

1 ^o	All the Metal Materials of a 40 Inch Cylinder 6 feet stroke as per printed list	£ 1100
	Great Pump of 40 Inches fitted	242
	Two less pumps of 28 Inches each D ^o	<u>342</u>
		£ 1684
2 ^o	All the Metal Materials of a 28 Inch Cyl ^l 6 feet stroke double power as p ^r printed list	£ 842
	A Pump of 28 Inches D ^r fitted	171
	Two Pumps of 20 Inches D ^r D ^o	<u>244</u>
		£ 1257

These prices are for the goods delivered here and payable at three months. The Carriage to Hull & Shipping to form an extra charge.

As the boiler for each of these Engines would too large to be taken on shipboard in one piece, they must be sent in several and put together upon the spot.

We have now to remark that the space allotted for the boiler in the Engine house now building according to M^r Blankens directions is too confined for either of the sizes of Engine and have suppose(d) that this may be partly remedied by putting the boiler in a separate building which on many accounts we prefer. We should also object to the proposed method of throwing Arches under the cylinder, which could not be made equally steady with our platform. Proper drawings will be sent you as soon as we learn which Engine is preferred.

Mr Boulton desires me to say that he flatters himself he could procure from the Duke of Portland a passport for you & perhaps also for M^r Blanken if you should rescind your intention of coming hither should the prospect of an approaching peace materialise & (.....) the hope, that you may soon come over here & (.....) expectation (.....) we are respectfully (.....)

Dear Sir Your ob^l hble serv^{ts} for Boulton Watt & C^o
James Watt Jun^r

P.S. My father & M^r Boulton Jun^r are not yet returned and M^r B Sen^r has only been at home a few days. We thank you for your information respecting the German Engines, but have(?) no apprehensions from that quarter.

HvL to BW&C 1800-10-15

*AoS ref. MS 3147/3/506/30. Docket: Has recd ours of 30th Sepr & will transmit the Resolutions of th' Comn.
Copy from J.L.Meijer.*

Mess^{rs} Boulton Watt & C^{ie}
at Soho near Birmingham

at Rotterdam 15th of October 1800

Gentlemen !

I had write you a letter with th'intent of inquiring If my former letters, and specially that of 19th of August, was come to your hands as M^r Blanken and I longued greatly to know your Ideas after having received th'Illucidations, I have given you in my said letter, but before It was send away I received your very Agreeable favour of last of September the contents of which I am sure shall bring us to a determined resolution about the kind and size of th'Engine we wish to be provided with; and of which resolution I shall given you knowledge as soon as the Commission shall have had occasion to deliberate upon your proposals; — It is a pity that by this tedious way of correspondence, we have lost so much time that th'Engine cannot be made ready this year, which would have extremely well suited our purpose.

As your letter is signed otherwise than ever before; and your Watt junior signs it for Boulton Watt & C^{ie} my curiosity induces me to inquire (as certainly it will not be a secret) who the partners in th'altered firm of the house are; to whom I wish as much prosperity and success as ever th'ancients have enjoyed.

I remain with due consideration

Your m^t ob^t & Hm: Serv^t
J:D: Huichelbos van Liender

BW&C to HvL 1800-10-18

AoS ref. MS 3147/3/95/236.

M^r J.D.H. Van Liender
Rotterdam

Soho 18th October 1800

Dear Sir

We are favoured with your esteemed of the 30th Ult^o containing your remittance of £ 90 which is duly passed to your credit. The advantage to be derived from the substitution of Iron in your Machinery certainly results in the superior durability, greater convenience and (in parts exposed to wear) in the diminished friction of the material (.....) cost, though perhaps the difference will be less striking in the working parts of the Mill. It is also to be remembered that had the trough been made to suit our Millwork & not according to dimensions given us, it would have been less bulky & less expensive; but even under the difference of cost you mention, we should not hesitate to give it a preference.

The German founders might perhaps do simple castings of this kind tolerably well, but we (.....) we may safely assert that their knowledge of Iron Machinery in general is very deficient and that the casting only, forms but a small part of what it requires to enable them to construct it upon those principles which theory & practice here have shown to be the best. —

M^r Cartwright has never made (to our knowledge) but two Steam Engines. One of them does not go at all and obstinately persists in not going; and the other we are at this moment applied to, to pull down and substitute one of our own

We never read the article you mention, but shall get it. In the mean time it may suffice you to know that this M^r C. about 3 years ago, took a patent for condensing by external application of cold bodies, already patented by my father thirty years ago, and also for a metallic elastic piston, which my father also describes in one of his patents, but which did not answer with him & much less with M^r Cartwright. We wrote to you a long letter on the 30th Ult^o to which we are expecting your answer & remain

D^r Sir Yours faithfully
for Boulton Watt & C^s

James Watt Jun^r

HvL to BW&C 1800-10-31

AoS ref. MS 3147/3/506/31. Docket: Order for Blanken's Engine. Further complaints of the Expence of trough. Stamps overlap and are unreadable, FO stamp probably dated Nov 18. Copy from J.L.Meijer.

Mess^{rs} Boulton Watt & C^{ie}
at Soho near Birmingham

at Rotterdam 31st of October 1800

Dear Gentlemen !

My last letter of 15th of this month gave you to understand that your letter of Ult^o September seemed to me so satisfactory that I had no doubt of its furnishing abundance of materials to decide what size of Steam Cylinder the Commission would elect of the two you had proposed; — To M^r Blanken and me, as well as to all th[']other members of the Commission it had appeared plainly that th[']Engine for which we ought to give our election could be no other than that, which you have described under N^o2. As the size of that Engine, when double power, and working three pumps alternately, one middle of 28 inches and two side pumps of 20 inches diameter each; shall fully answer our desideratum, to know (*Ed.Note: a Dutchism, meaning here viz.*) of raising 120 Tuns of 5¼ Cubical feet Rhijnland measure every minute, and that even to the depth or height of 18 Rhijnld. feet, as your letter assures, that an Engine of 28 inches Steam Cylinder's diameter, so qualified, and working said pumps with a six feet stroke, will be adequate to what we have required from the beginning; — but you must certainly reckon upon a greater number of strokes as we do; otherwise th[']Engine according our calculations will only given 110 Tuns every minute, with eleven strokes, but this I only mention that you may again make your calculation, and if you are sure of your's, we shall thrust in it; only I beg you to consider that we absolutely depend upon raising 120 Tuns everij minute and it is in consequence of the deliberations holden upon the contents of your letter of 30 September that I pray you to provide â Steam Engine double power having â Steam Cylinder 28 Inches diameter provided with three cast Iron pumps one of 28 and two of 20 Inches diameter, and provided with the necessarij flanches nuts etc. to hang them by upon wooden beams; and all th[']other metal materials as usually furnished and expressed by your printed list and for the price noted in your letter, delivered at Birmingham; to be transported from there to Hull or London; the boiler to be sent over in pieces, with the necessary bolts to nail the pieces together. — As you make â remark, that the space allotted for the boiler in th[']Engine house now building is to confined I pray you to send over the true dimensions in â plan or drawing; that we may go on with laying foundations and otherwise further its construction as likewise I wish you to send over as many drawings as may serve to direct us in furthering the construction of the building and its appurtenances, as much as possible; — As we wish to make this Engine house more showij as in common, I should think that to cover its roof with Mr. Wyatt's plates would be preferable, I wish to know your opinion about this measure; we shall otherwise cover it with slates, but â quite even roof neatly painted would make a good showij appearance; we are of your opinion that Iron pumps are preferable above wooden ones; — That you have put down my name in your order book, that mine order may have precedence before ordres received after the 19th of August is very well; but I beg you to consider that in my letter of 6th July (*Ed.Note: this is in fact letter 1800-07-07*), I have given explicitly enough an order for an Engine able to do what I have mentioned then; and that properly speaking my name ought to have been put in your orderbook upon the receipt of said letter; as I have said We are in want of an Engine etc. but as circumstances have greatly retarded our design in this operation I only must beseech you to accelerate the preparing of this now finally ordered Engine as much as will be in your power; as a very important undertaking depends from its having it here, as soon as possible; It would have been infinitely advantageous for our purpose If we could have put it up before the month of March; all what we do it later, is nearly a Year lost; pray be so kind as to take this in consideration, and say If there is any possibility to help us sooner; we shall undoubtedly order afterwards the six remaining pumps of cast Iron, compleately fitted up; — The German castings can do you no harm in England, but greatly in Germanij, as they propose to build up two Engines at Hamburgh, one for raising water for â part of the Town; and another for grinding corn; and one for â tobacco manufactory shall be constructed at Magdebourg; those all shall be cast in Silezia as likewise that for Onna in Westphalia has been done last year; — With â copy of these I shall send you â drawing explaining better M^r Blanken's plan or Idea of the manner of working the three pumps and shall send it by a Vessel directed to the care of Mess^{rs} van Dijk Gevers & C^{ie} in London; to whom I have likewise send my letter of 15th Curr^t by Vessel from here; there being daily opportunity for this kind of conveyance; — By your furnishing us with good well executed drawings we shall not want a man from your side, to help us in putting th[']Engine together. —

By my letter of 30th of September I have purposelij writed you about the Iron through for one of the scheprad mills in Nieuwkoop drainage and have remitted you by the same a Bill of Exchange of 90 £St: on account of its Invoice; but since examining some former letters received from your side, I find in your letter of 16th November 1797 that you had calculated â cast Iron through or back for wheel upon the water as of the scheprad will cost about £ 14.8.-. and when we have ordered this through to be cast we had always in view said

calculation and now by receiving th'Invoice th'amount differs so immensely that indeed our Commission finds it very difficult to adjust this capital difference and the more so as Invidious persons do accuse us of greatly spending the public money; by ordering cast Iron goods from England (an Inimical Country) at so much graeter prize, as the same could have been made of our own inland materials; and this had been done in th'open Assembly of the first authoritij in the Republicq; I hope your calculations in the same letter about the Iron materials for the scheprad Mill will not so widely deviate, when compleated as those of th'Iron through, or I do not know how to defend the same; not doubting this letter will satisfy your expectations and remain

Yours very affection:

J:D: Huichelbos van Liender

ordered this through to be cast we had always in view said calculation and now by receiving th' Invoice th' amount differs so immensely that indeed our Commission finds it very difficult to adjust this capital difference and the more so as Invidious persons do accuse us of greatly spending the public money; by ordering cast Iron goods from England (an Inimical Country) at so much greater prize, as the same could have been made of our own inland materials; and this had been done in th' open Assembly of the first authority in the Republicq; I hope your calculations in the same letter about the Iron materials for the scheprad mills will not so widely deviate, when compleated as those of th' Iron through, or I do not know how to defend the same. — Not doubting this letter will satisfy your expectations I remain

Mess^{rs} Boulton Watt & C^{ie} at Soho near Birmingham

at Rotterdam 12th of November 1800

Since my last letter of of Ult^o October, of which you have a copy above, I am favoured with yours of 18th of same month, by which I have learnt the good receipt of my Letter of Ult^o September and mij remittance of 90 £St. — As you do not use Wind Watermills the through would never have suited your millwork; therefore we were of opinion, that you had made your evaluation by what you had found in the Groot Moolenboek; It is true our present mills are heavier than those described in said work but as you are now provided with very well detailed contracts (bestekken) of the present building mills you can easily inform yourselves of the true dimensions of the principal parts; — I am quite of your op(*inion*) , that the German founderies will be long in working before they shall be able to attain that perfection which the English founderies can boast with so much justice; — I thank you kindly for your information about M^r Cartwright, It has been just as I supposed. — by these you will receive the drawing spoken off in my former letter; to the contents of which I refer myself wholly; and remain Yours Verij Affection^s

J:D:Huichelbos van Liender

BW&C to HvL 1800-11-28

AoS ref. MS 3147/3/96/7.

M^r J.D.H. van Liender
Rotterdam

Soho 28th Nov^r 1800

Dear Sir

We are much obliged to you for having by the doubts expressed in Your favour of the 31st Ult^o induced us to revise our Calculations for the New Steam Engine, in which we have now discovered a Material original Error arising from our having reversed the proportion of the Rhenish foot to the British, having assumed the former to be shorter than the latter in the proportion of 97 to 100, whereas it should have been taken larger in the reverse ratio as we now find by referring to some old (.....) of Yours & to the article Toise in the French Encyclopedia. —

With these corrections we find that to produce the stated effect of raising (120?) Tuns of water 18 feet high / 5¼ Cubic feet to the Tun Rhenish measure, per minute, one pump of 30 Inches and two of 21 Inches each will be necessary, working with a 6 feet stroke at the rate of 11 to 12 strokes per M(inute) (.....) with equal beam will require a 30¾ Inch Cylinder in which size some allowance is made for the friction of the Machine more than in the former calculations. —

The Cost of the Metal Materials of a 30¾ Inch Cylinder 6 feet Stroke	
Double Power as per printed list annexed to our letter of 30 th Sep ^r Ult ^o will be	£ 905
Pump of 30 Inches D ^r fitted	183
Two D ^o of 21 Inches D ^r D ^o	<u>256</u>
	£ 1344

Delivered here and payable in three Months from such delivery.

Presuming that the Gentlemen of the Commission will view the alteration in the size and Estimate of the Engine in its true light, we shall consider it to be their wish that the above should be immediately proceeded with, and shall put it in hand accordingly without waiting their confirmation of the order, which however we shall be obliged to you to forward when obtained. —

We sincerely wish we had it in our power to furnish the Materials of the Engine in the time you mention. We have reckoned upon furnishing it in Six Months from the end of September, the state of our prior engagements not permitting us to mention a less time, and you are sensible that in Machines of this magnitude it is not possible to ascertain the period of their execution with perfect accuracy. — So may be a few weeks more or less than we have stated, but you may rely upon our sparing no exertion to compleat it with all practicable dispatch. We are going on with the drawings, which shall be forwarded by the first opportunity. — Those of Mr Blanken's method of working the pumps are not yet received & will be necessary for our Government. —

We are sorry it is not in our power to give an opinion on M^r Wyatt's plates for covering buildings as we have no experience of them, but should conceive they must come very high at the present enormous price of Copper. —

We note your observations upon the expence of the Trough, which are partly answered in our letter of the 18th October, but shall undergo a more particular consideration in a few days and form the subject of a separate letter

We are with much regard

Dear Sir

Your ob^l hble Serv^{ts}
Boulton Watt & C^o

HvL to BW&C 1801-02-24

AoS ref. MS 3147/3/506/33. Docket: Has received our letter of 28th Nov. & drawings of the Engine. Accepts our terms for a 30¼ Inch Cylr. Enquiry about the trough and state of castings for Nieuwkoop Drainage. New Copper boiler wanted for Mydrecht. Stamps FOREIGN OFFICE MR 14 1801 and B MR 16 801. Copy from J. L. Meijer.

The stated dimensions, with 11 strokes/min., will indeed raise just over 120 tuns/min, but this is tacitly assuming 100% volumetric efficiency of the pumps. In calculations concerning this type of pumping engine (and also atmospheric or Cornish engines) that assumption appears to have been quite common practice.

Mess^{rs} Boulton Watt & Comp^y
at Soho near Birmingham

Rotterdam 24th of Februarij 1801

Dear Gentlemen !

My last letter to you was of the 12th of November 1800. Serving mostly to send you coppij of a former one, and the drawing mentioned in th'original for your government.— Since that time I have been favoured with yours of the 28th of the same month, as likewise with a bundle of drawings of the Steam-Engine now in hand.— and I shall now proceed to answer your said letter, by the contents of which I saw with pleasure, that my suggested doubts about the size of the Steam Cylinder for the intended Engine has given occasion for the discovery of an error in your calculation, and such in time sufficient for remedijing it, and that by the correction of it, you had found, that to produce the required effect of raising 120 tuns of water 18 feet high (5¼ Cubic feet to the tun) Rhenish measure per minute, one pump of 30 inches and two of 21 inches each will be necessary, working with a 6 feet stroke, at the rate of 11 to 12 strokes per minute and that this with equal beam, will require a 30¼ Inch Cylinder in which size some allowance is made for the friction of the Machine, more than in your former calculations; and that such an Engine double power with the necessary apparatus and the three pumps should cost together £ 1344. delivered at Birmingham and payable in three months from such deliverij; — this your letter and last determination, I have produced in the Assembly of the Members of the Commission; and I am by the same duly empowered to concede and accept your said proposals and determination of size of the engine and pumps and price of the same, supposing you have mentioned the lowest, you can possibly state it.— And the Commission has approved and apprized with satisfaction, that you have supposed they should consider this alteration as unavoidably necessitous and proceeded immediately with its construction, as the most speedij execution of the same is so greatly desirable; Which therefore I again take the liberty to recommend very earnestly.— As you undoubtedly will have received long Ago M^r Blanken's drawing; I shall gladly receive your animadversions upon the same, as likewise your more particular considerations about the heavy expence of the Iron through, promised in your letter of 28th November (*Ult?*). This through in its use answers perfectly well.— If I remember right, the Iron materials for the wind watermill N^o9 in the drainage of Nieuwkoop, must be ready at this time (the mill being fully build up, and ready to receive 'em) and send off; If it was possible to have them send by water to London, which I think now possible, as I have read so much of canals extending to that metropolis, and of making the river Thames navigable to near the present canals; we should prefer that greatly as so many more opportunities offer at London for here, than at Hull, and in said case you could direct them to Mess^{rs} van Dijck Gevers & C^o there.— We have resolved to cover th'Engine house with slates, as you did not seem to recommend Mr Wyatt plates for covering buildings.

The drawings you have send over, are just come in good time, to follow the greatest part of your directions.

If a new copper boiler was wanting for Meydrecht Engine I suppose you would provide one made in pieces with you, and only wanting to be nailed together here; do me the pleasure to acquaint me with the price nearly of such a piece, and of the time it would require to prepare it.

Is it possible to have good coal tar from the manufacture in your neighbourhood ? in that case I should wish to have half a dozen barrels of it; send over with th'Iron materials of the watermill.

I remain with my hearty salutations and every regard

J:D: Huichelbos van Liender

BW&C to HvL 1801-04-20

AoS ref. MS 3147/3/96/239.

BW&C once again stress that they want nothing to do with Blanken's mechanism, and rigidly decline to offer even the slightest comment or opinion on it (this in spite of requesting a drawing & explanations in [1799-10-28a]. One senses that this reticence may have been as much reason not to meet HvL and Blanken in Hamburg in 1800, than the professed non-availability of a BW&C representative.

M^r J.D.H. Van Liender
Rotterdam

Soho 20th April 1801

Dear Sir

We received in due time your favours of the 12th Nov^r and 24th Feb^y the latter acceding to the terms proposed in our letter of the 28th Nov^r and advising the receipt of the Engine drawings.

We have given every possible dispatch to the Engine, which is now nearly completed and might be sent off in the course of the present month; but as the pumps are not in the same forward state, it may be the end of May before the whole is expedited. We shall then attend to your directions in sending it by way of London instead of Hull. —

Mr Blanken's sketch of his manner of connecting the different beams and pumps has been duly received, but we have no particular remarks to offer upon it, as we presume it is understood from our letter of 30th September a.p. that these parts are to be manufactured by Yourselves.

We have much trespassed upon your indulgence with respect to the time taken for completing the Windmill Machinery, which has far exceeded our expectations and is chiefly attributable to the great number of new patterns required. We judged it advisable, in consequence of the doubts expressed by yourself and the Gentlemen of the Commission, to add considerably to the strength of the shafts and dimensions of the wheels originally proposed, that every possibl(e) security might be given to the success of your enterprize: and from the same motive we have spared no expence in filing & fitting the iron teeth of the wheels in the most perfect manner and in turning the shafts and fitting the brasses to them with such accuracy as will tend materially to diminis(h) their friction. The whole will be ready to be forwarded with the Engine, or sooner if we find an earlier opportunity of getting them shipped. We presume that yourself and colleagues will of course be aware that the increased weight of the parts, the greater perfection of the workmanship and the making entirely new patterns, added to an advance of 2 to 4/ per Cwt on the prices of Castings will very materially augment the cost as stated in the pro formâ Invoice of our letter of 16 Nov^r 1797 to which you have referred us for the first Estimate of the Trough.

In your letter of the 12th Nov^r (*Ed.Note: 1800*) you seem to be of opinion that our original estimate was adapted to a trough of suitable dimensions for the millwork now in use in Holland; but if you (*will*) refer to the letter above quoted, you will there see that we meant otherwise, having expressed ourselves as follows. "The trough or Bak would be better of Iron and its dimensions may be considerably reduced as the wheel which runs in it will be both of smaller diameter and narrower in the rim." We are however willing to admit that our estimate even in that case would have been below the mark probably owing to some error of calcu(lation) What we had then in view and conceive still the essential point, was not so much a diminution of the first cost of the Millwork, as a saving of the constant unnecessary expenditure of power and the Trough was only mentioned incidentally.

We should by no means recommend a copper boiler for Mydrecht at the present extravagant price of that metal. A new one of Iron would cost about £ 285(?) delivered here, and one of copper would come to nearly three times that sum.

We shall send two barrels of Coal tar with the Materials of the Windmill, if we can get leave to export them as we are doubtful whether it may not come under the description of articles prohibited in time of War. (*Ed.Note: the shipping list of the mill materials 1801-05-16 does not mention the coal tar*)

Two barrels will be a very ample supply

We were much concerned to learn your late indisposition from M^r Ravee although accompani(ed) by the intelligence of your entire recovery. All your friends here continue well and desire to be kindly remembered to you. We are truly Dear Sir (*Ed.Note: remainder of ending too badly faded*)

BW&C to Parkes 1801-05-05

AoS ref. MS 3147/3/506/34b. Copy from J.L.Meijer.

This looks like being the BW&C copy of the list given to the shipper Soho-London, with shipping weights of the parts for the Blanken engine, and very little else. For further details see [1801-05-15].

Attached is a copy of the sketch of the cast-iron trough which also came with [1800-02-01]; it is unclear why that should be attached to this list, maybe this is an archival mistake — the sketch has not been reproduced here.

The “canal weight” is a conventional measure, not necessarily equal to the actual weight, which is used to calculate the charges for transport on the inland waterways system.

Mess^{rs}. Parkes & C^o.

Soho n^r. Birm^m
May 5th 1801

Gent^l/

You will forward with the utmost dispatch the undermentioned Goods, mark'd **B** & numbered as in Margin to M^{rs}. Mathews, N^o 13 London Street, Fenchurch Street, London.

for Boulton Watt & C^o.
Tho^s. Hutton

No.		Cwt. qu. lbs
1	a Piece of Casting -----	10.2.24
2	1 D ^{to} -----	5.-.1
3	1 D ^{to} -----	4.3.24
4	1 D ^{to} -----	7.3.24
5	1 D ^{to} -----	15.2.20
6 to 11	6 D ^{to} -----	16.-.-
14	1 D ^{to} -----	-3.20
15 & 16	2 D ^{to} -----	16.-.2
19	1 D ^{to} -----	3.3.18
20	1 D ^{to} -----	4.4.20
21	1 D ^{to} -----	1.1.13
22 & 23	2 D ^{to} -----	6.-.23
a & b.24 & 57	2 D ^{to} -----	6.1.22
25	1 D ^{to} -----	11.3.19
26	1 D ^{to} -----	1.1.22
27	1 D ^{to} -----	..3.1
28	1 D ^{to} -----	1.2.21
29	1 D ^{to} -----	4.2.21
30	1 D ^{to} -----	1.3.5
31	1 D ^{to} -----	3.-.21
32	1 D ^{to} -----	2.-.26
33 & 34	2 D ^{to} -----	6.-.-
37 & 38	2 D ^{to} -----	4.3.20
39 to 56	18 D ^{to} -----	15.3.3
58	1 D ^{to} -----	2.1.19
59	1 D ^{to} -----	4.3.1
60	1 D ^{to} -----	3.3.11
61	2 D ^{to} -----	5.3.18
a.b.c.62	3 D ^{to} -----	13.2.1
77 & 78	2 D ^{to} -----	1.3.19
	Boiler in 20 Pieces -----	46.2.22
	17 Boxes mark'd B & numbered 1 to 17--	83.-.14
	Short W ^t -----	334.1.27
	Ton.Cwt.qu.lbs	
	Canal W ^t . 15..12..-.23.—	

BW&C to HvL 1801-05-15

AoS ref. MS 3147/3/506/34a. Docket: List of materials for Mr. Blanken's engine. Copy from J.L.Meijer.

List of materials for the Blanken (Hellevoetsluis) engine, shipped to Holland; this list (which would be intended for the erector) identifies all items, [1801-05-05] just gives their shipping weights.

The cement in boxes 14-16 would be iron cement for joints &c.; it is not clear what the engineering use of pomatum (well known as a cosmetic preparation of mashed apples, pork fat and rose water) would be; could it be for treating leather ?

A list of Steam Engine Materials which were sent from Soho on the 15th May 1801.

Mark'd B.

No.1 Cylinder— No.2 Inner Bottom for do.— No.3 Outer Bottom for do.— No.4 Lid for do.— No.5 Air Pump— No.6 to 11 Steam case in 6 parts— No.14 Cover for the foot valve— No.15 Upper Nozles— No.16 Under Nozles— No.19 Main Gudgeon— No.20 A Plummer Block for Main Gudgeon & 2 Glands— No.21 A Gland for the Beam Straps— No.22 & 23 Perpendicular Steam Pipe & Socket— No.24 a & b Eduction Pipe & Socket— No.25 Condenser & Cover— No.26 Socket for do.— No.27 Blowing Pipe— No.28 Safety Pipe Cover & Gland— No.29 Boiler Steam Pipe & Bonnet— No.30 Socket for do.— No.31 & 79 Straight Boiler Steam Pipes— No.32 Manhole Pipe & Cover— No.33 & 34 Dead & Lintel Plates— No.37 & 38 2 Bearer Bars— No.39 to 56 18 Grate Bars— No.58 Hot Water Pump & Door— No.59 Cold Water Pump & Working Barrel— No.60 Clack Seat & Door— No.61 Suction Pipe— No.62 a & b 2 Stand Pipes— No.77 A Hot Water Cistern— No.78 A Feed Cistern—

Box No.1 Conts. 8 Nozle Valves with Racks, Sectors & Pins; being a double Set.— 4 Steeled (?) Spindles— 4-½ inch Pins, Nuts, &c. for Guides— 14 Do. for Bonnets— 8 Wedges & 2 Brass Guides— All the above belong to the Nozles.—

Box No.2 Conts. Two Radius Plummer Blocks (No.63 & 64)— 8 Pins, Nuts &c. for do.— Saddle Plate (No.65) & 2 Glands (No.66) for inner end of Motion— Saddle Plate (No.67) for Back end of Motion— Gland for the side Straps (No.68)— 5 Pins, Nuts & 2 Plates for Inner end Saddle Plate— Cap for Piston Rod, with Gibs, Cutters & False Piece— Marallel Motion— 3 gages for do.— 2 Beam Straps, Nuts & Washers— 28 Brasses for Parallel Motion & Radius Blocks— 2 Glands for Main Plummer Blocks (No.20).—

Box No.3 Conts. One Set Working Gear— 8 Pins & Nuts for do.— Bucket & Clack for Hot Water Pump— Gearing for do.— Bucket & Clack for Cold Water Pump— Gearing for do.— Stem & Gearing for Safety Pipe & Valve— Iron Work for feeding Apparatus— Rod & Bracket for Cold Water Pump— Blowing Valve— Copper Valve for Safety Pipe— Injection Cock— Rod, Handle & Index for do.— Valve & Spindle for do.— .—

Box No.4 Conts. 36 Pins Nuts &c. for Hot Water Pump— This Box is packed in Box 8.— .—

Box No.5 Conts. 2 Dogs for holding down the Air Pump (No.12 & 13)— Throttle Pipe (No.69) with Brass Collars, Spindle, Gearing & Valve— Cistern Valve & Rod— 16-¾ Inch Screw Pins for Steam Case— 49-½ inch do. for side joints of do.— 25 Screw Pins, Nuts &c. for Cylr. joints— 8 Pins & Nuts to screw Nozles to the Cylr.— Air Pump Bucket Rod & Cutter— Rod & Bracket for Hot Water Pump— Brass for Cylr. Stuffing Box— Brass for top of Air Pump— 4 Brasses for Main Plummer Block— Feeding Valve— Reverse Safety Valve fitted complete.—

Box No.6 Conts. Cast Iron Plug in 2 pieces (No.74).—

Box No.7 Conts. Damper & Frame (No.35)— 3 Screwed Bolts Nuts &c. for holding down the Cylr.— 2 do. for Air Pump— 8 Pins Nuts & Washers for Main Plummer Block— 5 Dozen 1 inch Pins, Nuts & Washers for joints— 3 Dozen ¾ In: do. for do.— 3 Dozen ½ In: do. for do.—

Box No.8 Conts. Air Pump Bucket & 2 Clamps— 2 Brass Valves for do.— 4 Pins, 4 Cutters & a Stop for do.— Stuffing Box for Feeding Apparatus (No.70)— Brass & Iron Wire for do.— False Face for Air Pump (No.71)— 2 Fire Doors & Frame (No.75)— Crooked Pipe for Injection (No.76)— 2 Brass Valves for the top & bottom of Air Pump— 2 Eye Bolts & Cutters for Pivots of Top Valve of Air Pump— 8

Screwed Pins, Nuts &c. for joints of Air Pump— Hinges for Fire Doors— 2 Brasses for Pivots of Foot Valve— Box No.4.— —

Box No.9 Conts. Piston Rod, 2 Gibs & 1 Cutter.—

Box No.10 Conts. Barometer, Pipes, Cocks, Scales & Socket— Steam Gage— 49 feet of 2½ In: feed pipes. 4 feet Gage & 8 Flanches— 2 feet small Pipe for Hot Water Cistern, one piece do. for Stuffing Box of Feeding Apparatus & 6 feet do. for Stem Case— 4 feet Suction Pipe for Hot Water Pump & 2 Flanches— 2 Gage Cocks— 2 Barometer Cocks— 1 Inch Cock for letting Water out of False Bottom.—

Box No.11 2 Weights for Working Gear (No.17 & 18)— 2 Brackets for do. (No.72 & 73)— 8 Brasses for do.—

Box No.12 Conts. Piston & Cover— Plate for Bottom of do.— 26 Screw Pins for do.— 3 Spanners for do.—

Boxes No.14: 15 & 16 Contain Cement.—

Box No. 17 Conts. Pomatum.—

Boiler in 20 Pieces

Box No.13 Conts. Rivets for do.—

Weight of the whole 334 Cwt 1 qu 27 lbs.

BW&C to HvL 1801-05-16

AoS ref. MS 3147/3/506/35. Copy from J.L.Meijer.

This list would appear to be for the erector.

A list of Materials for the Wind Mills of Nieuwkoop & Zevenhofen.—
forwarded from Soho on the 16th May 1801

Marked NZ

- No.1. A Bevel Wheel with 88 Wooden Teeth, with projections for Brake Wheel.—
,, 2. A Bevel Pinion with 58 Teeth, for top of upright Shaft.—
,, 3. A Bevel Pinion 57 Teeth; for bottom of Upright Shaft.
,, 4a. Two Sets of Arms for the Bevel Wheel upon the Axis of Water Wheel.
,, 4b. Nine Segments for Rim of do.— eight only to be used: - one to spare.—
,, 5. Water Wheel Shaft
,, 6a. A Plummer Block & Gland for do.—
,, 6b. Do. Do.
,, 7. Lower part of upright Shaft.—
,, 8. Middle part of— Do.—
,, 9. Upper part of— Do.—
,, 10. Plummer Block for Bottom of upright Shaft.—
,, 11. — Do.— & Gland for top of lower piece of upright Shaft No.7.—
,, 12. — Do.— & — Do.— for lower neck of upright Shaft No.9. -
,, 13. — Do.— & — Do.— for top of upright Shaft No.9. -
,, 14. Great inclined Axis.—
,, 15. Plummer Blocks for small end of Do.—
,, 16 & 17. — Do. & Gland for large end of Do.—
,, 18. Cross at the end of Do.—
,, 19.a. 4 Glands for inner Holes of Cross
,, 19.b. 4 Do.— for middle of — Do.— .—
,, 19.c. 4 Do.— for outer — — Do.— .—
,, 20. A Box Containing
 .6 Pins, Nuts &c. screwing Arms No.4a at center together
 .16 Do. screwing Arms No.4a to Segments No.4b.—
 .16 Do. screwing Segments No.4b together.—
 .4 Do. for Plummer Blocks & Glands No.6a & b.—
 .6 Do. for — — Do.— — Do.— No.11,12 & 13.—
 .2 Do. for — Do.— — 16 & 17.—
 .24 Do. for Cross & Glands
,, 21. A Box Containing
 .4 Brasses for Plummer Blocks No.6.a & b
 .1— Do.— for — — Do.— No.10
 .2— Do.— for — — Do.— No.11
 .2— Do.— for — — Do.— No.12
 .2— Do.— for — — Do.— No.13
 .1— Do.— for — — Do.— No.15
 .2— Do.— for — — Do.— No.16
 1 Steel Plate for Bottom of upright Axis.
 1 Wrought Iron — — — Do.— — —
 1 Cast Iron Plate for small end of inclined Axis.—
 1 Steel Plate for — — Do.— — — —

Canal Wt. of the whole 19 Ton 3 Cwt 0 qu 26 lbs

BW&C to HvL 1801-07-01

AoS ref. MS 3147/3/97/1.

Ref. in [1801-09-24], as being just the covering note for copy of [1801-04-20]; it arrived in badly damaged condition; [1801-08-01] refers to a bundle of drawings accompanied by a letter damaged beyond legibility; from BW&C list [1801-12] this would appear to be [1801-07-01]. Copy was sent with [1801-10-15].

M^r J.D.H. Van Liender
Rotterdam

Soho 1 July 1801

Dear Sir

Since writing to you on the 20th April (of which we annex a copy) we forwarded from hence under date of the 15th & 16th May, the Materials of M^r Blankens Steam Engine and those of the Windmill of Niewkoop and Zevenhofen addressed according to your request to Mess^{rs} Vandyke Gevers & C^o of London, from whom you will have received advice of their having been shipped by Permission of the Privy Council on the (.....) of last Month, and we flatter ourselves that before now they are safe arrived. —

We inclose a list of the Materials provided. Those of the Steam Engine being marked **B** & numbered **1** to **77** and those of the Windmill being marked **NZ** N^o **1** to **21**.

The completion of the Pumps for the Steam Engine has been unfortunately retarded by unforeseen accidents, but we hope to forward them so as to be with you by the time you are sufficiently advanced with the erection of the engine to be ready for them.

The Goods for the Windmill are in every respect as compleat, as we believe they can be made, but from the (.....) in our former letter we cannot afford to charge them at a less (*price*) than £ 600 delivered here, and in case of future orders, we may from the increasing price of Iron, be under the necessity of making some (*addition*). The Carriage of them to London will come to from £ 60 to £ 70. —

In the same parcel with this you have such drawings & instructions for the Erection of the Engine & Windmill as occurred to us to be likely to be useful, and if any difficulties occur, we shall have much pleasure in giving you further information.

Expecting the satisfaction hearing from you soon with an Account of the arrival of the Goods, we remain truly

Dear Sir
Your Ob^t H^{ble} Serv^{ts}
Boulton Watt & C^o

HvL to BW&C 1801-07-16

AoS ref. MS 3147/3/506/36. Docket: Have received Engine Materials— Want pumps. Weight of Windmill castings much exceeds his expectations. Prefers a copper boiler for the Mydrecht Engine. *Copy from J.L. Meijer.*

Mess^{rs} Boulton Watt & C^{ie} at Birmingham

at Rotterdam 16th of July 1801

Dear Gentlemen !

In due time I was favoured with your esteemed letter of 28th of April last (*Ed.Note: that letter is actually dated 20th April*), which gave me to understand, that you had given every possible dispatch to th'Engine, which was then nearly completed, only the pumps were not so far advanced, and this part of th'Engine seems still to be liable to some difficultij, as we have received th'Engine materials according the list send to Mess^{rs} van Dijck Gevers & C^o but no pumps inserted on it, or send off by the goods.— I confide totally on your prudence, in giving more strength and solidity to the Iron materials for the mill which indeed I have found a great deal heavier than I did suppose them; my idea was that the great inclined Axis, and the Waterwheel shaft, should have been cast hollow, and not solid, as I do now find them, your letter mentions that you have spared no expence in filing & getting the Iron teeth of the wheels in the most perfect manner. and in your list of materials you mention a bevel wheel with 88 wooden teeth, this is or seems at least contradictorij; and I long to have your explanation of it.

If we can have a new copper boiler for Meydrecht Engine made of best copper in pieces ready to be nailed together at 855 £st. or three times 285 £ as you mention in your letter, we shall not hesitate to given it the praeferece above an Iron one, as it will last, when made in good order four or five times an iron one and given besides a very good drawback when unfit; for old copper, an old Iron one being of no value.

The coal tar has been omitted, pray be so kind as to send it with the pumps, two barrels will be no object, as it will be not used for Vessels.

It made me verij happy, to be acquainted of the welfare of all my very good friends, at and about Soho; In some few days I hope to do you some remittances on good account. Mean while I wish to be kindly remembered to all of you; being without any reserve

Your Sincere friend

J:D: Huichelbos van Liender

HvL to BW&C 1801-08-15

AoS ref. MS 3147/3/506/37. Docket: Remittance on acct. £ 200.— Has recieved (dr)awings & Instructions, the latter so much mutilated as to be illegible. Stamps B AU 24 801 and FOREIGN OFFICE AU 24 (1801?). Copy from J.L.Meijer.

This letter was sent via Hamburg (see [1801-08-25])

Mess^{rs} Boulton Watt & C^o at Soho near Birmingham
at Rotterdam 15th of August 1801

Dear Gentlemen !

Since my last letter of 16th of past month I have been favoured with a rouleau of drawings, which are come to my hands in very good order, but the letter that accompagnyed it had been teared in such a manner that it has been impossible for me to read the contents or to conceive the meaning of it; therefore I beg to have a copy send me of the same.— These shall most principally serve to hand you for a beginning of my remittances â first bill of exchange drawn from Embden in date of 14th of August by J.Knox at three usances ordre Coysgarne & Lloyds on M^r Sampson Coysgarne Lloyd No.2 St Mildred's Court Poultry London for the sum of 200 £St: of which you will procure the needful, and given mine account credit for it. I should have remitted you more this daij; If I could have found bills on shorter terms of payment; which I hope will succeed better next week.— In hope to receive shortly th' Iron pumps, and Invoice and weight of the different materials; I remain very Sincerely

Your affection: f^d
J:D: Huichelbos van Liender

HvL to BW&C 1801-08-22

AoS ref. MS 3147/3/506/38. Docket: Inclosd. duplicate Bill of Exchange & copy of his former letter. Busy erecting the Engine. The instructions & documents of this Engine much injured in the carriage. Stamps unreadable. Copy from J.L.Meijer.

This letter, with copy of [1801-08-15] and Secunda Bill, sent via direct Vessel, see [1801-08-25].

Mess^{rs} Boulton Watt & C^{ie}. at Soho near Birmingham

Rotterdam 22th of August 1801

Dear Gentlemen !

Below these you will find the coppij of my last letter to the contents of which I refer myself wholly, and these will serve principally to hand you the second bill of exchange of which I have send you the first; these goes by a Vessel directly; and next post I hope to do you more remittances, having given orders for it to mij broker; we are now very busij in erecting the Engine; the boiler has been compleated this week.

I am always very sincerely

Yours

J:D: Huichelbos van Liender

Coppij Mess^{rs} Boulton Watt & Co:

at Rotterdam 15th of August 1801

Since my last letter of 16th of past month I have been favoured with a rouleau of drawings which are come to my hands in very good order; but the letter that accompanied it has been teared in such a manner that is has been impossible for me to read the contents or to conceive the meaning of it; therefore I beg to have â Coppij send me of the same. These shall now principally serve to hand you for a beginning of my remittances á first bill of exchange drawn from Embden; in date of 14th of August by J.Knox at three usances ordre Coysgarne & Lloyds on M^r Sampson Coysgarne Lloyd N^o2 St.Mildreds Court Poultry London for the sum of 200 £st: of which you will procure the needfull, and given mine account credit for it; I should have remitted you more to daij; If I could have found bills on shorter terms of payment which I hope will succeed better next week; In hope to receive shortly th' Iron pumps, and Invoice and weight of the different Iron materials etc.

I remain very sincerely

th' above

J:D:H:vL^r

(Ed.Note: the Secunda Bill sent with this copy of letter 1801-08-15 turned out to be redundant, as the First had arrived safely and had been cashed — and so the Secunda was archived with the letter. It has been reproduced in the section about payments)

HvL to BW&C 1801-08-25

AoS ref. MS 3147/3/506/39. Docket: Remittance of £ 322.7.5.—. Stamps unreadable in copy. Copy from J.L. Meijer.

The letter mentions an Assignat, the description of which looks much like a Bill of Exchange (Lettre de Change); the more usual meaning of Assignat appears to be a form of paper money created during the French Revolution.

Mess^{rs} Boulton Watt & Co: at Soho near Birmingham
at Rotterdam 25th August 1801.

Dear Gentlemen !

The 15th of this month I wrote you per post via Hambro and the 22th of the same by a Vessel inclosing a first and a second of exchange of 200 £St: dated Embden 14th of August at three usances by James Knox order Coysgarne & Lloyds on Mr. Sampson Coysgarne Lloyd N^o2 St.Mildreds Court Poultry London to whom I refer myself; and now inclose by these the three following bills; viz^l a first of exchange from Bremen 24 August at fifteen days date by van Vollenhoven en van Dam to mine order upon Henry Combault & Cie London for 100 £St:— a first of exchange from Bremen dated 13th July at two usances by Th^s B.Templeman van der Hoeven selfs ordre upon Mess^{rs} W^m & John Hulme London the first accepted at Mr John Wollast(?) for 103 £ 2 β 8 pcs One Assignat dated Aberdeen 27th July at fifty days after date from the Commercial Banking Company ordre M^r William Thompson by Al: Chivas Cashier upon G:Fr: Kinloch & Sons in London to me by Th: van Egmont & Sons of the sum of 119 £ 4.9 of these you will procure the needfull and given mine account credit for th'amount— by the following post I send you some more; mean while I remain with every regard.

Dear Gentlemen Your aff^{te} f^d

J:D: Huichelbos van Liender

100. - . -
103. 2. 8
119. 4. 9
£:322. 7. 5

HvL to BW&C 1801-08-29

AoS ref. MS 3147/3/506/40. Docket: Remittance of £927.14.11. Wants a cast iron pot for melting lead and information about the boiler for Mydrecht engine. 4 mills going to be erected to assist in the drainage of Mydrecht.

The lead melting pot mentioned, was most likely needed for HvL's white-lead manufacture. At the time, even relatively thin lead sheets (such as needed for the white-lead process) would be cast, not rolled.

The Mijdrecht drainage, now running in its 8th year, was apparently becoming a desperate undertaking. Even the strengthening of the foot of the encircling dike with a massive cover of sand, did not cure the abnormally large dike seepage. The Blijdorp engine was lying in parts close to the Mijdrecht engine, but political considerations precluded its use, the good old proven Dutch windmill was to be given preference. Of course, the immense difficulties encountered with the Mijdrecht engine may also have played a part.

Mess^{rs} Boulton Watt & C^o. at Soho near Birmingham

Rotterdam 29th of August 1801

Dear Gentlemen !

Last Post (via Hamborough) I wrote you , and did did send you three first bills of exchange amounting together to the sum of 322 £St: 7 β 1 pce to the contents of which letter I refer myself wholly; these principally serve for handing you three other first bills of exchange viz^a a first bill of exchange dated Branch Perth 7 August at 45 days after date by William Marshall Agent for the bank of Scotland; to the order of M^r Alex: Paul, on Mess^{rs} Th^s Coutts & C^{ie} London for the sum of 500 £St. — A first of exchange drawn from Hamborough 20th of August at 2 usances by Lucas Pietersz & Son, ordre Corn: Vanderhoeven & Son, upon M^r Richard Page, London for the sum of 226 £13β 9 pce and a first of exchange drawn from Hamborough 25th of August at two usances by E^d Suurmondts & Sons & C^o mine ordre opon M^{rs} Harman & Co London for the sum of 201 £1β 2 pce — of these you will procure the needfull, and given mine account credit for it; — after I shall have received your Invoices and weight of materials etc I shall remit you the remainder of your due; — praj be so kind as to Acquaint me If I can get from your founderij a cast Lead melting pot of about 38 English inches wide at top, and 20 Inches deep round bottom, weight about eight centners (*Ed.Note: a centenaar was 100 pounds of probably 468 g, i.e. an equivalent of the cwt*) ; and what will be the lowest price.

I wish likewise you would given yourself the trouble to acquaint me in full about the copper boiler of which I wrote you in one of my former letters; as we are absolutely in want of one for Meydrecht engine, At that draining we shall contract next month the building up of four large Wind water vijzel or screw mills to try If with them and th'Engine we shall be able to drain that lake more effectually;—

Yours affect:

J.D. Huichelbos van Liender

(in another hand, probably at BW&C:)

July 1st— with drawings

Augst 31st. id.

Sept 10th—

BW&C to HvL 1801-08-31

AoS ref. MS 3147/3/97/65.

Soho Aug^t 31th 1801

J.H. Van Liender Esq^t
Dear Sir

We have been honored with your obliging favors of the 16th July & 15th Aug^t the latter covering your remittance value £ 200 with which we have done the needful & (*.....ed*) the acc^t to your Credit — The copper boiler for Meydrecht Engine is ordered & will be ready in abt 8 weeks when we shall deliver it to the care of your friends Mess^{rs} Van Dyke Gevers & Co to be forwarded as you direct. — The am^t will not exceed the sum stated to you viz £ 855. We presume it will be unnecessary to enter into explanations in regard to the mode of fixing the wooden teeth into the cast iron rims. The casting itself with the cogs which have been fitted in as a pattern for the remainder, together with the further remarks upon this subject contained in the annexed explanations of the drawings will fully remove your doubts — In machinery similar to yours it is generally preferred to have an alternation of Iron & wooden teeth as they are found to work smoother than Iron & Iron & for this reason we have adopted this principle in the construction of your wheel work — We hand you annexed the particulars of the pumps which have forwarded agreeably (*.....*) & such remarks as (*.....*) to be necessary for your government in putting them together are subjoined —

Those joints which could be made without rendering the pieces too bulky for carriage have been completed here & we hope will not be deranged in their transport to you

The invoice & weight of the materials of the Steam Engine & Windmill were forwarded to you with our letter of the 1st July & if they are not at hand before the receipt (*sic*) of the present we shall transmit you a duplicate by any channel which you may be pleased to point out as the most secure.

Pursuant to the wish expressed in your letter of the 16th July we have repeated the instructions to our agent in town (*Ed.Note: i.e. London*) to ship with the pumps 2 barrels of coal tar if he can obtain permission to that effect which we much doubt.

We are persuaded however he will do every thing in his power to meet your wishes in this respect & shall (*be?*) happy to find that our doubts are premature — It will at all times give us much pleasure to receive tidings of your successful progress in the importa(*nt*) undertakings which you are carrying into effect & with sincere wishes for you(*r*) health & prosperity

We remain

D^t Sir

Your sincere friends
Boulton Watt & Co

BW&C to HvL 1801-09-10

AoS ref. MS 3147/3/97/78.

In the AoS this was accompanied by an unreadable copy of [1801-08-31].

J.H. Van Liender Esq^r

Sep^r 10th 1801

Dear Sir

We had the honor of addressing you on the 31st Utim^o(sic) as per copy herewith & we trust our letter is safe at hand — We hope likewise to learn soon that you have safely received(?) the materials of your pumps with which our agent has obtained permission to ship the two barrels of tar — With many thanks we acknowledge the receipt of your obliging favor of the 24th Utim^o (*Ed.Note: that letter is in fact dated the 25th*) covering sundry bills value together £ 322.7.3 (*Ed.Note: actually 2p more*) with which we shall do the needful & pass the amount to the credit of your acc^t —

The instructions & list of particulars of the pump materials were forwarded to your agent in town (*Ed. Note: =London*) with instructions to send them p^t post via Hamburgh with which we presume he complied & we remain with sincere regard

Dear Sir your obed^t humb Ser^t
Boulton Watt & Co

P.S. Since writing the foregoing your favor of the 29th Ult^o with bills value £ 927.14.11 is just come to hand. We shall do ourselves the pleasure of replying to it p^t first post as time will not now permit before the departure of (.....).

BW&C to HvL 1801-09-17


AoS ref. MS 3147/3/97/89.

J.D.H. Van Liender Esq^d

Soho Sep^r 17th 1801

Dear Sir

Percieving from your several favors that our late letters have not been duly received we beg to observe that we had the pleasure of addressing you one the 1st July with list of Materials on the 31st Augt & 10th Inst which we confirm.

In the postscript of our last we mentioned the receipt of a remittance value £ 927.14..11 which with your former remittance have been carried to the credit of your Acc^t according to the annexed statement which we trust will be found correct. — We have now the pleasure of replying to the other content of your last favor (*Ed.Note: i.e. [1801-08-29]*) in regard to the Lead Melting (*pot*) of which you you enquire the price — Not being an article of our manufactory we sent your description to some neighbouring founders whose particular business it is to make articles of this description. They stated that if the pot is made exactly to your dimensions & weight viz 38 inches top diamr 20 inches deep with a round bottom & to weigh 8 Cwt the price will be 18 shillings p^t Cwt but if it would equally suit your purpose to have it at 30 in^s diam^t & 21 deep of which they (*Ed.Note: "have" omitted*) patterns they could afford it at 16/ p^t Cwt. They desire to know also whether you would prefer it with a flanch thus  or with wha(*t*) are called snugs viz two projections on the sides which are fixed into the brickwork for the purpose of suspending the pot — The former method we believe (.....) most usual & preferable —

Having already noticed to you in our former letter that we have given order for a boiler to be made for the Mydrecht Engine we presume it is unnecessary to say more on this subject at present (.....) that every diligence shall be used in expediting it —

We remain very respectfully

D^t Sir

Your obed^t humble Serv^t
& sincere friends
Boulton Watt & Co

HvL to BW&C 1801-09-19

AoS ref. MS 3147/3/506/41. Docket: Remittance of £200 - receipt of our letter of the 31th Aug. Stamps B SE 29 801 and FOREIGN OFFICE SE 29 1801. Copy from J.L.Meijer.

Sent via Hamburg

Note addition error of 3 pence.

Mess^{rs} Boulton Watt & Co.
at Soho near Birmingham

Rotterdam 19th of 7ber 1801

Dear Gentlemen !

Being till this moment without any of your letters or any Answer upon my former ones, of 16th of July 15th 22th 25th and 29th of last month, by the four last of those I remitted you 200 £St. 322 £ 7 β 8 pce 927 £ 14 β 11 pce In all 1450 £ 2 β 4 pce which I hope will all have come to your hands; safely; — by these you will now receive a first bill of exchange drawn from Zierikzee the 8th of July upon three months date by V.C. Bogaard ordre W^m Cannenburg Gzn(?) to me by Corns. van der Hoeven & Son, upon M^r Richard Page London for the Sum of 200 £St: of which remittance you will do the needfull, and after being paid, given mine account credit for it; and now before sending you any more bills of exchange, I shall expect your answer, advice and accounts; remaining always with every consideration

Your (...) Oblidg^d friend

J.D. Huichelbos van Liender

P.S. after having written this letter; I had the pleasure of receiving yours of the 31th of August, with the duplicate of th'Explanations send with the last drawings for the Steam Engine and th'Iron millwork etc. but no copy of the letter that accompagnied th'original neither th'Invoice of the several castings, only I was advised with pleasure of the good receipt of my letter of 15th of August , with the bill of 200 £St: next post I hope to answer your said letter of last of August, and remain as above th'above

HvL to BW&C 1801-09-24

AoS ref. MS 3147/3/506/42. Docket (on separate wrapper): Copy of his last letter of the 19th Inst. Enclosing sundry duplicates of his remittances. Surprised to find we had ordered a copper boiler without further instruction. Must consult the committee before a positive order can be given for it. Defects in the present one which they have. Query if the cogs are to be made of beech. Has received particulars on the iron pumps. Wants copy of letter of 1 July. Contract for the new drainage mills. Approbation of our castings. *Copy from J.L. Meijer.*

Sent by Vessel, i.e. directly. The current letter is preceded by a copy of [1801-09-19], in which the addition mistake of the original has not been repeated. The copper boiler for Mijdrecht appears to have an elliptical central internal vertical flue which is subject to external pressure and thus liable to crush (= buckle) if not stiff enough. HvL's three measures (circular, and either thickness increase or stiffening hoops) show sound engineering judgment.

Coppij Mess^{rs} Boulton Watt & Co: at Soho near Birmingham
at Rotterdam 19th of 7ber 1801

Being till this moment; without any of your letters or any answer upon my former ones of 16th of July 15th 22th 25th and 29th of last month. by the four last I remitted you 200 £St: 322 £ 7 B 5 pce 927 £ 14 B 11 pce in all 1450 £ 2 B 4 pce which I hope will all have come to your hands safely; by these you will now receive a first bill of exchange; drawn from Zierikzee the 8th of July upon three months by V.C.Bogaard, ordre W^m Cannenburg Gzn to me by Corn^s van der Hoeven & Son upon M^r Richard Page London for the sum of 200 £St: of which you will do the needfull, and after being paid given mine account credit for it, and before sending you any more bills of exchange, I shall expect your answer, advice, and accounts, remaining always etc.—

P.S. after having writted this letter I received yours of the 31 of August with the duplicate of th'Explanations of the drawings for the Steam Engine and the Iron mill work etc but no coppij of the letter that accompagnyed th'original, neither th'Invoice of the several castings only I was acquainted with pleasure of the good receipt of my letter of 15th August with the bill of 200 £st, next post I hope to answer your said letter of last of August.

Messrs Boulton Watt & Co. at Soho near Birmingham
at Rotterdam 24th of September 1801

Dear Gentlemen !

Th'above is a coppij of mine last letter send by post and via Hamborough; and these I intend to send by a Vessel; and with it you will receive the seconds or duplicates of the bills of exchange send you by my former letters viz. a 2^d Bremen 24 Aug. at fifteen days date Van Vollenhoven en Van Dam, mine order, on M^r Combault & Co: London for 200 £St: — a 2^d Bremen 13 July at two usances Th^s B: Templeman van der Hoeven his order on W^m & John Hulme London for 103£2B8pce— â coppij Aberdeen 27th July 50 days after date by Alexander Chivas Cashier for the commercial banking Co: ordre W^m Thompson on G:F:Kinloch & Sons London for 119£4B9pce— a coppij branch Perth 7 August at 45 days by W^m Marshall Agent for the Bank of Scotland ordre Alex^s Paul on Th^s Coult & C^{ts} in London for 500 £St: — a second Hamburgh Sieds Pieters & Zoon 20 August two months ordre Corns. van der Hoeven & Son on Richard Page London for £226.13.9 — a second Hamburg 23 August at two usances by Evert Suesmond Sons & Co.; mine ordre, on mess^{rs} Herman & Co: London for £201.1.2— a second Zierickzee 8th July at three uso by V.C.Bogaard ordre W^m Cannenburg Gzn on Richard Page London for 200 £St: — of them you may make Use when wanted.

And now proceeding to answer your last letter of 31st of August. I was surprised to find you had already given orders for the copper boiler for Meydrecht Engine, without having had my positive orders; as I am only an individual member of the commission appointed by the Executive power for the promoting and effecting the drainage of the Meydrecht Lake, I had wished only to be informed by you, at what sum and in what time you should be able to deliver said boiler; which Information I then should have laid before th'Assembly of the commission; and If by them judged favourable for th'interest of the Country I should have had their formal resolution of ordering one, of which I am now unprovided; But as I know your intention in this has been only to promote our undertaking as much as possible, and bij having seen my desire of getting a boiler from your side; I shall do my utmost to obtain said resolution; at our first meeting together which will be in about three weeks; — but as we have found some faults in the construction of the first copper boiler made here; these ought to be remedied vizt. the tube that goes through the middle of the boiler for conducting the heat and flame through the bodij of boiling water, ought to be of a circular or Cylindrical form, not of an elliptical one, as has been done in imitation of the first iron one as the last form makes it subject to be crushed;— no iron bars for strengthening the boiler ought to be used; as Iron tears the copper away when heated and wet, and thereby

occasions leakage; If the tube is not of very thick copper it ought to be strengthened with copper hoops;— those precautions, we have found necessarij, by our experience of four years, that we have used the copper boiler at Meijdrecht; and which ought to be taken in consideration by the construction of a new one.

With regard to the wooden teeth to be placed in the cast iron Rims, I only wish to know (as your explanation before received is satisfactory enough) If the teeth must be made of the same kind of wood (viz^t beach) as you have send with it, as patterns; or if we must have them made of harder wood, as we commonly do here.

I have with your Agreeable letter well received the particulars of the three Iron pumps, and it gave me great satisfaction to be apprised of their perfection; and to see they were forwarded; but you have omitted to mention whereto; I hope and suppose to London, as that conveijance will make them less liable to be deranged; as when they were to be conveyed via Hull to Embden etc.

Your letter of 1st of July contained only the coppij of your letter of 20th April; which was legible enough for the greatest part; but the letter of said 1st July was so weared away that nothing could be made of its contents; so that I want a copy of said letter and weight and Invoice of received materials and of the pumps etc.

I thank you for your attention in regard to the desired barrels off coal tar, I think that a permission for so small a quantity will not be refused.

The Commission for the promoting of Meydrecht's drainage has contracted the four screw wind watermills for about 10,000 £St: to be ready the first of August 1802.— The mill for putting the Iron machinery in, at the drainage of Nieuwkoop (being N^o9) will be ready the first of November next; I am very curious to see this machinery in its place; this last drainage goes forward enough, notwithstanding some inevitable accidents, which happen from time to time; the water in the Lake being lowered 54 Inches viz^t under Nieuwkoop; and 32 under Zevenhoven being two separate drainages; contiguous to one another and fifteen mills already built up, and about 14,000 perches of 12 Rhijnland feet length of ringdykes made;

I thank you kindly for your friendly wishes; and I see with great pleasure the progresses you have made in th'undertaking of your foundry; as your castings have obtained the greatest admiration of their perfection, by every one who have seen them here— .

I remain always your very sincere friend

J:D:Huichelbos van Liender

(note in another hand, clearly BW&C:)

The seconds sent this Letter seems to be the same as the firsts formerly received entered + forwarded.—

BW&C to HvL 1801-10-01

AoS ref. MS 3147/3/97/95.

J.D.H. Van Liender Esq^d

Soho Oct^d 1st 1801

Dear Sir

We have the pleasure to advise you of the receipt (*sic*) of your favor of the 19th Ult^o with a bill value £ 200 which has been duly placed to your credit.

It gives us pleasure to learn from it that one duplicate of the explanations with our letter of the 31st Aug^t are safe at hand & we trust that the other letters which we have had the honor of addressing to you according to the dates quoted in our last of which annexe you a copy will also be received in course. We beg to add that a duplicate of the List of particulars of the Engine Materials was transmitted to you under the date of our last letter & which we hope will be more fortunate in coming to your hands than the original. —

We remain with great respect

Dear Sir

Your obed^t humble Serv^{ts} & friends

Boulton Watt & Co

HvL to BW&C 1801-10-03

AoS ref. MS 3147/3/506/43. *Docket:* Receipt of our letters of the 31 Aug & 10 Sept. Wants copy of our letter of ye 1st July.— Meeting of the Commission of Drainage hesitate to confirm the order for the Copper boiler, till they receive answers to sundry queries—. *Stamp* FOREIGN OFFICE OC 12 1801. *Copy from* J.L.Meijer.

Mess^{rs} Boulton Watt & Co:
at Soho near Birmingham

at Rotterdam 3th of October 1801

Dear Gentlemen !

The 19th and 24th of Last month, I have wrote you, the first by post via Hamborough; the second by Vessel, with which I have send you the seconds or coppys, of the bills of exchange I had remitted you the first off by former letters;— Since that time I have had the pleasure of receiving your letter by post of the 10th of last month , with a coppij of your letter of 31st of August; but no copy of your letter of 1st of July, which I still want; as likewise weight and invoices of the different materials send over for a new Steam Engine, and for the windmill N^o9 In Nieuwkoop's drainage;— by the contents of your said last letter, of 10th of September, it gave me pleasure to perceive your Agent in town has obtained permission to ship two barrels of coal tar; till this moment I have learnt nothing with regard to the pumps, further, than what your letters have apprised me; and it gave me no less satisfaction to be advised by your said letter, that all my letters and remittances were come safe to your hands.— Since mij former last letter of 24th past to you: there has been a meeting of the members of the Commission for Meydrecht's drainage, to whom I have communicated, that part of your letter, which regards the copper boiler; th'accepting of which they could not resolve upon before they hath recived your answer upon the following quaeries viz^t 1° what thickness the bottom of the boiler will have? 2° what will be the thickness of the sides? 3° what will be the thickness of the cover? 4° what will be the thickness of the inside tube; 5° what will be the dimension of this boiler? and if possible a sketch or drawing of the same is desired; and lastly 6° what will be the weight of the whole?— I wish you will be so kind as to let me have your explicit answer upon those questions, as without them, I shall not succede in obtaining their resolution for accepting said boiler.

In expectation of which I remain always your sincere friend !

J.D. Huichelbos van Liender

HvL to BW&C 1801-10-13

AoS ref. MS 3147/3/506/44. Docket (on separate wrapper): Has procured a lead melting pot in Holland. Complains of the charges for the millwork freight and other items. Reflections thereon and desire to have minute explanations for the satisfaction of the Commission. Copy from J.L.Meijer.

Sent via Hamburg. The reference to a letter of 29 September is HvL's mistake, this should read 24th.

Mess^{rs} Boulton Watt & Co: at Soho near Birmingham

Rotterdam 13th of October 1801

Dear Gentlemen !

My former letters addressed to you are of 19th and 24th of last month, and of the third of this. Since that time I have been favoured with your letter of 17th of last month accompanying your account of the materials, send off from your foundry and a note of the remittances done by me and received by you till that time. Since then you certainly will have received my last remittance of 200 £st: by mine letter of 29th of last month; of which I hope to be apprised very soon; — all your letters are come to my hands not one excepted; only your letter of 1st of July was so much wearied away, that the contents could not be read or conceived.— I give you my thanks for your advice about the lead melting pot, but having had occasion in the beginning of last month to go to Deventer in OverIJssel I have visited and examined th' Iron foundry there, kept up by Ore dug up in some parts of Guelderland; and as they had cast several melting pots for lead melting houses; and the manufacturij could not long be frustrated from that utensil; I have contracted with the proprietors to deliver within a month's time a melting pot of the given dimensions for ten guilders the hundred weight; which is very near the price of 18ß; eviting besides th' expences of freight insurance etc in having it from England;— I have wrote you largely about the copper boiler; and hope to be instructed by you in answer so satisfactorily; that the Commission may take the resolution of accepting it.— And so I am now more or less embarassed with the members of the Commission for executing the drainage of Nieuwkoop; who have had â meeting last Saturday at Haerlem where we were all compleat; by which occasion I gave them to understand, that I had received from you an Invoice of the materials for the machinery of the windmill N^o9; and that you noted them at 600 £ which sum greatly surprised them as exceeding so much the first calculations and pro forma Invoice, and no other or nearer calculation being since mentioned not only, but as being more than double the cost of the machinery If made of wood, even in the time that Oak wood was so extravagantly dear here; I am sollicit by them, to write you seriously upon this subject; as you will observe that our Commission is in every case responsible to the Sovereign, the members of the Commission are instituted by the Executive power, who is â part of the Sovereignitij of the Republicq and we are bound to given account of all the measures and means we make use of in promoting this undertaking and the more so when we hazard new things; If they succeed it is well, but If not, all the blame will fall upon us, and our detractors (as insidious persons are never wanting) will terribly blame us for making use of machinery, which is so very dear, in comparison of what they know is satisfactorij; If we had contracted the mill N^o9 as we have done all th' others, we had been liberated of all account, as we had only gone the common way; but now having entered upon a new sheme; which cost more than double the sum of the old one, oblidges us to produce solid reasons to defend that, as we always have supported and mentioned, that the cost of the Iron plan would not exceed very much that of the wooden one.

It is therefore that I sollicit you Gentlemen in the first place that you will lower your price as much as possibly you can and that you will be so kind as to furnish â circumstantial account of the several pieces of this machinery, to know weight and prices, as you do of the spare buckets, clacks etc of the Great waterpumps for the Steam Engine and lastly that you will furnish me with a memoir to deduce minutelij the reasons of the so much higher expences of this machinerij than stated in the beginning; that I may this altogether communicate to my fellow Commissioners, to disculpate myself, as having so forcibly patronised this new plan, and to serve for our defense; when oblidged to account for this new measure; of which the first cost is besides so greatly aggravated by the following expences of freight from Birmingham to London, from there to Rotterdam, besides insurance commission, reception here, transport to Nieuwkoop, putting the machinery in the mill, al which is an augmentation of expences, above the wooden machinerij; which could have been contracted, and put up in going order, for less than 300 £st: — I must observe that in your account is inserted carriage to Birmingham off Engine materialls 2£10ß2pce for Windmill machinery 3£1ß7pce. I have always mentioned, that these must be delivered at Birmingham for the contracted price; and those expences have never before been inserted in your Invoices.— The sum of 53£1ß3pce which I find noted in in your account for buckets clacks gearing spindles leather etc, I suppose is for a set of spare ones. as in your account, under th' article of a double Engine, you mention the three pumps completely fitted; the freight of th' Engine and mill materials from Birmingham to London is a great deal dearer; than from London to Rotterdam; which is surprising as ship freight was then verij high; What all those heavy and extraordinary charges has occasioned; I cannot tell, but I declare, that in all our former transactions of this kind I never had anij occasion for reflections of this nature; I will not think that,

as it seems the direction of the business at Soho is now wholly left to the care of the Young Gentlemen copartners in the Society; this circumstance contributes something to it; and must unavoidably deter me from enterprising or recommending any new measure(?) of this kind; — I hope you will conceive the want I am in of good arguments to obviate the reflections, that are made by mine fellow Commissioners on this mighty difference; and who do not fail to make me Angry, as the whole direction of this matter has been left to me; and as I never could have thought, that this first essay should have had such an disadvantageous event, of which I am quite unable to give any explanation.

I have had a letter of Mess^{rs} van Dijck Gevers & Co: acquainting me, that they have received the pumps and should ship them hereto at the first opportunity.

I very gladly congratulate you, and myself with the return of the so long desired peace, by which it seems that England has bought the Isles of Ceylon and Trinidad at a much dearer rate, than ever could have been supposed.

I am in hopes that my following letters to you shall not want to go by Hamburg as these shall do; and that our correspondence shall meet a more regular channel, than that round about waij.

I remain with every regard

Dear Gentlemen !

Your Sincere F^d

J:D: Huichelbos van Liender

BW&C to HvL 1801-10-15

AoS ref. MS 3147/3/97/105.

The answers to queries on the "opposite page" have not been found in the AoS.

J.D.H. Van Liender Esq^r

Soho Oct^r 15th 1801

Dear Sir

We have the pleasure to subjoin a copy of our last letter under date of 1st Inst^t since which we have received your favors of the 24th Ult^o & 3rd Inst^t the former accompanying sundry second bills of exchange which we find to correspond with the firsts before received & placed to your credit in conformity to our several letters acknowledging their receipt. — We are sorry to have mistaken your intentions in regard to the copper boiler which we fully understood it was your wish to have ordered without delay as you mentioned that it was absolutely necessary to have a new boiler for the Mydrecht Engine & afterwards that you gave the preference to copper if the price would not exceed £ 854 the amount for which we have contracted to furnish it. The particulars which you desire for the information of the Committee as well as a (.....) of the boiler are stated on the opposite page & we shall be happy to learn that they meet with the approbation of yourself & colleagues — You will observe that from the proposed construction of this boiler it is not likely to be subject to the defects which you experience in your present one, there being neither tube nor stays required — The few copper boilers which are used for our Engines in London are made using the same plan & are found to answer very well —

The few teeth or cogs which we affixed into the Iron rim of the wheel were only intended to shew the form of the teeth & mode of fixing them & not to regulate you in the choice of the wood — Beech is generally used for such purposes in this Country but you may probably have other preferable woods & we conceive it may be advisable for you to employ in this instance such wood as your experience has proved to be best adapted for making cogs —

With the present we transmit you copies of the list of particulars of ye Steam Engine & Windmill Machinery & likewise of our letter of the 1st July which we hope will (.....) safe — Indeed we now flatter ourselves with the prospect of the speedy reestablishment of the commercial & friendly intercourse between our two countries & we trust (.....) the peace which has been so very unexpectedly concluded will soon remove the shackles under which our mutual commerce has so long languished — Wishing you may long enjoy the blessings of peace & health we remain respectfully

Dear Sir

Your obed^t Ser^{ts}
Boulton Watt & Co

P.S. The parcels were assigned as usual to your friends Mess^{rs} Van Dyke Gevers of London & we are surprised that you are yet witho(ut) tidings of their arrival — We shall enquire into ye source of their (.....)

HvL to BW&C 1801-11-03

AoS ref. MS 3147/3/506/45. Docket: Enclosing first of Exchange for £ 70.-. Stamps FOREIGN OFFICE DE 2 1801 and (?)DE 3 801. Copy from J.L.Meijer.

Sent via Hamburg; a copy was sent by Vessel, covered by [1801-11-04], and including the second of the bill mentioned below. This second apparently arrived earlier, and was cashed (its due payment date was 4 November!), and so the first remained in the archive with this letter.

Mess^{rs} Boulton Watt & Co:
at Soho near Birmingham

Rotterdam 3th of November 1801

Dear Gentlemen !

The 13th of last month I wrote you my last letter to the contents of which I refer myself; and by my return from a short tour in the Country Sunday night I found both your letters of 15th last as likewise the coppij of your letter of first of July with a coppij of the List of materials; — Your letter of 15th past will be answered at the first opportunity; these shall mostly serve for conveying to you a first of Exchange drawn from Altona 4th of September at two usances to mine order by U.A.Hoogwerff & Co: upon Mess^{rs} Field & Ronalds London for the sum of 70 £St: of which remittance you will procure the needfull, and given mine account credit for it; Since three or four days the Vessel with the Iron pumps etc. Is arrived here in town from London; Just in time, as with the end of the Year we hope to set th'Engine a going.

I thank you kindly for your friendly wish which I return in all sincerity; and will be glad to be apprised by your rescription of the good state of health my good friends the old gentlemen Boulton & Watt may enjoy; and to meet them in full good health I hope this return of peace will given me an opportunity to; as I greatly long to see and vizit England once more. In this agreeable expectation I remain very Sincerely Yours

J:D: Huichelbos van Liender

(Ed.Note: enclosed Bill of Exchange, italics for handwritten portions; evidently the second, sent with [1801-11-04], was cashed)

P^{ma}. £ 70.— Sterling Altona 4th Septem^r. 1801.
At Two usance pay this our First of Exchange to Mr. J.D.
Huichelbos van Liender or Order Seventy pounds
Sterling Value of him & place to Acco^l. as per Advice
To Mess^{rs} Field & Ronalds
London U.A.Hoogwerff & C^o.

HvL to BW&C 1801-11-04

AoS ref. MS 3147/3/506/46. Docket: Remits £ 70 in a second of exchange. Intends visiting England soon. Stamp (partial) A N(O) 13 8(01). Copy from J.L.Meijer.

Sent by Vessel, i.e. directly. The current letter is preceded by a copy of [1801-11-03].

Mess^{rs} Boulton Watt & Co: at Soho near Birmingham
at Rotterdam 3th of November 1801

Coppij

The 13th of last month, I wrote you my last letter to the contents of which I refer myself; and by my return from a short tour in the Country Sunday night I found both your favours of 15th last, as likewise the coppij of your letter of first of July with a copy of the list of materials

Your letter of 15th past will be answered at the first opportunity; these shall mostly serve for conveying to you a first of exchange drawn from Altona 4th of September at two usances to mine order by U:A:

* Hoogwerff & Co. upon Mess^{rs} Field & Ronalds London for the sum of 70 £St: of which you will procure the needfull and give mine account credit for it;— Since three or four days the Vessel with the pumps etc Is arrived here in town; and just come in time; as with the end of the Year we hope to set th'Engine a going.— I thank you kindly for your friendly wish; which I return in all Sincerity and will be glad to be apprised by your rescription, of the good state of health my good friends the Old gentlemen Boulton & Watt maij enjoy, and to meet them in a very good state of health

I hope this return of peace will give me an opportunity to; as I greatly long to see and visit England once more; In this agreable expectation I remain etc.

*(Ed.Note: at * in margin initialled JWJr)*

Rotterdam 4th of November 1801

Dear Gentlemen !

Th'above is a coppij of the letter I forwarded to you by post via Hamborough; but as the remittance I inclosed in it is so near expired; I send you the second of the bill mentioned above by a vessel, in hope it will reach you sooner; and having now no leisure to add more to these I remain always Yours very sincerely
J:D: Huichelbos van Liender

(enclosed second Bill of Exchange U.A. Hoogwerff & Co.—£ 70 to J.D.H. van Liender on Field & Ronalds, London, 4 Sep 1801 at two usances, i.e. maturing on 4 Nov)

BW&C to HvL 1801-11-10

AoS ref. MS 3147/3/97/132.

M^r J.D.H. van Liender
Rotterdam

Soho 10th Nov^r 1801

Dear Sir

We are much concerned to observe from your favour of the 13th Ult^o that the charges made by us for the Materials of the Windmill and the Extra Materials of the pumps have given rise to some unpleasant observations, but as we do not feel that any blame attaches to our conduct in these respects we flatter ourselves that the Gentlemen Your Colleagues upon a candid review of these transactions, will be induced to think differently.

The causes of the increase of prices of the Materials of the Windmill have already been briefly developed in some of our former letters to you, particularly in that of the 20th April of the present Year, but for the satisfaction of the Commission, we shall now repeat them more at large.

The calculation contained in our private letter to you of the 16th Nov^r 1797, upon which the principal stress appears to be laid, were intended for the purpose of conveying general information, and were perhaps not drawn up with the same accuracy we should have employed in forming the basis of official proposals. You will observe that in them no mention whatsoever(?) is made for some of the most material articles afterwards sent, such as the Cross, its Glands, the Plummer blocks and brasses of all the shafts, which together form a large portion of the total amount. — The dimensions there assigned to the different parts were afterwards very much increased in consequence of the doubts repeatedly stated in the Memorial(s) sent us and the apprehensions so forcefully expressed of the disagreeable predicament in which the Commissioners would be placed in case of a failure from any cause. We refer you to M^r Brunings Memorial of the 15th March 1800 and your letter of the 25th of the same month. We are free to acknowledge that after these cautions and the apparent mistrust which was placed in our judgements, we did not feel ourselves entirely at liberty to adopt those proportions which calculation and practice had taught us to consider as adequate. It appeared to us that in an Experiment where so much responsibility was involved, it was our duty to take perfectly sure ground, and that the first cost would be an object of comparatively small importance with the security and perfection of the Machinery. This led us into several Expenses which formed no part of our original calculation. Instead of using patterns already in our possession, (we) were obliged to prepare an entirely new set at (a) time when both labour & wood were extremely high (&) it also became necessary from the great weights & lengths of the shafts (much exceeding those employed in our Engines) to make expensive additions to our lathe for turning them; and in consequence of the recommendations from your side to attend to good workmanship, as well as our own desire that this machinery should be as perfect as its nature would admit of, we had all the teeth of the Iron wheels accurately filed and dressed with a view to diminish their friction & wear & to make them work without noise. This operation requires much time and skilful workmen and being only done in machinery of the first quality did not enter into our original plan, but we are convinced it is money well bestowed. —

When to all the above considerations, is added the still more important one, of an advance in the price of the Raw material (Pig Iron) of from £ 3 to £ 3.10 per ton, from the time of making our calculations in 1797 to that of executing your Order, it must be obvious to yourself and Colleagues that a very considerable increase in the price of the finished work became necessary. This indeed was partially noticed at the end of our Reply to the Remarks of the directors under date of the 28th October 1799, prior to the receipt of the order for the Materials; and we at the same time further mentioned that the preferable mode of charging might be for us to undertake the delivery of the whole on board ship at Hull or London for a specific Sum. This has of late been our only mode of transacting business in all cases where we are employed both as Engineers and manufacturers, and it is our intention to adhere to it in future, as it leaves us at liberty to proportion the value of the workmanship to that of the material in the manner we consider best from the whole; of which our customers are not in general competent judges. — It is only in cases where a few duplicates, or extra Materials are furnished, that specific charges are needed. But though we must decline a deviation from our general rule, it is our desire to place this matter upon such a footing as we hope will prove equally satisfactory to yourself and colleagues. We propose to leave it entirely to the Gentlemen of the Commission to make such deduction from our charge, as after having impartially considered all the circumstances above stated, may appear to them just and proper. — It is true that at the present prices of Iron and Copper we should not undertake another order for the same materials at a less sum but we are willing upon this occasion to submit to whatever loss they may award, being satisfied that the first introduction of Iron Machinery will lead to extensive future Order(s) from a Country where the advantages of employing capital in providing

durability and perfection is so well understood. Upon this subject, it only remains for us to add, that we are noways anxious to have the Payment compleated until the Machinery has undergone full trial. And in case of a definitive Treaty of Peace between the two Countries taking place before the Mill is erected, we should endeavour to send out a competent person to see the parts properly put together and the whole tried. We doubt not that in such a case, sufficient assurances would be given that he should not be detained beyond the time strictly necessary. —

We now come to reply to the other parts of of your favour. —

The charge of £ 53..1..3 for Buckets & Clacks, is, as you rightly suppose, for a spare set; our original proposal included compleately fitted with what was necessary, but it afterwards occurred that if a spare set should be wanted, they could not be so well fitted to their places when the pumps were gone. We therefore thought we acted for the best in preparing them at that time, although we ought in strict propriety to have had your approbation, and should have applied for it but for the length of time required for a letter to have reached you. As it is, we shall remove all difficulty by proposing that these goods should remain in your hands for our account and not be paid for until some of them may be wanted, when we shall expect to be paid for the whole.

For the carriage to London we have only charged the customary rate of 3/ per Cwt. To H(*ull*) it would have been considerably less, but it wa(*s*) your express order that they should be sent viâ London.

The charge for carriage from hence to Birmingham is customary, and you will se(*e*) that our proposal for the Engine Materials states them to be delivered here; but as you appear to have understood this matter otherwis(*e*) and the charge is not considerable, it may b(*e*) deducted altogether. —

We hope that these explanations and proposals will meet your wishes. They will at least serve to show you that our intentions have been good, and if we have fallen into error, it has proceeded from not attending to the minute caution requisite in treating with public bodies, who not acting for themselves, may not feel at liberty to make the same allowances, an individual would. In all futu(*re*) cases, when we may be favoured with your Commands, it will be a preferable way for u(*s*) to undertake the delivery of the Goods in one of our ports for a specific sum, so that you will only have to calculate upon the additional expence of Sea freight and Insurance.

We are with true regard

Dear Sir
Your obedient Serv^{ts}
Boulton Watt & C^o

BW&C to HvL 1801-11-18

AoS ref. MS 3147/3/97/138.

M^r J.D.H. van Liender
Rotterdam

Soho 18th Nov^r 1801

Dear Sir

We have the honour to inclose you copy of our letter of the 10th Inst^t which we hope has been received and proved satisfactory to the Gentlemen of the Commission.

We have now to acknowledge receipt of your favour of the 4th Inst^t covering the Second of Exchange upon Fields & Ronalds for £ 70, with which we shall do the needful & have duly credited your account.

The same letter contained a Copy of your favour of the 3rd Inst^t, the original of which is not yet received. We are glad to learn the arrival of the pumps & the forward state of the Engine, and it gives us particular pleasure to notice your intention of visiting this Country soon. You will find both our old Gentlemen in the full enjoyment of health & heartily desirous of seeing you again & contributing all in their power to your entertainment during your stay here. —

We are glad to learn that the pacific arrangements are likely to meet with no difficulties from either party and remain truly

D^r Sir
Your ob^t Serv^{ts}
Boulton Watt & C^o

HvL to BW&C 1801-12-12

AoS ref. MS 3147/3/506/47. Docket: Has received our explanatory letter respecting Windmills. Mydrecht Commissioners decline ordering the Copper boiler. Wants Instructions about the Cogs of Wheels. Wishes the weights of the Cast Iron Machinery. Wants the price of ship stoves. Stamps C DE 28 801 and unreadable FO stamp. Copy from J.L.Meijer.

Mijdrecht originally had a B&W iron boiler of the waggon type; when this became leaky it was replaced with a copper ditto. For the next replacement copper boiler BW&C now propose a haystack type, for which the foundations and house would have to be substantially altered, or rebuilt from scratch. For this reason the BW&C boiler was declined.

Mess^{rs} Boulton Watt & C^{ie} at Soho near Birmingham

Rotterdam 12th of December 1801

Dear Sirs !

I am favoured with your letters of 10th and 18th of last month covering your memorial about th' Iron materials for the Windmill N^o9 in Nieuwkoop drainage which I shall lay before the Commission at our first meeting together and I hope will prove Satisfactorij. — This shall mostly serve to acquaint you, that the Commission for Mydrecht drainage have had â meeting and that at the same your letter of 15th October, with the sketch and dimensions of the copper boiler has been duly considered and that we have been obliged to conclude unanimously that your copper boiler can by no means serve our purpose, because it is a round or circular one, which it is absolutely impossible to fit upon the piled foundation, as this foundation is wholly adapted for â long one, according the drawings you have furnished us with, for Meydrecht Engine, which necessitates us to adhere unavoidably to the same form and dimensions as the Iron boiler, which you have send over, at the time with th' other Engine materials; these reasons I doubt not will be found weightij enough with you, to justify the resolution of the commission, for declining its acceptation, as we can in no manner make anij alteration in the foundation brickwork fireplace etc ready to receive the boiler:— besides it seems that copper can be had here at a lower price, than in England, as th' Owners of some capital copper works in Guelderland will engage to deliver â boiler of best hammered Stolberg or Swedish copper in sheets and nailed together for 8 £St: the hundredweight or 160 £St: the tun (*Ed. Note: " ton " meant*), and as by all th' informations we have been able to gather from several parts where copper boilers are much used, our inland copper is preferred for the bottom parts, above English copper, said price for the weight of 8000 lbs would only come at 640 £St: ready delivered and put together upon the spot, will make a mighty difference with 850 £St: delivered with you, and afterwards augmented with th' Expences of Inland Navigation freight Insurance from England, custom house duty here, and transport to Meydrecht expences of nailing the pieces together etc.— The first copper boiler, that was made for Meydrecht Engine has cost a great deal more, because the direction of that undertaking at that time had not addressed themselves to the first men in that line of business.

I thank you for your directions about the cogs of the wheels in the mill machinery. but it would give me great pleasure to have the particular weight of the several pieces of the Iron machinery for the windmill as we had no occasion to weigh them here and as people here make so much noise about the weight for bringing them in the mill; which I suppose will be no greater as of wood; because they are less bulkij; pray be so kind as to let me have this.

A friend of mine desires to know what the price is of the cast Iron fireplaces for Vessels (or combuyses as we call em) wherein they dress their victuals etc

I remain with every regard

Dear Sirs

Your mst oblidge^d frnd

J:D:Huichelbos van Liender

c.1801-12

AoS ref. MS 3147/3/506/2. *Docket:* Reference to correspondence with Mr. Van Liender respecting the Windmills of Nieuwkoop and Zevenhofen 1797 to 1801. *Copy from* J.L.Meijer.

This is an annotated list of correspondence with HvL on the Nieuwkoop and Zevenhoven drainage windmills, covering period 1797-06-14 to 1801-11-10. The list is undated, but can be roughly assigned to December 1801.

*Below is a list of letters in this compilation, which mention the "Ironwork in Windmills" subject; those not in the B&W list are **bold***

1797-06-14, 1797-07-17, **1797-11-05**, 1797-11-16a (memorial), 1798-01-07, 1798-02-01, 1798-03-12, 1798-12-25 (with "undated draft memorandum 1798?"), 1799-05-18 (with "undated revised draft memorandum 1799?"), 1799-08-16, 1799-10-28a, 1799-10-28b, 1800-02-01, 1800-03-15 (with "undated definitive memorandum 1800?"; lost in post, copy sent with 1800-05-07), 1800-03-25, 1800-03-27, **1800-04-15, 1800-05-07, 1800-05-16, 1800-05-19**, 1800-06-05, **1800-06-15, 1800-07-07, 1800-07-09, 1800-08-05, 1800-08-09**, 1800-08-12, 1800-09-30, 1800-10-18, 1800-10-31, 1801-02-24, 1801-04-20, **1801-05-16** (shipping list), 1801-07-01, 1801-07-16, 1801-08-15, 1801-08-31, **1801-09-19, 1801-09-24**, 1801-10-13, 1801-10-15, 1801-11-10, **1801-12-12, 1802-03-02, 1803-04-19, 1803-05-17, 1803-09-06, 1803-09-27, 1803-10-24, 1805-03-25a, 1806-07-07.**

Dates of Documents & Correspondence with Van Liender respecting the substitution of Iron in the Dutch Windmills.

1797

- June 14 Mr. Watt mentions the erection of a Foundry by B&W and that they are prepared to supply all sort of Engine & Mill Materials.—
- July 17 Mr. Van Liender suggests the substitution of Iron for wood in the axis of the Water Wheel & the Groot Aas of the Windmills used for raising water.—
- Nov. 16 B&W's Observations upon the parts of Windmills which may advantageously be made of Iron, containing a pro formâ Invoice (&.). NB This they call our first Memorial.

1798

- 7 Jany. Van Liender mentions having put a translation of our letter into the hands of the Director General, who approves of the suggestions in general. They are to be considered in the assembly of the Commission & we are to have the result transmitted. — V.L. states that the dimensions given in the Groot Moolenbuck differ considerably from those now in use.
- 1 Feby. B&W's letter of this date contains cursory remarks in answer to the above, and states the necessity of our being supplied with plans & sections marking the dimensions of the principal parts of the mills proposed to be erected.
- 12 March Mr. V. Liender states that being no longer in the Commission of drainage, the consideration of our observations must be postponed.
- 25 Decr. Mr. V.L. incloses the Remarks of the Director General & proposes some Queries of his own.

1799

- 18th May V.L.'s letter of this date incloses a duplicate of the above remarks & propos for an Answer.
- 16th August V.L. much displeas'd at not having heard from us.
- 28th Octr. Long letter from B&W to Van Liender explaining the cause of their silence and accompanying a Reply to the Remarks of the Director General, with a drawing of the proposed construction in Iron.

1800

- 1 Feby. V.L. expresses himself fully satisfied with our Explanations & says, that the Iron parts of a Mill will certainly be ordered from us. Orders a Cast Iron Trough.
- 15 March Mr. Brunnings Memorial and Order for the Cast Iron Work for one Mill; with exception of the Great Axis.
- 25th Do. Mr. V.L. advises of the above and strongly recommends attention to the quality of the work, stating the consequences of a failure.
27. Do. V.L. advises of having sent drawings of a windmill as now constructed.
- 5th June B&W's letter to V.L. contains an acknowledg't. of the order, a statement of the time required for its execution and a recommendation to employ also a Cast Iron Cross & inclined Axis. Information of the shipping of the Trough at Hull.
- 12th August V.L. in his letter of this date informs us of the Resolution of the Director to have the great Axis

- made of Iron & leaves us at liberty to adopt such part of the securities proposed by Mr. Bruning as we may think proper.
- 30 Sept. Van Liender complains of the Expence of the Trough & hopes the price of the Millwork will not be in proportion.
- 18th Octr. B&W reply to his observations.
- 31st Do. Van Liender repeats his Comments upon the Expence of the trough, with additional remarks. Hopes our calculations upon the Iron Materials of the Windmills will not so widely differ, or does not know how he shall defend them.

1801

- 24 Feby. V.Liender expresses a wish to have the Castings of the Windmills sent by way of London on acct. of the superior convenience of shipping for Rotterdam.
- 20 April B&W's letter of this date, mentions the probability of the Windmill materials being forwarded (with those of Blanken's Engine) in May; explains the causes of the delay and prepares him for an Increase of Price of the Mill Materials. Contains also a further explanation of the charges for the Trough.
- 1 July Advice of the forwarding of the Materials of the Windmill & Steam Engine on the 15th & 16th May addressed to Messrs Van Dijck Gevers & Co. London. States that from the causes mentioned in our former letter, they cannot be afforded at a less price than £ 600 & that from the increasing price of Iron they are likely to be higher in future.
- 16 July V.L. remarks that he had confided in our giving solidity to the castings of the Windmill & in fact he does find them heavier than he supposed them.
15. Aug. V.L. mentions having received drawings of Windmill (& Engine) but that our letter of 1st Jul(y so) much obliterated as to be illegible.
- 31 Aug. B&W announce the forwarding of the Pumps for Blanken's Engine, explain the construction of the Wheels for the Windmill & offer to send copies of Invoice by any safe Channel which may be pointed out.
- 15 Octr. B&W send Copy of letter of 1st July.
- 13 Octr. V.Liender states a Meeting of the Commission has been held at which the price charged by us for the Windmill Materials has been censored; wishes to have Invoice of Weights & Prices.
- 10 Nov. B&W's Explanatory letter.

BW&C to HvL 1802-02-05

AoS ref. MS 3147/3/97/212.

M^r J.D.H. vanLiender
Rotterdam

Soho 5 Feb^y 1802

Dear Sir

Your favour of the 12th Dec^r did not reach us until long after the time it should have done. We immediately made application to M^r Brodie in London who is the principal manufacturer of Combuyses or shipstoves but did not receive his list of prices until a few days ago.

“a ships hearth to cook for 50 Men costs	£ 77..14..10
“open hearth or (.....) for 25 Men with Kettle	33..-.-
“small stoves for 4 Men given to ships in Ord(.....)	15..-.-

We are no judges of the article, but these prices appear to us high, and as they have been given with some reluctance & apparent jealousy, it is possible that your friend may be better supplied by making his application through a London Merchant.

We observe from your favour that (*the*) Mydrecht Commissioners have countermanded (*the*) Copper boiler, on account of being able to get it made cheaper in Holland. We know not how this happened, as we believe that at the present enormous price of Copper in this Country, no person could afford to do it at a much less rate than we have stated. We had made some progress in (*the*) boiler, before we received your letter of the 3rd October — we shall however endeavour to dispose otherwise of what is done and submit to the loss.

We are sorry to have to acquaint you with the death of our valuable frien(*d*) M^r Matthews, in consequence of which we have found it necessary to establish a house in London for the transactions of the banking and shipping business of the various concerns of this place, under the firm M&R Boulton J&G Watt & C^o. Our establishment for the present, is at M^r Matthews late Counting house No 13 London G^t(?) Fenchurch St^t, where it will give us pleasure to render you any service and remain respectfully

Dear Sir

Your ob^t Serv^{ts}
Boulton Watt & C^o

HvL to BW&C 1802-03-02

AoS ref. MS 3147/3/507/1. Docket: Reasons of the Mydrecht Commissioners for declining boiler. Consoles upon the death of Mrs. Matthews. Commissioners of Nieuwkoop & Zevenhofen satisfied with our explanations. Remits £278.2.8 on account. Advertisements of the Rose Copper Company's bills. Mr. Blanken's engine performs to satisfaction.

The "round about" postal route via neutral Hamburg is no longer needed after the Amiens peace treaty (which eventually held less than a year)

HvL speculates that the high price of English copper may be due to exhaustion of the mines. However, around this time the English (i.e. Cornish) copper mines were fast growing to become the leading copper producers of the world, and would continue to grow until c.1860.

Mess^{rs} Boulton Watt & C^{ie}
at Soho near Birmingham

Rotterdam 2^d of March 1802

Dear Sirs !

Your favour of 5th of last month has come to my hands the 14th of the same in so much shorter time, as my former letter has reached you, notwithstanding it was send by post to Hambro, but we are luckily now freed of that tedious round about way. — I thank you kindly for your enquiries and advice about the ships hearths.—

The reason that the Commission for promoting the drainage of the Meydrecht Pool, has declined th' acceptance of the copper boiler you had ordered to be made, is not to be found in the more cheapness of the boiler contracted here, as this last by the more thickness of its parts shall cost a great deal more than 855 £St: but in the form, as a circular boiler was in no manner to be adapted to Meydrecht Engine and therefore the commission could not have accepted it for that Use, even if it was to be had for nothing. The new boiler is contracted ready and completelij fitted, and put in its place for less than one guilder the pound, or the Centner at 10£2ß6pc. Copper is imported in this Countrij from so manij places, that it may easilij be cheaper here, than with you, where there is so great a demand for it, and your mines perhaps not so rich as formerly. — I condole sincerely with you and participate in the heavy loss you sustained by the death of your estimable friend M^{rs} Matthews, and that by this melancholy circumstance, you have been oblided to form a new establishment which undoubtedly must give you more trouble. — Your explanation about the more expensive amount (than first calculated) of th' Iron materials for the windmill N^o 9 has been duly considered by the Commissioners of Nieuwkoop and Zevenhoven drainages; and they have acquiesced in th' arguments you have produced for it; so that I have given your account credit for th' amount of your Invoice.

I remit you now by these a second bill of exchange, drawn from Hamburg 26th februarij at two months date by Corn: van der Hoeven & Son, mine order, upon M^r Charles Dymoke at Hull payable in London for the sum of =278 £ 2 8 p^{cs}, the first accepted with Mess^{rs} Dorat and Diverst in London, of this remittance you will procure the needfull and give mine account credit for it. In mij former letter I had desired to have the particular weight of the principal pieces of the Iron materials off the windmill, which I will solicit to have If it can be done;

Please to acquaint M^r Matthew Boulton that I received his letter, inclosing the handbill about the loss of the two accepted East India Compagnys bills. the last of februarij; that I have directly wrote to Haerlem to have it inserted in the Gazette of that City, as likewise in the Gazette of this town, and that of Amsterdam being the three most renowned ones; that the publisher of that of Haerlem has received after mine letter and (*Ed. Note: an?*) order from Amsterdam for the same purpose, and that no other precautions are wanted here for stopping the negotiation of said bills. That the reward of 20 guineas seemed abundantly sufficient. And may I request you in the same time to offer my best respects to said gentleman, as likewise to mij most honoured friend M^r Watt Senior being very sincerely

Dear Sirs !

Your m^t ob: S^t & friend

J:D: Huichelbos van Liender

P.S. I ought not to forget, to tell you, that the new Steam Engine at Hellevoetsluysch has been set a going some time ago with the three Iron pumps, that this construction has succeeded, beyond our most sanguine expectations; the working being as smooth easy and regular as can be wished. The six wooden pumps are now in hand and will be ready for working in a short time.

BW&C to HvL 1802-03-08

AoS ref. MS 3147/3/97/252

*Badly faded, barely copyable, transcribed directly from letter book in the AoS.
Account statement precedes letter.*

J.D.H. van Liender Esq ^t D ^t to Boulton Watt & C ^o			
1801			
Sep ^t 17	To balance of account transmitted		£ 676.6.6
Oct ^t 21	To 2 Barrels Coal Tar	£ 3.-.-	
	To 4 Iron hoops each wood do Cooperage	-8.-	
	To shipping on board the Vrouw Heiske Maria Cap: O:Janson	-1.6	<u>3.9.6</u>
			£ 679.16.-
----- C ^t -----			
1801			
Oct. 1	By Bill	£ 200.-.-	
Nov. 17	By D ^o	70.-.-	
1802			
March 8	By D ^o	<u>278.2.8</u>	<u>548.2.8</u>
			<u>£ 131.13.4</u>

M^t J.D.H. van Liender
Rotterdam

Soho 8th March 1802

Dear Sir

We have your very agreeable favour of the 2nd Inst^t covering your obliging remittance of £ 278.2.8 on Mess^{rs} Dorat & Diverst in London with which we shall do the needful and have credited your account as above.

It gives us much pleasure to learn that the new Engine performs so well and that our explanations of the increased cost of the Windmill machinery have proved satisfactory to the Commissioners. We are truly sensible of your friendly attention to this affair.

We have communicated the contents of your favour to our M^t Boulton who desires we will express his thanks for the trouble you have taken. You will please to debit our account with any Expences that may be incurred by You — Not the least intelligence has transpired of the fate of these Bills.

We scarcely know here what opinion to form of the state of the negotiations at Amiens. Peace certainly has not seemed so secure, as we were at one time inclined to suppose it.

At foot you have the weights of the principal castings of the windmill and we remain truly

Dear Sir
Your ob^t h^{ble} Serv^t
Boulton Watt & C^o

N ^o 1	Bevil wheel for brake	cwt weighs about 25½
N ^{os} 2&3	Bevil pinions	d ^o d ^o 12 each
N ^{os} 4&5	Arms & segments of Bevil wheel on water wheel axis	55
N ^o 5	Waterwheel shaft	49½ (Ed. Note: this is probably meant to be No.6)
N ^{os} 7,8&9	Upright shaft weighs together about	60
N ^o 14	Great Inclined Axis	64
N ^{os} 16&17	Plummer blocks for end of D ^o	13½
N ^o 18	Crop at the end of D ^o	64
N ^o 19	Glands for D ^o	19

HvL to BW&C 1802-08-03

AoS ref. MS 3147/3/507/2. *Docket:* Is arrived in London and wishes to know if any of the firm are there.
Intends visiting Soho.

Mess^{rs} Boulton Watt & C^o at Soho near Birmingham

London 3th of August 1802

Dear friends !

I am come to this town with my Sister and another Ladij â friend of us; Intending to staj here about a fortnight, and to make afterwards a tour through some parts of England, I wish to know If anij of your Gentlemen is at present in London; that I may have the opportunitij of seeing him here; In my tour I shall take Birmingham In mij waij; to visit those of your gentlemen who shall then be there. We are lodged at La Sablonieres hotel Leicester Square N^o 29 but otherwise our direction is at Mess^{rs} G: F: Kinloch & Sons bankers here.

Wishing to hear soon from you, I remain meanwhile Yours very sincerely

J:D:Huichelbos Van Liender

HvL to BW&C 1802-08-19

AoS ref. MS 3147/3/507/3. *Docket:* Notice of his arrival and requesting that his letters may be sent to him.

Mess^{rs} Boulton, Watt & C^{ie}

Gentlemen —

Being arrived in this town speedier than we expected by our leaving London; I have had no opportunity to give you any notice before; these is to praij you, If anij letters for me were send from London to your discretion; to have them given to the bearer of these by which you will oblidge

Gentlemen

Your m^d ob: H^c Serv^t
J:D: Huichelbos van Liender

Swan Inn — Highstreet
Birmingham 19th of August
1802

HvL to BW&C 1802-09-13

AoS ref. MS 3147/3/507/4. Docket: Preference given by him to Birmingham over Manch^t. Favourable opinion of M^t Jee. Meeting with M^t W^m Chapman at Hull. Sentiments upon the commerce of Liverpool and Hull. Wishes to know the price of a goldbeaters mould. Answered by James Watt Jr.

From the inquiries after the health of the two Seniors it would seem that HvL, having been in Birmingham only a few weeks before, has not met either of these old friends.

Mess^{rs} Boulton Watt & C^{is} at Birmingham

at Northampton 13th off 7^{ber} 1802.

Gentlemen

In our return from the Northern part of this kingdom we are today arrived here; after having visited many parts of this happy Island with great satisfaction; but the so much renowned town of Manchester has not answered our expectations; we all think it is not comparable in many respects to Birmingham; Undoubtedly there you may see displayed as great an industry as anywhere else; but then the town has so many inconveniences; Is so extremely dirty enjoys so few fair days in a Year that any one who is not necessitated by circumstances would not live there; Liverpool is a town of great consideration for commercial concerns; your friend M^t Jee is a clever young man, as industrious as not always is to be found, having the true spirit of commerce, I wish to procure him some friends in Holland; I found by chance M^t William Chapman at Hull being there on purpose of an enlargement of the Docks, he has shewn me every thing of that kind there: Notwithstanding extensive commerce is going on at Hull, it is quite of another kind than that of Liverpool, on a much smaller scale, not requiring so large capitals, as the commerce of Liverpool must have to command.

I wish greatly to be advised how your M^t Boulton Sen^t does, what tidings you have off M^t Watt and of your Gregory Watt. I wish heartily to receive a favourable one.

Please to acquaint me If a good workman for making moulds to struck gold leaves, is to be found at Birmingham and if so, what price he demands for a perfect good mould; for which he will answer, as it are costly implements, and if not perfect good, very detrimental to those who use them —

Your kind answer to my inquiries directed and under the care of M^t G:F: Kinloch & Sons London; will be very acceptable; mean while accept our best respects always I remaining with every regard

Gentlemen

Your m^t ob: H^c S^t

J:D:Huichelbos van Liender

JWj to HvL 1802-09-16

AoS ref. MS 3147/3/98/148.

M^r J.D.H. Van Liender
London

Soho 16th Sep^r 1802

Dear Sir

I have your favour to BW&C^o of the 13th from Northampton, and the post just going out will only allow me time to say that I have received a letter from my father of the 8th Ins^t from Brussels which place he & M^{rs} Watt had reached without much inconvenience or fatigue. I am sorry that the intelligence from my brother is not so satisfactory. He writes under date of the 26th August from Carlsbad in Bohemia that he has continued extremely infirm & weak. He had not then received the letters which announced his father's and mother's Journey to the Continent and indicates his intention of being at home before the Winter sets in. I am much afraid he will miss my father, and have taken the liberty of addressing a letter to him at your house at Rotterdam, to request he will remain there until he hears from his father, in case he has not received any of the prior letters. If you are writing home, please desire that the latter may remain at your house until his arrival. I have sent (.....) letters in various directions, so that I think some of them cannot fail reaching him. —

To the best of our knowledge no moulds for Gold beaters are made here; we beleive (*sic*) that London is the place for them, but shall inquire & if we learn any thing, will write you again. I beg my best regards to Miss Van Liender & her friend and am with real esteem

Dear Sir

Your ob^t Serv^t
J Watt Jun^r

HvL to JWj 1802-10-12a

AoS ref. MS 3147/3/507/5. Docket: Safe arrival in Holland. Receipt of sundry letters for Mr. Gregory Watt. Estimate of new pumping engine wanted.

[1802-10-12b] was written on the same sheet, but has been compiled separately. The docket covers both letters.

Gregory Watt died on 18 October 1803 of consumption.

M^r James Watt Junior
Birmingham

Rotterdam 12th of October 1802

Dear Sir !

Your letter of 16th of September has been duly received by me in London 18th of the same, and in the last days of said month, we have left the Metropolis, and taken our Journey home from Gravesend in a London trader bound for Rotterdam; with that Vessel we have had a tolerable good passage to Hellevoetsluysch having been more comfortable in his Cabbin (bij being alone in it) than in a much crowded Packet, as theij are now almost; — by my arrival here, I have found and since received several letters for your brother and his compagnon de voyage, from your father and others, and from your brother to your father; and have received one of your brother from Leipzich in date off 6th off September by which letter he mentions to have received a letter of introduction from his father to me which he hoped to have the pleasure of delivering soon personally; and that he had desired his letters to be addressed to me; intending to go from Leipzich to the Hartz and from there thro Westphalia to Holland, not saying any word about the state of his health; this letter has given me great hopes that he must have recovered from his infirmitij; your letter for him is likewise received and put up with th'others. I fear he shall not meet his parents in Germanij; If I have had any direction for addressing a letter to your father, I should have communicated the contents of your brothers letter from Leipzich;

I have found and bought in London a good Mould for gold beating, so that you do not want to trouble yourself any further about it; London seems to be the place for this manufacture. my Sister Joins me in giving you our Compliments and I am very Sincerely

Dear Sir ! Your m^t affe^{te} r^d
J:D:Huichelbos van Liender

HvL to BW&C 1802-10-12b

AoS ref. MS 3147/3/507/5. Docket: Safe arrival in Holland. Receipt of sundry letters for Mr. Gregory Watt. Estimate of new pumping engine wanted.

[1802-10-12a] was written on the same sheet, but has been compiled separately. The docket covers both letters.

The engine is for the "Verveening" (peat extraction project) in the Krimpenerwaard.

Mess^{rs} Boulton Watt & C^o
at Soho near Birmingham

Rotterdam 12th of October 1802

Gentlemen !

I have a Commission to desire your information upon the following object 1st—what size of a Steam Engine single power would be wanted for raising 525 Cubicq feet (Rhymland measure) of water everij minute from three to seven feet height, the raised water being emptied in a tide river, by eb or low water to be raised three feet, and by the common flood tide seven feet, the height varying between these two extremes according the height of the water in the tide river, and that upon the land ? 2^{dly} what such an Engine will cost ? and 3^{dly} in what time you should engage to deliver it from the foundry after having got the order ? This Engine If it will be put up, shall be of a constant Use, and serve in lieu of windmills; therefore as it (*...., letter torn*) will be a Standard Engine and of great consequence for their further introduction in this Countrij; I hope you will value it at the lowest price you possibly can, and let me have the pleasure of receiving your answer as speedij as you can convenientlij given it; in this expectation I remain very sincerely

Gentlemen

Your m^t ob: H^c Serv^t

J:D:Huichelbos van Liender

BW&C to HvL 1802-10-23

AoS ref. MS 3147/3/98/199.

M^r J.D.H. van Liender
Rotterdam

Soho 23 Oct^r 1802

Dear Sir

Your favour of the 12th Inst^t requesting to be informed of the Size, Cost & Time required for the Execution of a Steam Engine with single power capable of raising 525 cubic feet of water Rhymland measure / equal to 575 Cubic feet English per minute, to the extreme height of Seven feet, but varying occasionally from that to 3 feet, has been received & duly considered & we have now the pleasure to state in reply, First, That a Single Engine with a Cylinder of 31½ Inches in D^r with a 2½ feet stroke, working a pump 48 Inches D^r with equal beam, at the rate of 20 Strokes per Minute would be adequate to the extent of the work required (.....) the pump to be so constructed as to deliver at the 3 feet height and to have a lander or box at the top in which the water might occasionally rise to the extreme height specified. We should recommend a Cast Iron beam with parallel motions at both ends instead of chains. We should also think it desirable instead of a lever wall or wooden framing, to support the Center of the Beam by an Iron plate or beams across the house with two Iron Columns or uprights under it.

Secondly, All the Metal Materials of the Engine & Pump, according to the annexed list would amount to £ 960 delivered at Hull and payable in two months from such delivery. — If it is wished that we should furnish any duplicates of Articles not specifically mentioned in the annexed list, they will form an extra charge. Perhaps also it may be desired that the Lander at the top of the pump should be of Iron, in in which case it might be fitted here and charged extra. —

Thirdly. The time of delivery, owing to our having several new patterns to prepare, will be from 9 to 10 months from the receipt of the Order, but we should endeavour to anticipate that period, if possible. —

It will give us pleasure to learn that the above particulars prove satisfactory to the Gentlemen upon whose behalf the enquiry is made, and remain very respectfully

D^r Sir Your ob^t Serv^{ts}
Boulton Watt & C^o

HvL to BW&C 1802-11-02



AoS ref. MS 3147/3/507/6. Docket: Supposed error in our calculations. Doubts upon some part of our statements. Suggests the application of two or more pumps.

HvL's idea for a group of pumps has echoes of the Blanken arrangement for Hellevoetsluis, but here we have a single-acting engine, so the machinery would have to be quite different. With two tides a day, connecting and disconnecting pumps would be quite a task.

Mess^{rs} Boulton Watt & C^o at Soho near Birmingham

Rotterdam 2^d of November 1802

Gentlemen !

Some few days past I was favoured with your letter of 23th last ; the contents of which I shall translate and lay before the Commission for whom I have desired your information; - and by these I shall only make some observations. — If I am right, the 525 Cubicq feet Rhymland measure make only $540\frac{3}{4}$ Cub:feet English, not 575 as you have stated (*Ed.Note: HvL errs, he applies the c.1.03 conversion for linear feet, for cubic measure this is c.1.10*), as 100 inches Rhyml: Measure make 103 English; this will make some difference in the power required. — a length of stroke off $2\frac{1}{2}$ feet , and 20 strokes per minute will only make for the space run through by the Cylinder piston 50 feet, about the half off the space, which Meydrecht Engine piston runs through everij minute. — I do not disapprove â short stroke as this will render the length of the pump very short too, and thereby make the laying of the foundation of the building and pumppit much less expensive and difficult that it otherwise would be; — I do not well conceive, how, by putting a lander or box at the top of the pump, the water will be raised at the height of seven feet by the power of an Engine calculated to raise only to three feet height a column of water of three feet height, without having the power of lessening the diameter of said column. — would it not be preferable to put two pumps under the same beam, one before another, working together when the water is to be raised to the height of three feet, and lessening therebij the diameter of the outermost pump so much, as the column of water raised by the innermost would allow; and then in the case of raising the water at the height of seven feet, put a lander or box at the top of the outermost, and taking off th'innermost, in which case the difference of the diameter off the pump and the box at the top would not be so great. — Or is it unadviseable to connect with the piston rod a machinerij for working five pumps in this form situated  off different diameters so regulated, that all or a certain number of them could be made Use off,  according the height off the outer water, as the raising and falling of this water goes on gradually from the three to the seven feet, during the time of four or four and a half hours in rising and seven or eight hours in falling; such a sheme If it could be brought to any perfection, would be a verij desirable object.

I remain with everij regard

Gentlemen

Your m^t ob: h: Serv^t

J:D:Huichelbos van Liender

M^r J.D.H. van Liender
Rotterdam

Soho 11 Nov^r 1802

Dear Sir

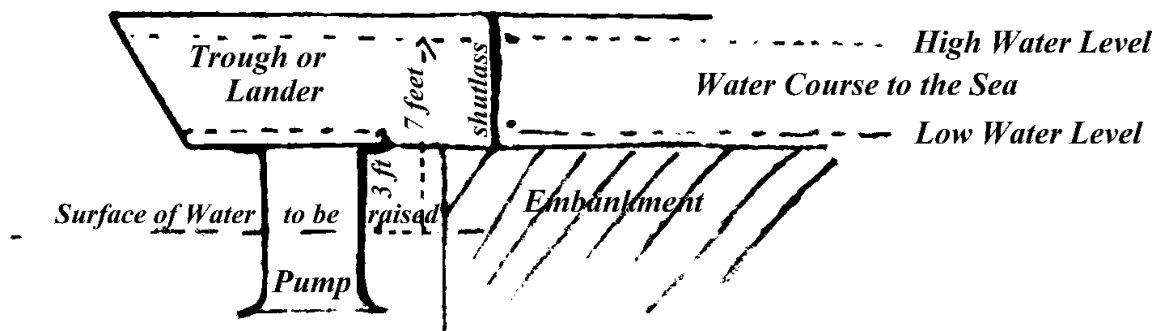
We have your favour of the 2nd Inst^t and shall have the pleasure of stating our Answers to your Remarks in the order in which they occur.

We have assumed for the proportions of the Rhymland & English foot nearly the same Basis as yourself, viz that the former is is to the latter as 100 to 97. But this being the proportion of the measure of length, the cubic measure will be in the Ratio of the Cubes of those numbers, which you will find to give nearly the quantity we have stated.

Our motive for giving so short a stroke to the proposed Engine, was chiefly the one which has occurred to you, the saving of Expencc in the Materials of the Engine & Pump, as well as in the house and Well, but more particularly in the latter which we have understood to have occasioned a considerable part of the outlay at Mydrecht. Engines having short strokes cannot on account of the frequent changes of motion, work through so many feet per Min. as those with long ones without great destruction of the parts.

We have calculated the power of the Engine for the extreme cases, say for delivering 575 English Cubic feet of water per Minute at the height of seven feet. When the Engine is working with a less column of Water the speed may be somewhat increased beyond the 20 strokes per Minute mentioned in our former letter, and you are of course aware that as the height of the Column of Water diminishes, a smaller quantity of Steam and consequently of fuel, will suffice. It being understood that though the speed of the Engine may be somewhat increased, it cannot be so in the same proportion as the load diminishes. —

The following sketch will explain our idea of the application of the Lander to the pump.



The pump is fixed low enough to deliver at the 3 feet height and the Trough or Lander is made somewhat higher than high water, so that the pump can also deliver at that or at any intermediate level. The Water of the sea or river is intended to have free access to the Lander whilst the pump is working and the use of the shutlass (?) or Stopgate is to cut of the communication when any repairs are wanted to be done to the pump. —

It remains for us to state our opinion upon the application of the Engine to the working of two, or more pumps. —

We do not conceive that any advantage would be derived from the use of two pumps one to deliver at 3 & the other at seven feet, because the Engine would only work to its full effect at the two extremes and there would be a waste of power in all the intermediate stages.

If on the other hand the Engine were to be applied to work several pumps, say a small one to the height of 7 feet and additional ones as the column diminished so that upon the average of the whole time of working it might deliver the specified quantity of 575 Cubic feet per Minute; — it is true that a less Engine might do, and that it would require somewhat less steam per stroke when the height of the water was seven feet, but as it would be always fully loaded by the addition of pumps as the height diminished, it would constantly require a full supply of Steam and consequently of fuel. The friction would also be so much greater from the increased surface rubbes over by the leather of the buckets as to absorb a portion of the power & increase the wear & tear of the whole Machinery. Upon the whole it may be presumed that no saving would accrue in point of fuel and the original cost must be very much enhanced by the number of the pumps & the complicated machinery required for working them.

It therefore appears to us that the preference ought to be given to the Engine with the single pump; the expence of the Materials and Erection will be less, it will not expend more fuel to raise the same quantity of Water and its repairs will be far less numerous & expensive. We trust that these reasons will prove satisfactory and enable the Gentlemen concern(*ed*) to decide upon this matter. We remain trul(*y*)

Dear Sir Yours &c
Boulton Watt & C^o

HvL to BW&C 1802-12-17

AoS ref. MS 3147/3/507/7. Docket: Orders 31½ inch pumping engine for the out-turfing of the Crimpenrewaerd. Intends applying additional machinery to the engine. Returns thanks for drawing of corn mill governor.

The corn mill governor is a centrifugal governor which in a corn mill (wind or water powered) regulates the gap between the two stones depending on the speed. It is a feed-forward device, unlike the Watt steam engine speed governor which uses the same two-ball centrifugal arrangement but is a feedback device. The drawing plus description provided by John Southern, would be the basis for a paper in the Batavian Society Transactions, with a silver medal awarded to John Southern [1803-09-06].

Mess^{rs} Boulton Watt & C^o
at Soho near Birmingham.

at Rotterdam 17th off Xber 1802

Dear Sirs !

Both your letters off 23th off October and 11th of November, having been translated by me, I have send this translation to the President off the Commission for benefitting the Verveening (out turfing) in the Crimpenrewaerd (off which Commission I am one off the four members) and having corresponded with said President about the contents off your letters, he has instituted â convocation off all the members off said Commission, besides off the three Commissioners chosen by the land proprietors and undertakers off this Verveening, which is particularly patented by the Government off the Republicq, under limited regulations. — And in this combined Assemblij, it has been unanimously resolved; to desire me, that I should order a Steam Engine from your Manufactorij according the dimensions plan etc proposed and explained by you; in your said letters.

And in the supposition, that you have noted the least price for this Engine viz^t 960 £St: delivered at Hull; it has been agreed, to pay this sum for said Engine, after it has been delivered at Hull; and begging that you will endeavour to shorten the mentioned time off 9 months as much as possibly you can, without injuring in the least the utter perfection of said Engine, th'erection off which, and its good success, will be of infinite consequence for establishing the good opinion off their Superioritij in hydraulic operations; and as for this reason I am Vastly pleased with this verij favourable resolution, I hope and wish, that you will apply everij possible improvement in the construction off this particular Engine; and that you will provide me as soon as a good execution will allow, with the drawings off the building which we intend to erect, as soon as the season will admit.

We intend to prepare for it a very roomy Lander or Stortvloer, in which we shall be able to place pumps or other machinery for raising water, which we may find means to connect with the moving power off th'Engine, without interfering in any wise with your original plan off having only one Standard pump as we cannot resolve to neglect the superfluous power which th'Engine shall possess, in raising the polder water only to three feet height; and as dispatch in the deliverij off the water to be raised, is off great moment in our case;

We consider this Engine, and its concomitant circumstances, as extremely well adapted to make experiments for bringing our System to some perfection.

The letter of your James Watt Junior from London 19th November has been received by me, as likewise the drawing off the Cornmill Governor for which I give my best thanks to your M^t Southern; the drawing and its explanation, seems to me quite satisfactorij for understanding the matter.

I received in the same time with pleasure th'information off M^t & M^{rs} Watt's safe return from Paris, and off their good health, which I hope maij long continue. — And now paying my and my Sister's best respects to all our friends at Soho, I remain very Sincerely

Dear Sirs !

Your m^t ob: H^c Serv^t
J:D:Huichelbos van Liender

HvL to BW&C 1802-12-31

AOS ref. MS 3147/3/507/8. Docket: Incloses copy of his letter of 17 Decr. Confirms the order and requests to have the drawings. Stamps B JA 4 803 and FOREIGN OFFICE JAN 4 1803. Copy from J.L.Meijer.

Copij

Mess^{rs} Boulton Watt & Co: at Soho near Birmingham

Rotterdam 17th of December 1802

Both your letters of 23th of October and 11th of November having been translated by me I have send this translation to the President of the Commission for benefitting the Verveening (outturfig) (*Ed.Note: i.e. peat extraction*) in the Crimpenrewaerd, of which Commission I am one of the four members; and having corresponded with said President about the contents of your letters, he had instituted an assembly or convocation of all the members of said commission, besides of the Commissioners elected by the land proprietors and undertakers of this Verveening; and in this combined Assembly it has been unanimously resolved that I should be desired to order a Steam Engine from your manufactorij according the dimensions plan etc proposed by you in your said letters; and in the supposition that you have noted the least price for this Engine vizt. 960 £St: it has been agreed to pay this sum for said Engine, after its delivery at Hull and begging that you will endeavour to shorten the mentioned time of nine months as much as possibly you can, without injuring in the least the perfection of said Engine; Th'erection of which Engine, and its good success, will be of infinite consequence for establishing the good opinion of their superiority in hydraulic operations; and as for this reason I am vastly pleased with this favourable resolution, I hope and wish that you will apply every possible improvement in the construction of this particular Engine; and that you will provide me as soon as a good execution will allow, with the drawings of the building; which we intend to erect, as soon, as the Season will admit.

We intend to prepare a very roomy Lander or Stortvloer in which we shall be able to place pumps or other machinery for raising water, which we may find means to connect with the moving power of the Engine without interfering in any wise with your original plan of having one standard pump, as we cannot resolve, to neglect the superfluous power which th'Engine will possess in raising the polder waters only to three feet height; and as dispatch in delivery of the water to be raised, is off great moment in our case; we consider Engine and its concomitant circumstances as extremely well adapted, to make experiments for bringing our system to some perfection.

The letter off your James Watt Junior from London 19th November has been received by me as likewise the drawing of the cornmill governors for which I give my best thanks to your Mr. Southern; the drawing, and its explanation, seems to me quite satisfactorij for understanding the matter. I received in the same time with pleasure th'information of M^r & M^{rs} Watt's safe return from Paris, and off their good health, which I hope may long continue; and now pajijng my best respects to all my friends at Soho I remain very Sincerely

Mess^{rs} Boulton Watt & Co: at Soho

At Rotterdam last of Xber 1802

Th'above is a copy of my former letter by which I have given you to understand, that I was authorised by the Combined Assembly of the Commission instituted by the Government and of the Commissioners elected by the Landowners and undertakers of the patented Verveening of about 2800 morgen (5600 acres) Veenland in the Crimpenrewaerd; to order a Steam Engine from your manufactorij, and according the plan proposed in your letters; and that it was agreed by the said assembly to pajij for it, the price mentioned by you, and with the metal materials mentioned on the list Send over by you after it had been delivered at Hull; and having received no answer from you till now; and considering that every loss of time will be detrimental for this concern, I have thought most adviseable, to write you again upon this subject; and to confirm in all the order given you in my said letter of 17th of this month; and solliciting again to prepare and send over the drawings after which we may be able to erect the building immediately; referring further to said coppij I remain Yours very Sincerely

J:D: Huichelbos van Liender

P:S: by rescription please to mention your direction in London; as this perhaps may be wanted.

BW&C to HvL 1803-01-05

AoS ref. MS 3147/3/99/5.

Confirms the order for the Krimpenerwaard engine.

M^r J.D.H. Van Liender
Rotterdam

Soho 5 January 1803

Dear Sir

Your esteemed favours of the 17th & 31st Ult^o have been duly received by us and the answer to the former only deferred until such time as we could prepare & forward the Drawings; but as we perceive that is likely to require some days yet, we lose no further time in acknowledging receipt of your obliging order and requesting you to assure the Gentlemen of the Commission that we shall use our best endeavours to execute the Materials in such a manner as will be satisfactory for them & creditable to ourselves. — The Order will bear Date from the 24th Dec^r upon which it was received and if in our power to anticipate the period pointed out in our letter of 23rd Oct^r we shall have much pleasure in doing so. remaining very respectfully

Dear Sir

Your ob^d hble Serv^{ts}
Boulton Watt & C^o

BW&C to HvL 1803-01-31

AoS ref. MS 3147/3/99/39.

M^r J.D.H. Van Liender
Rotterdam

Soho 31 January 1803

Dear Sir

We have this day forwarded the drawings of the Engine for the Crimpenrewaerd drainage to the care of our Agents in town (*Ed.Note: i.e. London*) with directions to forward them by the first Vessel to Rotterdam.

As you are so fully master of the subject, very few explanations will be necessary. You will observe that we have drawn the house in two ways,

1st with a lever wall in the old way and

2nd (upon lapells) with pillars & a plate across the house in the way we have recommended and in which we shall proceed to execute it unless we hear from you to the contrary. It is drawn in both ways, to enable you to form your own opinion of the advantages of both.

The relative height of the Pump and the Engine is left to be determined by You. It is desirable that Ash Pit should be clear of Water as low as the irregular line or from 12 to 18 Inches beneath the firing stage.

When you have settled this point we shall thank you to let us know the (.....) height for our Government in preparing the rod(?) & pipes of the cold water pump.

The Sump or Well from whence the Water is immediately to be raised, should be as little capacious as convenient, that it may be the sooner emptied when the Clack wants repairs. This may be accomplished by shutting the flood Gates by which the Water enters the Sump, and continuing to work the Engine till the surface of the Water in it is low enough to get to the Clack. The upper floodgate or shutlass by which the Water issues, is then to be shut, and what remains in the Cistern or Lander tapped off into the Sump; the rest will find its way soon through the bucket & Clack. It will be obvious to You that the Size of the Sump or Well must be governed in some degree by that of the Lander, or say of the quantity of Water which will have to be tapped off, & which at high Water will be full four feet deep. It, of course, must not raise the surface of the Sump Water so as to prevent access to the Clack. The best time to examine or repair the clack will however be at or near low water when the Engine will be capable of sinking the Water in the Sump to the lowest possible.

We have not drawn the pump end of the house as it is not essentially necessary that the roof should be continued over the pump but it will make a much more compleat job of it to put the whole under Cover & will not add much to the expence.

With the necessity of securing the foundation particularly the lever Wall by (.....) piling you are so well acquainted that it is not necessary for us to enter into many details.

We shall be glad to hear from you upon receipt of the drawings, with any observations that may occur & remain respectfully

D^r Sir

Your ob^l Serv^{ts}
Boulton Watt & C^o

BW&C to HvL 1803-03-21

AoS ref. MS 3147/3/99/96

Badly faded, not copyable, the few readable fragments transcribed directly from letter book in the AoS; it seems clear that the main message of the letter is a reminder of out-standing BW&C queries.

M^r J.D.H. van Liender
Rotterdam

Soho 21 March 1803

Dear Sir

We had the pleasure of addressing you upon the 31st January informing you of our having forwarded drawings of the Engine House for the Crimpenrewaerd Drainage, with some explanations and queries to the (.....) of which we have since been (.....) of receiving your reply (.....) remarks as have occurred to you (.....)

HvL to BW&C 1803-03-29

AoS ref. MS 3147/3/507/9. Docket: His answer has been delayed by the want of the drawings. Determines upon cross-plate and pillars. Relative height of the pump etc. Will make the well longer than drawn and give good security to the foundations.

Mess^{rs} Boulton Watt & C^o
at Soho near Birmingham

at Rotterdam 29th of March 1803

Dear Gentlemen !

Your verij Agreeable favours of last of January and 21th of this month are duly received, but the late receipt of the drawings mentioned in your first letter has absolutely retarded this answer; it was not before last Saturdaj the 26th of this month, that the Commission has had a meeting to consider the questions proposed in your first letter, by examining in the same time th'abovementioned drawings received only some few daijs before and it has been decided at the same meeting to adhere to the first approved plan viz^t to put the lever upon lapells (*Ed.Note: the word is clearly written, but no engineering usage is known, maybe HvL means a flat plate on top of a pillar*), with two pillars, and a plate across the house, in the way you have recommended it. — The building we shall have made compleat covering the boiler and the pump pit. — The relative height of th'upper part of the pump and of the Steam Cylinder is to be made out by the following admeasurements; the height of the lever wall at th'upper side of the stone pieces whereon th'Iron pillars are to be fixed shall be eight feet above the Summerpeil in the polder or 5½ feet above the Lander or Stortvloer; and the upper side of the lever wall shall be 2 feet 9 inches lower than the lower part or bottom of the Cylinder, the center of th'Iron lever shall be above th'upper side of the lever wall twelve feet and 17 feet 6 inches above the Lander or Stortvloer, th'under or bottom part of the Cylinder shall be eight feet three inches above the same.

These dimensions, I doubt not, will be satisfactorij enough for your Government.

Th'ashpit will always be free of water.

We shall given more room to the sump or well (or as we call it th'Agter Waterloop) than you have drawn it, as we have no fear of being able to drain it, when wanted, and as a free access of the water to the pump is alwaijs an advantage; — besides th'upper floodgates or shutless (*Ed.Note: shuttles? these are automatic hinged gates*) there will be at the fore end of the Voorwaterloop a pair of strong and high floodgates, to prevent the river waters by an uncommon high tide to enter the Voorwaterloop or to come upon the Stortvloer. — Notwithstanding the ground on which th'Engine is to be built up, is far from being a verij bad one; we shall secure the foundation as much as we have ever done before, and include the principal parts in a good casement with palplanches (*Ed.Note: sheet piling*) that no water can have anij access to it. — we have not anij one observation to make, after having examined the drawings, and shall go on now with the building as fast as we can, hoping to receive th'Engine materials on or before the stated term; — Mean while I remain

Yours very Sincerely

J:D:Huichelbos van Liender

BW&C to HvL 1803-04-14

AoS ref. MS 3147/3/99/119.

J.D.H. Van Liender Esq^t

Soho April 14th 1803

Dear Sir

We have been duly favoured with your letter of the 29th Ult^o mentioning the relative heights of various parts of the Steam Engine for our Government in proceeding with the execution of the Same — The measurements are satisfactory, but as we have some doubts whether our interpretation of the term Summerpeil is perfectly correct we have thought it advisable to send you the annexed sketch with the different parts placed according to our conception of your intentions & if we are mistaken in any respect we shall thank you to give us the earliest instruction of our error — We note the determination of the commission in regard to the method of supporting the Lever & shall pay due attention to their directions —

We remain respectfully

D^t Sir

Your obed^t Serv^{ts}
Boulton Watt & C^o

HvL to BW&C 1803-04-15

AoS ref. MS 3147/3/507/10. Docket: Application for the price of a four horse Engine on behalf of Mr H. de Heus. Copy from J.L.Meijer.

The “renseignement” may indicate that BW&C has referred a direct inquiry by De Heus to HvL as sole agent. For the story of this engine, see also [Meijer, 1990].

Mess^{rs} Boulton Watt & C^{ie}
at Soho near Birmingham

Amsterdam 15th of April 1803

Dear Sirs !

Being in this town, and by your renseignement in conversation with M^r H. de Heus of that citij said gentleman desires me to inquire on his account at what lowest price you can deliver him a Steam Engine of the power of four horses, or of equal size with that which is now going on at Rotterdam and what time its construction would require, as he is greatly pressed, to make use of it he wishes that you may limit the time as much as may be possible; your answer upon these quaeries—directed to me at Rotterdam—will be very agreeable to him as well as to yours sincerely

J:D: Huichelbos van Liender

(Ed.Note: in another hand:)

360-370

420 430

(Ed.Note: one may note that the Rotterdam rotative engine mentioned — see list of engines — was bought for £ 420 in 1797/1799)

(Ed.Note: further down:)

plat

HvL to BW&C 1803-04-19

AoS ref. MS 3147/3/507/11. *Docket:* Our drawing sent is perfectly correct with their intentions. Wishes answer about a 4 horse engine for a friend, Mr. de Heus.

Mess^{rs} Boulton Watt & C^{ie} at Soho near Birmingham

Rotterdam 19th of April 1803

Dear Sirs!

Last Friday being at Amsterdam, I had the pleasure, at the request of M^r de Heus, to write you about a very small Engine of the power only of four horses, for driving the machinerij of his manufacture, upon which enquirij I shall expect your answer here, as he seems firmlj intended to put up such an Engine If he can have it in a short time, I hope it will be possible for you to deliver it in a shorter space of time as commonly you seem to want; I have found him a verij spirited Young man, who will make a good employment of such an Engine; and therefore I should greatly wish to see one in his hands. — Some few hours after my return home I received your agreable favour of 14th of this month, with a sketch for explaining your meaning in regard to the water line which we call here the Summer peil being that height, at which the water in the trenches or ditches, cut through the lands, is always kept in Summer time when the cattle is grazing in the meadows, being commonly 18 inches under or below what we call the mayveld (mowfield) (*Ed.Note: =ground level*) which is the surface of the fields, Your annexed sketch is as plain and explanatorij of the situation, and relative heights as it can be and is fully consonant to our meaning, so that you maj proceed accordingly. — within a very short time the piling of the foundation will commence, and as all other founding and building materials are provided, we shall push it on as much as it can; the site of it, being not very far from here, only four or five English miles. — Last Saturday I was at the mill with the Iron machinerij, most parts of it were put together and within a fortnight we hope to make a tryall of it, and see if it surpasses its equal with wooden machinerij.

I remain with everij regard Yours very Sincerely

J:D:Huichelbos van Liender

BW&C to HvL 1803-04-21

AoS ref. MS 3147/3/99/123.

The copy in the AoS is badly faded, this very incomplete transcript cannot give more than a general idea of what BW&C wanted to convey.

J.D. Huichelbos Van Liender Esq^r

Soho April 21st 1803

Dear Sir

We had the pleasure of addressing you on the 14th Inst^t to which we beg your reference. Since that date we have been favored with your obliging letter of the 15th Inst^t & beg to express our thanks for your communications respecting Mr (*de?*) Heus ————— We presume that Engines of 4 or 6 horses power upon the(?) same construction as those which(?) (.....) sent(?) (.....) with side rod & bell crank (.....) (.....) the whole of the metal materials for said(?) Engine delivered at Hull (.....) £ 370 for the 4 horses power & +30 for the 6 horse (.....) This price(?) is (.....) flywheel & the (.....) parts which M^r de Heus will have (.....) the bolts & nuts for fixing (.....) for drawings of the Engine house; but all the expences incidental to the building & wood work as well as those of the erection of the Engine are are to be defrayed by M^r de Heus. — We beg likewise to observe that our charge is exclusive of the Commission which you will have to charge for th'expence(?) & trouble which (.....) occasioned to yourself by M^r de Heus's order, & as this gentleman is a stranger to us we shall expect the payment of our demands to be guaranteed by a house in this Country (.....) at two months date (.....) (.....) the great number of orders which are being received by us within the last months for Engines upon the construction (.....) referd that it will not be possible to complete one for M^r de Heus in less than 10 or 12 months — It would have given us much pleasure to have named a shorter period, but upon our examination (.....) state of our order we do not find that it (.....) to be done consistently with prior engagements — you will oblige us by conveying this information to M^r de Heus & we (.....)

Yours truly
Boulton Watt & C^o

HvL to BW&C 1803-05-17

AoS ref. MS 3147/3/507/12. Docket: Mr. van Heus declines ordering the small engine on account of time. Proposes to execute the wrought iron work in Holland. Enquires what is meant by a horse's power. An 8 horse engine wanted for a fulling mill in Leyden. Iron windmill not yet at work but has been turned around by hand. Mydrecht engine performs well.

The 1802 Amiens peace has broken down, and the Batavian Republic is once again at war with England.

Mess^{rs} Boulton Watt & C^o at Soho near Birmingham

Rotterdam 17th of Maij 1803

Dear Gentlemen !

After having written you the 21th of April, I have been favoured with your letter of the same date in answer to my letter of 15th of the same month; and confess myself of the same opinion with you, that very small steam Engines of of 4 or 6 horses power constructed after the same manner as those I saw at your foundry working with slide rods & bell cranks, and standing upon an independent platform, will be better adapted for driving manij small rolling machines, than those constructed with a beam being above all other considerations, preferable because more simple, and less complicated, it only vexes me very much, that even those, notwithstanding their more simple construction, require so much time for their construction; as this besides th'uncertain circonstances of the publick concerns, prevents M^r de Heus to given his ordres for the construction of one; If peace returns well established, he intends to think further and decidedly upon this subject, this is the answer he has given me by letter after the perusal of the translation of that part of your letter, which contained your answer upon his enquirij. — As I foresee that Steam Engines of small compas for various uses will be demanded, I wish you would given yourself the trouble for finding out, one or other measure for shortening the long term of construction you want now; by instance If you would provide all the cast materials, which, when you are provided with the moulds (*Ed.Note: i.e. patterns*), cannot take you much time; and that we made here in the mean time all the wrought Iron, scaffolding etc after drawings and directions you did provide us with; as the very long term now required, will always be an obstacle for people to resolve on having such an Engine; I sollicit likewise that you please to mention what power nearlij you understand by 4 horses 6 horses 8 horses as this is a question, that is made me manij times; we have here no machinery driven by more than three horses; mostly one or two; because If more power is wanted, wind is applied;

I have now Again been solicited to inquire from you, what will be the tarif, rate or first cost of a Steam Engine able to drive the pistons of a prettij heavij fulling mill, which now work with the help of wind, and which the proprietor wishes to retain in its full order only adapting to it, the Steam Engine for being able to work constantly, without being obliged to depend from the wind, alone; — for this purpose I have been at his mill (being in the vicinity of Leyden) with his mill wright, and after having considered everij circumstance, we are convened, that a Steam Engine's power can be adapted to the working parts of the said mill, only by putting the cranks lifting rod, upon th'upperside of the beam, instead of under the beam, so as at the small Engine here, which alteration in mij opinion can make no difference, If the power works in pushing upwards, or by drawing upwards or vice versa; we likewise were of opinion, that an Engine of 8 horses power would be adequate to the work required; and we did think that the flywheel could not be graetly superior in diameter of that of the small Engine at Rotterdam; as a verij large diameter of that part would be an inconvenience with th'adaptation; Said Gentleman has been here with his millwright to see M^r Boon's small Engine here in working; and this has served greatly to induce him to have a Steam Engine for working his mill which is a very strong and old one; Pray be so kind as to note me the least price of such an Engine, and the shortest time its construction will take, and be without anij fear for its payment, as my friend is a verij creditable and substantial man. — The mill N^o 9 with th'Iron materials is not yet quite finished, but by a tryall made with it last week (when I was there) in turning it with hands it seemed to move very easily, but the fixing of the steel wedges for fastening the cross to the great Axis, seems to be a verij difficult Job

Meydrechts Engine remains working in the best condition possible; I am always with everij consideration,

Dear friends Yours very Sincerely
J:D:Huichelbos van Liender

BW&C to HvL 1803-05-23

AoS ref. MS 3147/3/99/153.

M^r J.D.H. Van Liender
Rotterdam

Soho 23 May 1803

Dear Sir

From your esteemed of the 17th Inst^l we note the determination of M^r de Heus to wait the return of Peace before he resolves upon our Engine.

We are so fully convinced of the propriety of your remarks upon the necessity of preparing the little Engine in less time, that we are now erecting a considerable building for that purpose solely, and hope by the end of the present year to be in a situation to execute them with so much expedition as your friend can wish for. —

An 8 Horse Engine might be completed for your Leyden friend in eight to nine months from receipt of the order. We presume it would be his wish to have it with the recent improvements of Cast Iron Beam, Entablature Plate & (.....), in which case the amount of the Metal Materials would be £ 600 delivered at Hull & payable upon such delivery with a bill of 2 months upon London. We do not see any objection to the fly Wheel being put above the Beam instead of below it, in case the framing can be made sufficiently steady and you can admit the diameter of fifteen feet, which is the size we now use for the 8 horse Crank Engines. The diameter indeed might be reduced by augmenting the weight; but this would be more expensive & would require a new Pattern to be made. If you mention the extreme diameter which can be admitted, we shall state to you in how far we conceive it to be adviseable & what the amount of the additional expence will be.

We are sorry to find the war again con(?)ceived between our two Countries, but no(w) there appears to be no real enmity as far as Holland is concerned, we should hope it will be carried on with as little injury to trade as circumstances will admit of. We are going on with the Engine for the Crimpenrewaerd drainage which we hope to compleat by the period originally specified and shall send it by way of Hull, if no difficulty arises (?).

We estimate the Horse power to be equal to the raising of 33000 lbs weight, one foot high in a minute; being rather more than the average exertion of the strongest horses. When we say and Engine of 4, 6, or 8 horses, we mean that it is equal to the constant joint action of the number of Horses specified each being supposed capable to exert the above power; but in point of fact, if the Engine goes night & day, it would require three times that number of horses to be kept, to do the same work as they must be (.....) to relieve one another every eight hours or oftener.

We remain respectfully
D^r Sir
Your ob^t Serv^{ts}
Boulton Watt & C^o

HvL to BW&C 1803-09-06

AoS ref. MS 3147/3/507/13. *Docket:* The Batavian Society has voted a silver medal to Mr. Southern. Progress made in the Crimpenrewaerd engine house. The Nieuwkoop cast iron windmill set to work and answers perfectly. Wants estimate of three others to be erected next summer.

Mess^{rs} Boulton Watt & C^{ie} at Birmingham

Rotterdam 6th of September 1803

Gentlemen !

I am still in debt of advising you, that I have been in due time favoured with your always much esteemed letter of 23th May, when the commencement of those condemnable dissensions between the governments, who are so detrimental to the welfare of its inhabitants, did put a stop to every new undertaking of employing Steam Engines of your construction in this Countrij; did put likewise a stop to our mutual correspondence. — Th' opening of again of the same is now due to a resolve of the Directors of the Batavian Society; who have voted the giving of a Silver Medal to M^r John Southerne for his drawing and explanation of a regulator or Governor off the mill stones of a grain or corn mill, as they had promised in several of their programma's; — I shall take good care that this medal shall be provided with a suitable inscription; — And when any opportunity offers in those boisterous times to have it brought over and delivered safely; I shall prevail myself of it; — meanwhile I can assure you that the building for the Steam Engine in the Crimpener Waerd advances exceedingly well, and is constructed with every good and possible care, in regard to strength and thightness; — That the Nieuwkoop Scheprad Watermill with cast Iron materials, is since 8 or 10 weeks set to work, and answers most egregiously (*sic. HvL obviously means just the opposite*); and is admired by everij one who sees it, without any body being able to criticise it in the least manner, That we have contracted three other mills of the same size, without anij inside mechanism, being of intention to employ cast Iron materials in every one of them; If we can get them from you and therefore I wish to know, at what sum you will undertake to deliver them; the summer of next year being the time we shall want them. — And now having nothing more to add, than my wishing you all good health and prosperity I remain

Gentlemen ! Your m: ob: H^e Serv^t

J:D:Huichelbos van Liender

BW&C to HvL 1803-09-27

AoS ref. MS 3147/3/100/12.

M^r J.D.H. van Liender
Rotterdam

Soho 27 Sep^r 1803

Dear Sir

It always gives us pleasure to observe(?) a renewal of your correspondence and upon the present occasion we are desired by M^r Southern to say that he is particularly sensible of the trouble you have taken on his behalf with the Batavian Society, and of the Mark of approbation they are pleased to confer upon him.

We notice the progress made in building the Engine house of the Crimpenrewaerd drainage and are happy to (.....) to announce that the Materials are nearly ready, and we shall shortly expect your commands as to the proper mode of forwarding them. In the mean time we write to Hull, to learn what (.....) and whether any difficulties are likely to occur in shipping them for Rotterdam.

The success of the Iron Windmill at Nieukoop gave us much sincere satisfaction & we flatter ourselves that a longer trial (.....) to establish and ascertain its advantages over the former construction. When you or your colleagues have leisure to attend to the subject, we shall be glad to learn what remarks you have made upon the diminution of the friction, or in other words upon the increase of power.

We recommend a (.....) attention to the greasing of the (*noks?*) and the shafts, and taking care that they have sufficient liberty to work and are not bound by screwing the glands overhard. The friction will be considerably less after the first few months, as the parts will have adapted themselves to each other.

In stating our price for the execution of new sets of similar materials, we presumed it will be most efficient that we should consider the delivery made in Hull, as that (*enables?*) you to (.....) at once the whole (*of*) the expences, and considering the peculiar (*cir*)cumstances under which the two countries are now placed, you will perhaps approve of the Payment being made upon such delivery, that we may not incur the risk of their being seized by the French as English property. (.....*ing. th...*); and supposing them to be fitted up in the same compleat manner as the last, the price for each set would be £ 688, and we beleive (*sic*) that the three sets might be delivered at Hull in May or June next, if we were favoured with the order immediately. —

To explain the increase of the price above (*our*) former charge, it may be proper to state (*to*) you that besides the (.....) of the Carriage (.....) considerable rise has taken place in the wages of our (.....) and of some of the raw materials employed, (.....) indeed we had reason to anticipate as you will see by refere(*nce*) to our letter of the (.....); and for any (.....) are not yet to have attained the maximum. —

Your friends here are much in the same state of health as when we had the pleasure of seeing you here and desire to be kindly remembered. With much regard, we remain

Dear Sir

Your ob^l Serv^{ts}
Boulton Watt & C^o

HvL to BW&C 1803-10-24

AoS ref. MS 3147/3/507/14. Docket: Proposes the Crimpenrewaerd engine materials to be shipped to Embden. Increased price of our castings an obstacle to the order being given for the mill work of a second windmill. Can procure them cheaper from the German foundries.

One of the tricks to circumvent the embargo (instead of risking to confront it) becomes clear here: find someone trustworthy in a neutral port willing to have the goods sent to him as if he himself had ordered them, and then trusting him to send them onwards.

Mess^{rs} Boulton Watt & C^o
at Birmingham

Rotterdam 24th of October 1803

Dear Gentlemen !

Your always very agreeable favour of 27th Last came to my hands about one week ago and as what most presses now being the Steam Engine for the Crimpenrewaerd and its conveyance hither, I shall principally attend to in this mij answer; — Last Saturday a meeting of the commission for this object having taken place, I had an opportunity of communicating what you did mention in your letter about that matter, and in consequence of the deliberations entered into at that time, I shall observe to you, that we thought it most adviseable to ship said Engine materials from Hull to Embden, as being a neutral port the risk of capturing will be a great deal less and it may be directed there to the care of M^r Immanuel Frederick Godelman who has received th' Iron through in 1800 and who will perhaps given a declaration that said things are his propertij, and there will be at Hull more opportunity for shipping goods to Embden, than to any port of Holland, the prime of insurance will be less to, these are the considerations which have determined us to prefer the port of Embden, above any one of this Republicq.

What you mention about th' Iron mill machinerij I shall communicate to the commission of Nieuwkoop's drainage, but I fear the higher price you ask will be an obstacle; as founderies here will deliver those castings at a much cheaper rate; we have been in an incessant (*sic*) want of an Iron Waterwheel Shaft which has been cast at Amsterdam in a superior manner off about 49 Centner weight at a very moderate price; — You may depend that this War will be exceeding detrimental to your Manufactories, as it necessitates other people to endeavour to provide emself in what manner theij may; and the German founderies can furnish plenty of castings if they were encouraged;

I hope to receive soon your notice that th' Engine materials are ready and your advice about the shipping at Hull; in which case you will have th' insurance done at that place or in London, and beg to be kindly remembered to all my friends at and about Soho remaining always their most affectionate friend

J:D:Huichelbos van Liender

HvL to BW&C 1803-10-29

AoS ref. MS 3147/3/507/15. Docket: Duplicate of his letter of the 24th. Address for consignment of the engine at Embden.

Copy of [1803-10-24] not strictly verbatim.

Mess^{rs} Boulton Watt & C^o at Birmingham

Rotterdam 24th of October 1803

Copij

Gentlemen !

Your always very agreeable favour of 27th Last came to my hands about one week ago and as what most presses now being the Steam Engine for the Crimpenrewaerd and its conveyance hither, I shall principally attend to in this my answer; — Last Saturday a meeting of the Commission for this object having taken place, I had an opportunity of communicating what you did mention in your letter about that matter, and in consequence of the deliberations entered into at that time, I shall observe to you, that we thought it most adviseable to ship said Engine materials from Hull to Embden, as being a neutral port the risk of capturing will be a great deal less and it may be directed there to the care of M^r Immanuel Frederick Godelmann who has received th' Iron through in 1800 and who will perhaps given a declaration that said things are his propertij; — and there will be at Hull more opportunity for shipping goods to Embden, than to any port of Holland, the praemium of insurance will be less to, these are the considerations which have determined us to prefer the port of Embden, above anij one of this Republicq. — What you mention about th' Iron mill machinerij I shall communicate to the Commission of Nieuwkoop's drainage, but I fear the higher price you ask will be an obstacle, as founderies here will deliver those castings at a much cheaper rate; we have been in an incessant want of an Iron Waterwheel Shaft which has been cast at Amsterdam in a superior manner off about 49 Centner weight, and at a very moderate rate; — You may depend that this War will be exceeding detrimental to to your manufactories, as it necessitates other people to endeavour to provide 'emself in what manner theij may. —

I hope to receive soon your advice about the shipping at Hull; in which case you will have th' insurance done at that place or in London, and beg to be kindly remembered to all my friends In and about Soho remaining always their most affectionate friend

Mess^{rs} Boulton Watt & C^o at Birmingham

Rotterdam 29th of October 1803

Gentlemen !

Above you have a copy off my last letter, which has been directed by a Vessel, leaving this port that day, and as the wind has been verij fair since that time, I hope it will reach you very soon, this goes bij post and I refer myself to its contents; Only adding that the firm of the house of Godelmann is Putter and Godelmann at least it was so in 1800; when I was at their house.

having now for this moment nothing to add, I remain verij Sincerely

Your affection: F^d
J:D:Huichelbos van Liender

BW&C to HvL 1804-01-06

AoS ref. MS 3147/3/100/100.

Above the copy of this letter in the letter book is a blank half-page, indicating that the shipping information mentioned has not been copied.

M^r J.D.H. Van Liender
Rotterdam

Soho 6th Jan^y 1804

Dear Sir

Above you have particulars of the Engine and Pump for the Crimpenrewaerd drainage, which was yesterday forwarded to Mess^{rs} Southern Pearson & C^o of Hull with orders to ship it on board the first Vessel for Embden, assigned to Mess^{rs} Putter and Godelmann in conformity to your directions. We shall get the Insurance effected in London, and you will of course give such directions to Mess^{rs} Putter & Godelmann as may appear necessary for the farther protection & destination of these materials.

We shall forward the drawings with any explanations that may appear(?) necessary, by a private conveyance from Hull or London. It has been our endeavour to make the Engine as perfect in all its parts as possible and we flatter ourselves it will prove a standard for future erections of a similar application.

(Ed.Note: In the letter book there is another blank half-page here)

Wishing these goods safe at hand, we remain with much regard

D^r Sir

Yours faithfully
Boulton Watt & C^o

(Ed.Note: added in another hand:)

Duplicate sent 23 Jan^y 1804

(Ed.Note: neither that duplicate, nor a covering letter for it, have been found in the AoS)

HvL to BW&C 1804-03-02

AoS ref. MS 3147/3/507/16. *Docket:* Remits £500 on acc^t of Crimpenrewaerd engine. Wants account of shipping charges &c.

Rotterdam 2^d of March 1804

Mess^{rs} Boulton Watt & C^o at Birmingham

Dear Friends.

Your verij esteemed and agreeable favour of 6th Januarij and its duplicate are duly received, and according th'advice you gave me of the sending off of th'Engine materials etc for the Crimpenrewaerd towards Hull, I gave immediately directions to M^r Immanuel Frederick Godelmann at Embden to take the necessarij steps for ordering said Engine as for his account to be send from Birmingham to Hull, and to ship the same there for his account and to his direction at Embden and ordering th'insurance to be done in London; which he has advised me to have punctually executed; I hope your friends at Hull will have the goodness of advising me, when the same has been loaded there, that I may know something of the time, we have to expect it at Embden; It gave me great satisfaction to receive your certification of the great perfection you had brought this Engine to, which undoubtedly will serve for a strong recommendation of this so very useful Engine. —

Upon account of th'amount of said Engine I remit you under cover of these =500 £St: in the following bills of exchange on London viz^t One first of exchange drawn from Utrecht 1st of March at three days sight bij Rudolph Bentink ordre J:D: Croese upon Robert Show & C^o at their banking house temple bar for 200 £St: another second of exchange from Embden 28th Februarij upon one month by Jacobus Saftsema to mine ordre upon Mess^{rs} Birkett Fothergill & C^o in London, the first at Mess^{rs} Giles & Hennings for the sum of 200 £St: =a third being a first of exchange drawn from Norden 31 January at two months by Jacob Jansze Fischer ordre Berend Cornelis de Boer upon Mess^{rs} Giles & Hennings for the sum of 100 £St: to me by Jacobus Saftsema making together 500 £St: of which you please to procure the needfull, and give mine account credit for it; and let me have as soon as possible th'account of expences incurred by transporting th'Engine materials to Hull, as likewise th'expences at Hull; that we maij settle the whole account of this undertaking as spedily as possible;

Pray let me know If Mess^{rs} Boult & Jee at Liverpool are still in business and their affairs in order I do not receive any answer from them upon mine letters; theij have bought a parcel of lead for me, but as the ship has been wrecked upon the coast off Ireland, I want the necessary vouchers for proving that nothing has been saved, without which my insurers refuse to paj me mine damages, and as said gentlemen have executed that commission, under benefit of their provision, they ought to procure the same for me, as no other person can be obliged to furnish the same;

Having for this moment nothing more to add I beg my most sincere compliments to all our friends in and about Soho and remain very sincerely

Your very affect: f^d
J:D:Huichelbos van Liender

HvL to BW&C 1804-03-13a

AoS ref. MS 3147/3/507/17. Docket: Duplicate of his letter on 2nd. Transmits seconds of exchange of the bills before sent.

Duplicate not strictly verbatim; inclosed redundant bills not reproduced.

Duplicate

at Rotterdam 2^d off March 1804

Mess^{rs} Boulton Watt & C^o at Soho near Birmingham

Gentlemen !

Your verij esteemed and agreeable favour off 6th of Januarij and its duplicate are duly received, and according th' advice you gave me of the sending off of th' Engine materials etc for the Crimpenrewaerd towards Hull, I gave immediately directions to Mr Immanuel Frederick Godelmann at Embden to take the necessarij steps for ordering said Engine as for his account to be send from Birmingham to Hull, and to ship the same there for his account and to his direction at Embden and ordering th' insurance to be done in London; which he has advised me to have punctually executed; — I hope your friends at Hull will have the goodness of advising me, when the same has been loaded there; that I may know something of the time we have to expect it at Embden; It gave me great satisfaction to receive your certification of the great perfection you had brought this Engine to, which undoubtedly will serve for a strong recommendation of this so very useful Engine. —

Upon account of th' amount of said Engine I remit you under cover of these =500 £St: in the following bills of exchange on London viz¹ One first of exchange, drawn from Utrecht 1st of March at three days sight bij Rudolph Bentink ordre J:D: Croese upon Robert Show & C^o at their banking house temple bar for 200 £St: another second of exchange from Embden 28th Februarij upon one month by Jacobus Saftsema to mine ordre upon Mess^{rs} Birkett Fothergill & C^o in London, the first at Mess^{rs} Giles & Hennings for the sum of 200 £St: a third being a first of exchange, drawn from Norden 31th Januarij at two uso by Jacob Jansze Fischer ordre Barend Corn: de Boer upon Mess^{rs} Giles & Hennings for the sum of 100 £St: to me by Jacobus Saftsema making together 500 £St: of which you please to procure the needful, and give mine account credit for it; and let me have as soon as possible th' account of expences incurred by transporting th' Engine materials to Hull, as likewise th' expences at Hull; that we maij settle the whole account of this undertaking as spedily as possible; — pray let me know If Mess^{rs} Boulton & Jee at Liverpool are still in business and their affairs in good order I do not receive anij answer from them upon mine letters; theij have bought a parcel of lead for me, but as the ship has been wrecked upon the coast of Ireland, I want the necessarij vouchers for proving that nothing has been saved, without which my insurers refuse to paj me mine damages, and as theij have executed that commission, under benefit of their commission of 2^{pr^{ct}}, they ought to procure the same for me; Having for this moment nothing more to add I beg my most sincere compliments to all our friends in and about Soho and remain very sincerely

Yours etc

at Rotterdam 13th off March 1804

Mess^{rs} Boulton Watt & C^o at Birmingham

Gentlemen

By my former letter of 2^d of this month, I had the pleasure of answering your verij agreeable and interesting favour of 6th of Januarij, and of remitting you 500 £St: on account of th' Engine materials for the Crimpenrewaerd, which district of land is now in the greatest want of some powerful Engine, for delivering it from the superfluous water which this wet season has covered it with; standing at the height of 2 feet or 24 Inches R.M. above the Summerpeil, on the lands shewing no other appearance than a lake or an inland Sea. By these I send you the duplicate of my former letter and it shall besides principally serve for handing you the seconds off the bills of exchange of which the first have been inclosed in mine letter of second of March, as far as I have them, viz¹ the second of exchange dated Utrecht 1st of March 1804 at three days sight by Rudolph Bentink ordre J:D: Croese on Mess^{rs} Robert Show & C^o at their banking house Temple Bar to me by Christiaen Brunting for the sum of=200 £St: another second of exchange dated Norden 31th of Januarij drawn on two months after date by Jacob Jansze Fischer ordre Barend Cornelisze de Boer upon Mess^{rs} Giles & Hennings London to me by Jacobus Syftsema for the sum of 100 £St: . The first of the third bill of 200 £St: was to be found in London as you will have seen by the second inclosed in my former letter, to its contents my further referring

I remain with every consideration

Dear friends

Your m^t ob: H^e Serv^t

J:D:Huichelbos van Liender

BW&C to HvL 1804-03-13b

AoS ref. MS 3147/3/100/148.

M^r J.D.H. van Liender
Rotterdam

Soho 13 March 1804

Dear Sir

We have the pleasure to acknowledge receipt of your favour of the 2nd Inst^d covering bills on London as advised to the amount of £ 500 which we have duly passed to your credit with thanks.

We annex a statement of the shipping charges and duties paid by us in Hull and of the Insurance procured in London.

Mess^{rs} Boulton & Jee of Liverpool are separated, we shall write to M^r Jee, who still transacts our business, respecting your affair, and shall inform you what answer we receive.

At the same time we shall write respecting the drawings of the Engine, which we shall endeavour to get sent by some private hand. Your friends here (*Ed.Note: Remainder of ending unreadable*)

(Ed.Note: there follows an account statement)

Mr Van Liender Esq^r D^l
1804(?)

To Boulton Watt & C^o

Jan ^y (?) 5	To the metal materials of a Steam Engine for Crimpenrewaerd Drainage with 3 1/2 In: Cyl ^r 2 1/2 feet stroke with an Iron Beam & 48 In: Pump fitted complete and delivered at Hull.....	}	£ 960. - . -
	To Shipping charges at Hull.....	£ 4.14.10	
	Duty on £ 960 a 1 1/2 p ^t Cent.....	14. 8. -	
	Entry fee & Sufferance	<u>-10. 6</u>	19.14. 4
	To Insurance on £ 960 a 2 G ^s p ^t Cent	£ 20. 3. 2	
	Policy 50/ Commission at London 48/	<u>4.18.-</u>	<u>25. 1. 2</u>
			<u>£ 1004.14. 6</u>

J:D:H: Van Liender Esq^r D^l

1804

To Boulton Watt & C^o

March 12	To account herewith	£ 1004.14. 6	
	By Bills p ^t your favor of 2 ins ^t	<u>500. - . -</u>	
		£ 504.14. 6	
	By 5 p ^t Cent Commission on £ 960	<u>48. - . -</u>	
		£ 456.14. 6	
	To account formerly rendered	<u>112. 3. 8</u>	
		<u>£ 568.18. 2</u>	

Errors excepted

Soho 12 March 1804
Boulton Watt & C^o

BW&C to HvL 1804-03-26

AoS ref. MS 3147/3/100/163

Badly faded, not copyable, transcribed directly from letter book in the AoS.

M^r J.D.H. van Liender
Rotterdam

Soho 26 March 1804

Dear Sir

We wrote to you under date of the 13th Ins^t acknowledging receipt of your Remittance of £ 500 and forwarding statement of some castings(?) for the Crimpenrewaard Engine and also of our mutual account with You. We informed you (.....) should make a (.....) of the great(?) upon the only(?) (.....) the pleasure (.....) your favour of the 13th Ins^t with (.....) We have forwarded the drawings of the Crimpenrewaard Engine to London to be sent to you first safe convoy & when that takes place (.....) you again. Meantime we remain respectfully

Your m^t ob^t Serv^t
Boulton Watt & C^o

HvL to BW&C 1804-04-14

AoS ref. MS 3147/3/507/18. *Docket:* Remits £504.14.6 on account of the Crimpenrewaerd engine. Will remit the balance of his private account soon. Engine arrived at Embden. Hopes to have the drawings soon as they intend immediately to go on with the erection. Mr. Boulton has written satisfactorily about his lead.

at Rotterdam 14th of April 1804

Mess^{rs} Boulton Watt & C^o at Soho near Birmingham

Gentlemen !

I am duly honoured with both your favours of 13 and 26 March last; by the first I have received the desired account of the materials and shipping expences, of the Steam Engine belonging to the Crimpenrewaerd; amounting in all to £1004 14s 6d of which sum deducting the remitted sum of 500 £St: by my former letters, there remains a balance of 504£ 14s 6d in your favour, which balance I have the pleasure to remit you this day. In a première dechange tiré de Embden Le 7^e Avril payable Le dix Juin prochain; par L: Knuijse Junior a l'ordre de Mess^{rs} Couderc D:M:P: Brants pour la Somme de cinq cents quatre Livres quatorze Escalins et six deniers Sterling sur Mess^{rs} Minet & Fector a Londres; of which bill of exchange you will procure the needfull and after getting the moneij; close th'account of th'abovementioned Engine;

Your note of mij general account I have Examined and found right by which the balance I owe you till this day is £64 13s 8d. I intended to remit you this balance today, but have not been able to procure such an apoint, which will follow by the next opportunitij.

In the meantime I have the pleasure to acquaint you that the mentioned Steam engine is safelij arrived from Hull to Embden; which has been a verij grateful news for all concerned; — I thank you kindly for the trouble you have given yourself in writing to M^r Jee, about our parcel of lead; M^r John Boulton has taken up this affair, and has written us a verij satisfactorij letter, which has given full satisfaction to our insurer so that he has desired us to leave the settling of this whole matter to M^r Boulton, which according we have done.

I shall receive the drawings of the Crimpenrewaerd Engine with pleasure, as we intend to erect the same, without delay, as soon as we have brought the pieces together, in and near the building.

Desiring my sincere compliments to all our friends in and about Soho I remain

Your affect: ^d

J:D:Huichelbos van Liender

HvL to BW&C 1804-04-27

AoS ref. MS 3147/3/507/19. Docket: Reference to his last letter & second of the bill enclosed. Remits bal^c. of his private acct. enquires abt a 4 horse Engine. Drawings of Steam Engine arrived safe. Stamp unreadable. Copy from J.L.Meijer.

The "friend in Amsterdam" is H.de Heus, who inquired after a 4 horse engine a year earlier [1803-04-13]. The remainder of the letter concerns payments for the Crimpenrewaerd drainage engine, and for HvL's private account.

at Rotterdam 27th off April 1804

Mess^{rs} Boulton Watt & Co: at Soho near Birmingham

Gentlemen !

Being without anij of your favours, since my last letter of 14th of this month, by which I have remitted you the balance of th'amount of the materials and expences of the Crimpenrewaerd Steam Engine, in a first of Exchange date Embden 7 April for the sum of 504£14ß6p^{ss} which bill I doubt not or is already in Your hands; these serves principally to the second bill of exchange tiré d'Embden Le 7 Avril payable le dix Juin (La première ne l'estant) par Knuyse Junior a l'ordre de Mess^{rs} Couderc D. & M:P: Brants pour La Somme de 504£14ß6p^{ss} sur Mess^{rs} Minet & Hector a Londres; of which second bill of exchange you may make use, in case the first did not come to your hands; In the same time I remit you for mine own account â first of exchange drawn from Embden 16th April, at two usances, by Collings Bowden & Maingy to mine order, upon Mess^{rs} Campbell Bowden & Co: London for the sum off 64£3ß8p^{ss} of which you will procure the needfull, and close with its amount, our mutual long unsettled account.— I have no objections to opening a new one again; mine friend at Amsterdam has now compleated his flatting mill, but he finds the work, If going on as it ought to do, to heavy for horses, which will bring him to the necessity of employing â Steam Engine of about 4 horses power; such a small engine I think you should be able to make ready in a much shorter time as formerly, by the new manufactorij you have erected since some time;

Two days ago I received the rouleau with the drawings for the Steam Engine, in most excellent order. and I doubt not or th'adjoining explications shall be fullij sufficient for our Government, in erecting the parts of th'Engine.— After Wishing you all health and happiness I remain your affectionate friend !

J:D: Huichelbos van Liender

(The first-mentioned second of exchange was not cashed, and remained in the archive; it has been reproduced in the section on payments in the preamble of this compilation)

HvL to BW&C 1805-03-25a

AoS ref. MS 3147/3/507/20. Copy from J.L.Meijer. Docket (by Wm.Cheshire): Animadversions upon the state of public affairs. Rect. of our Letter of the 18 April 1804. Hopes that his letter of the 27th same month (*Ed. Note: more likely 24th*) with the seconds of Bills of Exchange had been received. The Engine for the Crimpenreward finish'd & gives much satisfaction. Observations of Mr.Duyster thereon. Laments the fatal consequences of the war — his friend's intention of erecting an Engine at Amsterdam suspended in consequence of it. The Iron Machinery for the Windmill answers perfectly. Others similar making at Amsterdam. The Bearer of this letter the Son of his friend Mr Van Heukelom — recommends him to our notice.

After HvL's death in 1809, mr van Heukelom jnr. was to take over his contacts with BW&C. The "new undertaking" in the Hoog-Heemraadschap (= hydraulic province, see Glossary) Rhijnland, is the Katwijk canal pumping scheme, see [vdPols & Verbruggen, 1996]. The engine appears to have been ordered in September 1806. With [1807-05-19] HvL assured BW&C, that direct import would be possible, the parts arrived in Rotterdam 1807-08-09 from Hull [Schama ch.12], and the engine first worked mid-1808.

Mess^{rs} Boulton Watt & C^o.
at Birmingham

at Rotterdam 25th of March 1805

Dear Gentlemen !

The very melancholy public circumstances, in which very bad ministers and condemnable Governments, do not hesitate to involve guiltless people, who are compelled to suffer all the calamities, which their wrong practices subject them to are the principal causes for our fainted correspondence; I am however still in debt, of answering your always dear letter of 19th April last Year, by which you have acknowledged the good receipt of mine remittance to your order on Mess^{rs} Minet and Hector in London, and notwithstanding I have not been favoured with any of Your letters since that time I do not doubt or you will have received mine letter of 27th of the same month, including the Second of the Abovementioned bill, and a bill for mine account drawn from Embden 16th April 1804 at two Uzo by Collins Bowden and Maingy to mine order upon Mess^{rs} Campbell Bowden & Co: for the sum of 64£388p^{cc} being for closing up our mutual account current to the said day; and in which letter I advised to have received in the best order the rouleau with the drawings of the Steam Engine for the Crimpenrewaerd. Some time after we received in very good order all the materials of said Engine from Embden; which has since that time been put up, and set to work in the month of November last.— Th'Engine is certainly a very compleat instrument, and pleases extremely to every bodij who beholds it, and by the few tryalls, we have been able to take with it, we are certain, it will fulfill the purpose; for which it is erected; The Machinist who has put this Engine as well as that at Hellevoetsluysch together, has desired me to participate the following remark made by him to you; vizt.—J.J.Duyster (this is his name) is of opinion that the Engine in the Crimpenrewaerd, by leaving of the third valve wants more ballast or weight for overpoising th'Equilibrium than th'other Engine with three valves: — — As he is a very clever and ingenious workman, I wish you will given me your answer upon his animadversion: he is likewise of opinion, that a longer stroke in the Steam Cylinder, in general shall be more advantageous in the consumption of fuel, than a short one; — There has not yet been an occasion that all the members of the Commission for the Government, and the Commissioners for the proprietors of th'undertaking, have been present to take an inspection of th'Engine and its working, but those that have been, have admired it greatly, and have given to understand, their satisfaction of it; for mine part it has charmed me exceedingly.— What you please to mention about the greater amount of its cost, above what you calculated before, this grieves me, because I am of opinion, that nobody can work with more oeconomy than you; having constructed all your apparatus upon â great scale; and thereby given you th'ability of selling or delivering your products as cheap as any where else they can be provided; It is verij certain, that this most fatal war and its concomitant circumstances, are greatly against you; our friend at Amsterdam, with his horse flatting mill, should undoubtedly have resolved to put up â Steam Engine, If it was in time of peace; — By the working of the Windmill with the cast Iron machinerij received from you; the Commission of the Nieuwkoop drainage is so firmly persuaded of its excellency, that we have unanimously resolved , to put Iron machinery in the three mills we are now constructing; but as it is now impossible to get any thing of English Manufactories, at this moment into this Country, we are compelled to have them cast at the foundery at Amsterdam, they being able to cast in once something more than 5000 lbs; which will necessitate us to have the great cross for keeping the Vanes, in two pieces; of which contrivance one of our Overseers has made a very good and ingenious plan and model; the difference in cost shall be very material, they have cast â water axis for one of our mills in a very compleat manner, and very cheap; the draining of Nieuwkoop Lake has been by the help of 16 mills lowered now 12½ Rhijnland feet over an extent of ground of nearly 6000 Acres, and when the three last mills, we are now building; shall be compleated the plas or Lake will be quite emptied from water, which we expect will be in the Summer of 1806.— I have taken duly notice of the price you state now for

making and delivering at Hull an Engine of the same size and quality; which certainly is very high, considering what expences must be incurred besides afterwards; which are all avoided by having it made at this side the water which easily could be done; if the machinery for boring the Cylinders did not want here.— A very great undertaking has been begun last summer in the Hoog-Heemraadschap of Rhijnland; being the cutting of a large Canal, provided with three heavy and strong sluices, from the river Rhine near the village of Katwijk to the North Sea for giving an outlet to the superfluous water of the Country laying along the South borders of said river consisting for the greatest part in drained lakes; This capital work (being an ancient plan) goes on with th'utmost vigour and will be compleated in four or five years, and will given opportunity by every common Eb tide; to exonerate the water of the Canal at least during two or three hours; — This letter shall be brought over to England by the Son of my friend M^r van Heukelom at Leyden who intends to make some staj in that Kingdom to learn the language and to get instruction in different branches of Philosophy; and I prevail myself of this opportunity for having safely brought over the Silver Medal which the Batavian Society has voted to our friend M^r John Souterne for his kindness in procuring me the drawing of the Regulator for the Corn mills; which has been made public in the Transactions of the said Society.— I have taken the liberty to recommend to your kindness by an Introductory Letter said young M^r van Heukelom, being sure of your goodwill in doing every service in your power to any person addressing himself to you from my part.

And now having nothing to add, as that I shall with pleasure be informed of the State of health of all my good friends at Soho, and in its neighbourhood, giving them my very sincere assurance of friendship and well wishes;

Their mst. affect: friend

J:D: Huichelbos van Liender

HvL to BW&C 1805-03-25b

AoS ref. MS 3147/3/507/21. *Docket:* Introducing van Heukelom.

at Rotterdam 25th of March 1805

Mess^{rs} Boulton Watt & C^o Birmingham

Dear Gentlemen !

Under th'auspices of this my letter, I take the liberty of introducing to Your Acquaintance my good friend M^r van Heukelom; who finds his pleasure, to be instructed in every branch of useful knowledge; and as your very extended works contain so many curious objects, he will be dilected by their inspection, which I am certain you will not refuse him; and what other civilities you will please to show him; I shall consider as done to myself, knowing abundantly that I do not want to urge that point between us; I remain very respectfully

Dear Gentlemen

Your m^t ob^t H^e Serv^t

J:D:Huichelbos van Liender

HvL to BW&C 1806-07-07

AoS ref. MS 3147/3/507/22. Docket: Particulars of the situation of an engine to be erected upon the Katwyk & Rhine Canal. Has sent a drawing of the situation etc. Also a memorial upon the Crimpenrewaerd engine by Mr. Blanken Jr. Recommends weighting the outer end of the beam. Desires to have our terms for the execution of the engine and a drawing of the house. Enquires the price of a cast iron cross for a windmill.

A Hoogheemraadschap is the umbrella hydraulic authority over all the individual polders of a region, it could be likened to a hydrological province or department, see Glossary.

A few weeks earlier, Napoleon had replaced the Batavian Republic by the Kingdom of Holland, with his brother Louis Napoleon as monarch; Hvl does not mention this seemingly rather radical change.

Blanken Jr. is Ary Blanken, Jan's younger brother, and Director of the Crimpenrewaard project; Hvl apparently enclosed a preliminary version of [Blanken, 1806].

The "iron cross" for a windmill (the pollend carrying the whips) is apparently too large for Dutch foundries to cast in one piece [1805-03-25a], so it will have to be procured abroad.

Mess^{rs} Boulton Watt & C^o at Soho near Birmingham

at Rotterdam 7th of July 1806

Dear friends !

I have given myself the pleasure of writing you a very extended letter dated 25th March 1805, which has been delivered to you by M^r van Heukelom; but was never favoured with anij of your worthy answer or letter after that time; In said letter I have given you some details of â great work going on now with every desirable good success, for account of the Hoog Heemraedschip of Rhymland, viz^t the cutting of an exoneration canal from the Rhine near Katwyk to the North Sea; and as the Directors and projectors of this undertaking, by the Advancement of the work, do find that for making it more complete, and more answering the end proposed by its construction, a method for scouring now and then the said canal is absolutely wanting, as likewise there is wanting in the heat of summer one or other means flooding or watering some parts of the Country in the neighbourhood of the Canal, which by the cutting of it, are now deprived of a sufficient irrigation. And as by weighing and considering every method, which can be employed for obtaining both these ends; they have concluded that no other waij can be made Use of, for being certain of arriving at the desired end, than to employ â Steam-Engine of a sufficient power; and in consequence of their conclusion on this point; theij have made an official proposal of their plan and project to the College of said Hoog Heemraedship; who after sufficient deliberations with all the Members, have agreed and consented in the said proposal, and have given them sufficient power for treating with me in order to obtain from you Said desired Steam-Engine; which I hope you shall find means of shipping off, from one of your ports, to one or other neutral port in our neighbourhood; If before that time we do not enjoy the happiness of â salutary peace; which every sensible man in everij part of Europe must wish for; — To make the proposed plan as explicit to you as possibly we can; in order to evite as much mutual correspondence and gain so much more time, I have joined to this letter â drawing of said Engine, by which you will see, what are the principal points, measures, and determinations, we ought to have in view, by the planning and constructing of Said Engine; — One of these is, what we know and call the Amsterdamsch Peil **AP**, which is â firm fixed and determinated line, for regulating all th'others; below this peil or regulating line, 1st the foundation of the Pump pit, cannot (without incurring many difficulties and subjecting to heavy expences) be laid deeper or lower than seven feet (Rhymland measure) and the waterline in the canal falls never lower than thirty inches below the **AP**. — 2nd The Stortbak or upper discharging canal or through may be raised to the height of seven feet above the **AP** being then even with the ground or earth; those determinations can serve sufficiently for regulating the length of the stroke, and other dimensions of the principal parts of th'Engine. — 3rd The Engine may and must be able to raise the water from 2½ feet below to 5 feet above the **AP**, and in consequence 7½ feet Rh: Meas: as its utmost height of raising be considered. — 4th The product or quantity of water raised per minute, ought not to be less than 150 tuns of 5¼ Cubicq feet each or about 800 Cubicq feet R:M: rather more than less, If th'expences will not be materially increased; — As I am confident that th'above will be satisfactorij for your Government in planning th'Engine; I wish to be informed as soon as convenient, If it is possible to get such an Engine (single power) and what alterations you think necessary to make in the on this side formed plan; and to send me thereabout Your prescriptions, that this summer the foundation, and as much of the building may be forwarded, as will be in our power, the intention is, as you will see by the drawing, to include th'Engine, boiler, pump and appurtenances within the building; Another consideration I must submit to your judgment, viz^t If it would not be adviseable to make one end of the Iron cast lever rather heavier, that by the working of th'Engine, the lever should be in Equilibrio, without being balanced by other pieces of Iron, as by th'Engine Crimpenrewaerd, we have been obliged to have two pieces

Iron cast of about =1000 lb weight together; by your answer I expect your calculation of the lowest term you shall charge for said Engine, and a sketch or drawing to proceed on with the building; — I have joined to this a short memoir containing some experiments made with the Engine of the Crimpenrewaard to ascertain its power or product made by the directors of said patented Verveening or (Outfenning); and directed to the Batavian Society with a map of the Crimpenrewaard made after its measurement done by the same Engineer; who is a brother of M^r John Blanken J^s Son director of the sluysch and dokworks at Hellevoetsluysch;

I have nothing more to add to this letter only I wish to be informed If a cast Iron Cross for putting the sail arms in for a windmill of the same size, as what you have send over, could be get from you; — And now wishing all mij good friends at and about Soho health and happiness, I remain sincerely their very obliged friend and humble Servant

J:D:Huichelbos van Liender

HvL to BW&C 1806-08-11

AoS ref. MS 3147/3/507/23. *Docket:* Refers to and recapitulates the contents of his letter of the 7 Jul. Recommends the house of Coysgarne & Lloyds to supply us with old iron.

at Rotterdam 11th of August 1806

Mess^{rs} Boulton Watt & C^o at Soho near Birmingham

Dear Sirs !

The 7th of last month I had the honour of writing you under cover of my correspondents G:F:Kinloch & Sons in London, accompnayed by a Short memoir on the tryalls made with the Steam Engine in the Crimpenrewaard illustrated with a map of the said Waard, and a print of said Steam Engine; Which letter was principally intended, to contract with your house about another Steam Engine; to be employed at the new cut or Canal at Katwyck, which arduous undertaking goes on very successfully; but to make it quite compleat, a Steam Engine is wanted; of which besides the description of its principal parts, I have included a sketch to make every circumstance as plain as possibly I could, that you should be able to send us a drawing for beginning directly to build up the house as we are greatly pressed, to put it up in conformity with the other parts of this uncommon work; — I doubt not or said letter is come to your hands, as already answers are received here, on letters send at the same date, and with the same conveyance to England; and that I may expect every day your grateful answer and so much more now, as we maij with everij fiducity depend on an approaching end of the so long extended hostilities;

This letter you will receive under cover of one of mij most intimate friends; Mess^{rs} Coysgarne & Lloyds; who are in th'opportunity of serving you completely in furnishing Your foundry with old Iron from here, which by the altered circumstances shall again be permitted to export to England; in which case, I sollicit your favour in giving your orders for that object to my said good friends, being firmly convinced their attention and punctuality in fulfilling your commands, will given you full satisfaction, and given me great pleasure, If it will suit you to make use of their Service;

In expectation of your desired answer Upon my several former letters

I remain with every regard

Dear Gentlemen !

Your m^t ob^l H^c Servant
J:D:Huichelbos van Liender

HvL to BW&C 1806-09-29a

AoS ref. MS 3147/3/507/24. *Docket:* Order for the engine for the Katwyk & Rhine Canal. Will adhere to the plans and directions sent them. Wishes our advice about a debt to him by Mr. John Blunt of Liverpool.

Mess^{rs} Boulton Watt & C^o at Soho near Birmingham

at Rotterdam 29th of September 1806

Dear Gentlemen !

Your very agreeable favour of 9th of August came into my hands 23th of the same month; I am much obliged to your kindness in giving me so speedily your desired answer; I have put the principal contents of your letter, the drawing and the schedule of metal materials; in hand of the three Directors of th'undertaking at Katwyk, who have communicated those pieces, with their animadversions to the Commissioners of the high Heemraedschap of Rhinland; who should have taken incessantly (*sic*) a resolution to accede to your proposals; has it not been, that the Directors having made an Estimate of th'expences wanted for the construction and erection of such an Engine, being of opinion that an Engine of the size of that put up for the Crimpenrewaard would have been sufficient for the purpose, did take for their base of calculation, the cost of said Steam Engine; and as th'Engine proposed by you, as absolutelij necessarij for obtaining the desired effect, did surpass so greatly in cost, that of the Crimpenrewaard, the Commissioners did not think themselves sufficiently qualified to resolve upon this point before they had known th'Opinion of th'Assembly hereabout, which has taken up some time; and occasioned the delay of mij answering your letter; And as I have now just received a resolution in forma, in the name of said commissioners, to order a Steam Engine from You, according the drawing and list of materials send over to me; I do not lose anij time to acquaint you of the same; and to beg you will endeavour to make every despatch in providing this Engine, as you conveniently can without injuring the perfection of the work, which has been so greatly admired in the Crimpenrewaard's Engine; So that I flatter myself you will taken the trouble of having made it no less perfect, than the abovementioned; The building up of the house; will be begun in a few days, as the necessarij materials are alreadij upon the spot, and the Directors shall take due notice of the several observations, you have mentioned.

As the bringing over of th'Engine from Hull to this Country is now of posterioris curae (*Ed.Note: =we'll worry about that later*), I shall not enlarge upon that; in regard to the placing of the boiler, we shall compleatly follow your plan, in this as in everij other material point.

It did give me an infinite satisfaction, in being apprized that mij so much esteemed old friends were in tolerable good health, and that even M^r Boulton did enjoy a better state of health as last year; which favourable circumstances I sincerely wish may continue for a long time; — I am (thank God) greatly recovered from my very serious indisposition, and able to take a great deal of exercise; which I find extremely beneficial for my health; And now offering my willing compliments to all my good and worthy friends, at and about Soho I remain very sincerely

Y^r M^t Ob^t H^c Serv^t

J:D:Huichelbos van Liender

P:S: I expect your answer upon receipt of these. M^r John Blunt of Liverpool owes to our firm of Peter van Liender & Son, a small balance of £13.15.6 which I cannot get out of his hands, do you know anij measure to make him pay that sum; which he has engaged himself several times to do.

BW&C to HvL 1806-09-29b

AoS ref. MS 3147/3/103/56.

The letter of 9th August mentioned, is in the AoS, but it is so badly faded as to be totally unreadable.

M^r J.D.H. Van Liender
Rotterdam

Soho 29th Sep^r 1806

Dear Sir

We had the pleasure under date of the 9th Ult^o of acknowledging receipt of your favour of the 7th July with the accompanying memoir by M^r Blanken and we at the same time transmitted you the drawing for the buildings of the pump and Engine upon the Katwyk & Rhine Canal, with schedule of the Materials and Explanations(?) of this (.....)

Your favour of the (27th) (*Ed.Note: this quite clearly reads "27th", but the remainder of the sentence fits the content of HvL letter 1806-08-11; no letter of the 27th of a likely month/year has been found*) referring to the contents of your former letter and introducing us to the house of Mess^{rs} Coysgarne & Lloyds has since been received, and we are daily flattering ourselves with the expectation of learning the thoughts by you upon said letter of 9th Ult^o (*and*) We are not(?) (.....) of old Iron, but should be happy whenever occasion(?) presents to render any services in our power to these Gentlemen or any friends of Yours remaining respectfully

(Ed.Note: remainder of ending unreadable)

HvL to BW&C 1806-10-08

AoS ref. MS 3147/3/507/25. Docket: Duplicate of his letter of 29 Sep. with order for the Katwyk & Rhine engine.

The duplicate is not strictly verbatim

Mess^{rs} Boulton Watt & C^o at Soho near Birmingham

at Rotterdam 29th of September 1806

Copij Dear Gentlemen !

Your very agreeable favour of 9th of August came into my hands 23th of the same month; I am much obliged to your kindness in giving me so speedily your desired answer, I have put the principal contents of your letter, the drawing and the schedule of the metal materials; in hand of the three directors of th'undertaking at Katwyk; who have communicated those pieces to the Commissioners of the Council of the High Heemraedschap of Rhyndland; who should have taken incessantly (*sic*) a resolution to accede to your proposals; had it not been, that the Directors having made an Estimate of th'Expences wanted for the construction and erection of such an Engine, being of opinion that an Engine of the size of that put up for the Crimpenrewaard would have been sufficient for the purpose, did take for their base of calculation, the cost of said Steam Engine; and as th'Engine proposed by you as absolutelij necessarij for obtaining the desired effect, did surpass so greatly in cost, that of the Crimpenrewaard, the Commissioners did not think themselves sufficiently qualified to resolve upon this point before they had known th'Opinion of th'Assembly (or Council) hereabout; which has taken up some time; and occasioned the delay of mij answering your letter; And as I have just now received a resolution in forma, in the name of said Commissioners, to order a Steam Engine from You, according the drawing and list of materials send over; I do not lose anytime, to acquaint you of the same; and to beg you will endeavour to make every despatch in providing this Engine, as you conveniently can without injuring the perfection of the work; which has been so greatly admired in the Crimpenrewaard's Engine; So that I flatter myself you will taken the trouble of having made it no less perfect, than th'abovementioned; The building up of the House will begin in a few days, as the necessarij materials are already upon the spot, and the Directors shall take due notice of the several observations you have mentioned.

As the bringing over of th'Engine from Hull to this Country is now of posterioris curae (*Ed.Note: =we'll worry about that later*), I shall not enlarge upon that; in regard to the placing of the boiler, we shall complatly follow your plan in everij material point. — It did give me an infinite satisfaction, in being apprized that mij so much esteemed old friends were in tolerable good health, I sincerely wish may continue for a long time; — I am (thank to God) greatly recovered from my verij serious indisposition out, and able to take a great deal of exercise; which I find extremely beneficial for my health; And now adding my willing compliments to all my good and worthy friends, at and about Soho I remain etc

P:S: I expect your answer upon receipt of these. M^r John Blunt of Liverpool owes to our firm of Peter van Liender & Son, a small sum of £13β15p^{cs}6 which I cannot get out of his hands, do you know anij measure to make him pay that sum.

Mess^{rs} Boulton Watt & C^o
at Soho near Birmingham

Rotterdam 8th of October 1806

Dear Gentlemen !

Th'above is the Coppij of my former letter, of which for certaintij I send you this duplicate; the first or original having been send by post and this by a Vessel. — Nothing having occurred since that time, for adding to its contents, I only refer myself in all to it; and remain with th'utmost consideration

Dear Gentlemen !

Your M^r Ob^d Humble Serv^t
J:D:Huichelbos van Liender

BW&C to HvL 1806-10-16

AoS ref. MS 3147/3/103/67.

M^r J.D.H. Van Liender
Rotterdam

Soho 16 Oct^r 1806

Dear Sir

Your favour of the 29th Sep^r and its Duplicate of the 8th Inst^t have just reached us, from which we learn with pleasure the determination of the Council respecting the Engine for the Katwyk & Rhine Canal. We shall in consequence immediately proceed to the execution of the Order and doubt not we shall be able to compleat it in such manner as to add to the satisfaction experienced from the Crimpenrewaerd Engine.

As it appears to have escaped the observation of the Gentlemen concerned, it may be proper whenever an opportunity offers, to observe to them that this Engine really comes cheaper in proportion to the power, than the former one, as you will readily see by comparing their effects. The Crimpenrewaerd Engine to raise 575 Cubic feet English to the extreme height of 7 f^t per Minute, cost £ 960, and could not be undertaken again for less than £ 1080; (see our letter of 19th Ap^r 1804 (*Ed.Note: AoS copy of that letter was totally unreadable*)) whereas this to raise 877 Cubic feet English to the height of 7½ feet in the same time amounts (.....) to £ 1550. —

We note what you say respecting M^r John Blounts debt to your Firm, and shall try the effect of a letter or application to him. But if he should refuse to pay, we doubt whether as an alien, you can establish any legal claims in time of War.

It gives us much pleasure to receive so favourable a statement of your health and with every good wish for its continuance remain

Dear Sir

Yours truly
Boulton Watt & C^o

HvL to BW&C 1807-03-19a

AoS ref. MS 3147/3/507/26. Docket: Expects soon to hear of the Katwyk & Rhine engine having been completed. Wishes our opinion about the mode of sending it over. Wants estimate of a 12 horse engine. Imperial foundries erected at Liege with 8 steam engines.

The 14 horse engine is for a "friend" who is not mentioned by name, now or in later letters; it would appear (and seems to be understood in [Meijer, 1990]) that this is the revival of the De Heus engine, then designated 4 horses, which had been put on the back burner in [1805-03-25a].

Mess^{rs} Boulton Watt & C^{ie} at Soho near Birmingham
at Rotterdam 19th of March 1807

Dear Sirs !

It was the first of November that I found myself favoured with your Agreeable letter of 16th of October last, which to mij great satisfaction, made me acquainted with the good reception of my former letters; in consequence of their contents and your promise I hope to receive in â not verij remote period, your advice of having completed th'Engine for the Canal at Katwijck; and at that time we shall consider what means will be best for getting it over here or (*meaning "either"*) by the way of Tonningen (*Ed.Note: probably Tönning, a small German port on the W coast of Schleswig-Holstein*) or directly by a friendly accord and convention between the two Gouvernments, it being an object of publicq Utilitij which interferes in no waij with anij warlike concerns, the last waij was preferable, as gaining so much in time; perhaps I may obtain this issue if your Government would accede to it; I expect your opinion on this matter.

This letter is in the mean time principally designed to inquire after the particulars of Another Steam Engine, wanted for a manufacture, employing the power of 12 horses (*saij* twelve) (*Ed.Note: "saij" is a too literal translation of a Dutch term meaning "in words"*) of which the proprietor wishes to know, what size of an Engine he shall want for that purpose; what sum it will cost (being a double power) what room it will exige for putting it up, and what quantity of fuel or coals, it will require in four and twenty hours, and what time for its compleating; — By this occasion I want to acquaint you, that at Liège â very extensive Imperial Foundrij is erected, principally calculated for casting cannon, but that they cast there likewise other objects, having erected, as I am assured, eight Steam Engines for different operations, and having engaged for that undertaking the most able workman that could be found in Germanij and Sweden, and this foundry being so near this Country and the transport of their productions to here so easij, will attire all the business wanted of cast Iron in this Country; but as I never can have that confidence in their knowledge; I persuaded mij friend rather to given your manufactorij the preference. Onlij I wish you will state your price as low as possible.

I hope to receive soon the desired illucidations, and remain with sincere wishes for the continuance of the good health of mij good friends at and about Soho Yours verij Sincerely

Dear Sirs

Y:m:o:h^e S^t

J:D:Huichelbos van Liender

(Ed.Note: on the letter the following calculation in another hand; as a 14 hp was eventually decided upon, the final price differs)

	£
Metal Materials of an 12 H as usual	800
Carriage to London	<u>45</u>
	845
vL Commn 5 P%	<u>42</u>
	887
Contingencies	<u>10</u>
	£ 897

HvL to BW&C 1807-03-19b

AoS ref. MS 3147/3/507/27. Docket: Duplicate.

Duplicate not strictly verbatim

Duplicate

at Rotterdam 19th of March 1807

Mess^{rs} Boulton Watt & C^{is} at Birmingham

Dear Sirs !

It was the first of November last, that I found myself favoured with your Agreeable letter of 16th of October, which to my great satisfaction, made me acquainted with the good reception of my former letters; in consequence of their contents and your promise I hope to receive in a not very distant period, your advice of having completed the Engine for the canal at Katwijck; and at that time we shall consider what means will be best for getting it over here, or (*meaning "either"*) by the way of Tonningen (*Ed.Note: probably Tönning, a small German port on the W coast of Schleswig-Holstein*) or directly by a friendly accord and convention between the two Governments, as being an object of public Utility which interferes in no way with any warlike concerns; the last way was preferable, perhaps I may obtain this issue if your Government would accede to it; I expect your opinion on this matter.

This letter is in the same time principally designed to inquire after the particulars of Another Steam Engine, wanted for a manufacture, employing the power of twelve horses; of which the proprietor wishes to know, what size of an Engine he shall want for that purpose; what sum it will cost (being a double power) what room it will require for putting it up, and what quantity of fuel or coals, it will require in four and twenty hours, and what time for its completing; — By this occasion I want to acquaint you, that at Liege a very extensive Imperial Foundry is erected, for casting cannon, but that they cast there likewise other objects; having erected, as I am assured, eight Steam Engines for different operations, and having engaged for that undertaking the most able workmen that could be found in Germany Sweden etc; and this foundry being so near this Country and the transport of their productions to here, so easy, will attire all the business wanted of cast Iron in this Country; but as I never can have that confidence in their knowledge; I persuaded my friend rather to give your manufacture the preference. Only I wish you will state your price as low as possible.

I hope to receive soon the desired illuminations, and remain with sincere wishes for the continuance of the good health of my good friends at and about Soho Yours very Sincerely

J:D:Huichelbos van Liender

BW&C to HvL 1807-04-18

AoS ref. MS 3147/3/103/213.

Mathew Boulton Senior suffers from severe kidney trouble [Dickinson, 1935 p185]

M^r J.D.H. van Liender
Rotterdam

Soho 18th April 1807

Dear Sir

It gives us great pleasure to learn from your favour of the 19th Ult^o that you conceive it probable that the permission of your Government may be obtained for the importation of the Steam Engine for the Katwyk & Rhine Canal. We had apprehended (*that*) the severe nature of the decrees forced on your side of the water against all English manufactures that the introduction of (*it*) would not be practicable, and that therefore it would not be prudent to go on with it as there was little chance of disposing of it in this country where no Engines are used for similar purposes. — We were (.....) writing to you to avoid placing you in a disagreeable predicament in the case of our letters being intercepted, (.....) much satisfaction to us since we have now occasion to suppose that our apprehensions have been exaggerated, and we have in consequence lost no time in reissuing the order with directions for every practicable degree of dispatch to be employed. The time (.....) that has been thus lost will necessitate a prolongation of the period we generally fixed for the completion of the materials and we must beg of you to solicit the indulgence from the Gentlemen concerned, who we know as (.....) the (.....), which have occasioned these frustrations. We shall in the mean time endeavour to learn if any (.....) are likely to be needed by our Government, which we do not (.....) at all probable. —

In reply to your Enquiry respecting the cost of a 12 Horse Engine we (.....) to inform you that the compleat metal Materials, delivered at Hull or London will amount to £ 897 payable in a bill at 2 M^{ts} date on such delivery which might take place in 3 to 4 Months from receipt of the order. The consumption of (.....) Newcastle coal would be about 100 lbs per per hour when fully loaded — The house would require to be about 24 feet long & 8 or 10 feet wide, and if the boiler should be on the side it would require the same length of house and about 9 ft of breadth. —

(.....) your friend that a 14 Horse Engine would stand in (.....) the same space and the cost of the same Metal Materials would be £ 50 more.

We are much obliged by the information communicated respecting the Establishment at Liege mentioned (.....) great approbation from Imperial (.....), (.....). —

Your friends here (.....) except Mr Boulton who suffers a great deal from the (.....)

(Ed.Note: remainder of ending unreadable, part fell off the BW&C copy)

HvL to BW&C 1807-05-19

AoS ref. MS 3147/3/507/28. Docket: Can readily obtain the permission of his government to import the Katwyk & Rhine engine. Decrees respecting English manufactories not strictly observed. Wish to have the engine at work this summer. Orders a 14 horse engine and requests drawings. Reflections upon the foundry at Liege and the progress making abroad in manufactures.

This letter is quoted in [Schama ch.12] to show the limited effect of Napoleon's attempts to fully block Anglo-Dutch trade.

HvL expresses a rather narrow interpretation of the war and its problems; Anglo-Dutch trade concerned much more than industrial engineering products, and in the big picture for the English government France would have figured much more prominently than tiny Holland, whose maritime power had been broken long before.

at Rotterdam 19th off Mai 1807

Mess^{rs} Boulton Watt & C^o
at Soho near Birmingham

Dear Gentleman ! (*sic*)

The last daij of past month, I was favoured with your Agreeable letter of 18th of the same , handed me by Mess^{rs} Bowden Collins and Mungaij an English Commercial House in this town, who expecting a Vessel with some permitted goods from Portsmouth, proposed me to ship the Steam Engine by the same, and to request a permission of entry for the same by our Government; which I maij easily obtain; — Since that time another opportunitij was offered me by a Vessel loading at Hull for this port; but I was unable to engage one of the two, as your letter did not plainly inform me that the Steam Engine was readij; by its contents, it seemed to me, that the Engine, was not quite compleated, which detained me of entering into any engagement of that nature; Your fears about this importation, founded on the Severe decrees against the introduction of English manufactures, were so far ill grounded, as their tendencij was mostly to impede, that overloading of everij kind of your Manufactures, which otherwise destroijs all kind of Industrij here; It seems that your Ideas about the tenor of our present Government are not verij Just, as not the least danger ever existed for me in receiving letters from England, the liberty of the post is as free, as ever it has been; besides there is a dailij intercourse of Vessels from one coast to another, which is known enough to manij of your London merchants, the severe decrees which you did mention, allow alwaijs exceptions between commercial nations; besides even if the post would not have been free, mine letters would never have been opened; as I have been employed in many commissions of trust by our Government; —

I hope that you will have been able by the prolongation naturally originating from this uncertainty of making any engagement for the transportation of th'Engine, to finish th'Engine spedily, as we want greatly to have it here, the building will soon be readij to receive it, and we hope to open this summer th'issue of the Canal in the North Sea, when the Engine ought to be ready for acting;

In answer to your information about the Engine equal to a power of 12 or 14 horses, it shall serve that my friend after mature deliberation is resolved to employ th'Engine having a power of 14 horses, and supposing you have noted your last price for it to the sum of =947£St:= delivered at Hull or London, he is determined to accede to it, and he is without the least fear of meeting anij obstacle against his importation here; and he has now sollicitated me, to pray you to make with its construction all the dispatch you may be able to set to work; he has further taken notice of th'other particulars you have mentioned; and he wishes now to have a sketch or drawing of th'Engine, to prepare the building for its reception in the two ways, with the boiler at the side, and otherwise;

Do not form to low an Idea of th'Etablissements for founderies at Liege, by all what I can learn from different persons who have seen and examined it, it is really in an Imperial Stile, and directed by very clever and able managers; some persons here have already received several pieces of cast Iron, which given entire satisfaction; — It seems that your ministry have engaged in and prolonged this ruinous War for maintaining the Superioritij in regard to your Manufactures, and as far as can be judged by the daily events, the reverse will take place; every nation stretches its nerves for for (*sic*) awaken their industry, and participate in the advantages your country has reaped for so long a time by the good success of its manufactures; — I hope now soon to be acquainted in what situation the Katwijk Engine is at present, and if I can directly make Engagements for its transportation here either by the way of Portsmouth or Hull; — I have send you â duplicate of my letter of 19th March send of the 8th of April which undoubtedly will have reaced you; — And having now nothing more to

add, I beg my Serviceable compliments to all my good friends, wishing them a continuance of their good health, and to M^r Boulton a relief of his severe complaint; I remain verij sincerelij Yours
J:D:Huichelbos van Liender

BW&C to HvL 1807-05-27

AoS ref. MS 3147/3/103/243.

(M^r J.D.H. van Liender)
Rotterdam

Soho 27 May 1807

Dear Sir

The duplicate of your letter of 19th March came duly to hand, and we are now favoured with your esteemed of the 19th Inst^t, giving your friends Order for a 14 horse Engine, the materials of which shall immediately be put in hand, and if possible completed in less time than we have stated. Agreeable to your request we annex two sketches of the Engine house, one with boiler at the side & the other with the boiler at the end; and as soon as we know which he will decide(?) to adopt, we shall prepare afterwards the necessary drawings for the Engine house. If the (.....) on (.....) we shall thank you to say which (.....) to make(.....): and if (.....), it will be proper to say on which side he would prefer having the flywheel shaft to turn.

(.....) matter of indifference to the Engine but it is necessary we should have it before we prepare (.....) of the materials; we also wish to know which way he would have the flywheel to move, say whether the upper part of it is to move toward the cylinder or from it. The Engine House might be shortened a little by letting the flywheel (.....) into the (.....) where a (.....) might(?) be left for it but unless he is (.....) we should prefer making it (.....) as drawn and should even wish if he can allow it, to have a couple of feet more space behind the Cylinder to admit of a staircase being taken up there, instead of by the side of the Cylinder; but this of course must depend entirely upon his conveniency, and we beg an answer as early as possible to these points with any remarks that may occur.

(Ed. Note: half page blank in BW&C copy in the AoS)

We have been making every exertion in our power to (.....) forward the materials of the Katwyk & Rhine Engine since our last, and hope to send the whole from here in 6 to 8 weeks from this time at the latest, and sooner if possible. The great number of new patterns to make for this Engine (.....) and we are sparing no provisions to make it very compleat.

It gives us much pleasure to find we can now inform you as to the extent of the (.....) of your (.....) (& (.....) &(?) remain with much regard

Dear Sir

Your ob^d Serv^{ts}
Boulton Watt & C^o

HvL to BW&C 1807-06-02

AoS ref. MS 3147/3/507/29. *Docket:* Duplicate of his letter of 19 May. Has obtained the King of Holland's permission to import the Katwyk & Rhine engine, and a vessel will be sent for it to Hull.

Copy not strictly verbatim

at Rotterdam 19th off Mai 1807

Mess^{rs} Boulton Watt & C^o
at Soho near Birmingham
Coppij

Dear Gentleman ! (*sic*)

The last daij of past month, I was favoured with your Agreeable letter of 18th of the same, handed me by Mess^{rs} Bowden Collins and Mungaij an English Commercial House in this town, who expecting a Vessel with some permitted goods from Portsmouth, proposed me to ship the Steam Engine by the same, and to request a permission of Entrij for the same by our Government; which I easily may obtain; — Since that time another opportunity was offered me by a Vessel loading at Hull for this port; but I was unable to engage one of the two, as your letter did not plainly inform me that the Steam Engine was readij; by its contents, it seemed to me, that the Engine, was not quite compleated, which detained me of entering into any engagement, of that nature; Your fears about this importation, founded on the Severe decrees against the introduction of English manufactures, were so far ill grounded, as their tendencij was mostly to impede, that overload in or overstriking of everij kind of your Manufactures, which otherwise destroys all kind of Industry here; It seems that your Ideas about the tenor of our present Government are not verij Just, as not the least danger ever existed for me in receiving letters from England, the liberty of the post is as free, as ever it has been; besides there is a daily intercourse of Vessels from one coast to another, which is known enough to manij of your London merchants, the severe decrees which you did mention, allow alwaijs exceptions between commercial nations; besides even if the post would not have been free, mine letters would never have been opened; as I have been employed in many commissions of trust by our Government; — I hope that you will have been able by the prolongation naturally originating from this uncertainty of making any engagement for the transportation of the Engine, to finish th' Engine speedily, as we want greatly to have it here, the building will soon be readij to receive it, and we hope this summer to open th' Issue of the Canal in the North Sea, when the Engine ought to be ready for acting.

In answer to your information about the Engine equal to a power of 12 or 14 horses, it shall serve that my friend after mature deliberation is resolved to employ th' Engine having a power of 14 horses, and supposing you have noted your last price for it to the sum of =947£St:= delivered at Hull or London, he is determined to accede to it, and he is without the least fear of meeting anij obstacle against its importation here; and he has now sollicitated me, to pray you to make with its construction all the dispatch you may be able to set to work; he has further taken notice of th' other particulars you have mentioned; and he wishes now to have a sketch or drawing of th' Engine, to prepare the building for its reception in the two ways, with the boiler at the side, and other wise;

Do not form to low an Idea of th' Establishment for founderies at Liege, by all what I can learn from different persons who have seen and examined it, it is really in an Imperial Stile, and directed by very clever and able managers; some persons here have already received several pieces of cast Iron, which given entire satisfaction; — It seems that your ministry have engaged in and prolonged this ruinous War for maintaining the Superioritij in regard to your manufactures, and as far as can be judged by the events, the reverse will take place; every nation stretches its nerves for awaken their industry, and participate in th' advantages your country has reaped for so long a time by the good success of its manufactures; — I hope now soon to be acquainted in what situation the Katwijk Engine is at present, and if I can directly make engagements for its transportation here either by the way of Portsmouth or Hull; — I have send you a duplicate of my letter of 19th March send of the 8th of April which undoubtedly will have reached you; — And having now nothing more to add, I beg etc:

Mess^{rs} Boulton Watt & C^o at Soho near Birmingham

at Rotterdam 2^d of June 1807

Dear Gentlemen !

Th' above is a duplicate of my last letter which I hope may already have reached you, and found everij part of th' Engine readij for sending of either to Portsmouth London or Hull; this last port I have preferred, as

you are accustomed to send th'Engines destined for Holland there and have obtained the Kings permission of importing the said Engine from Hull to this port. So that I hope and wish that you shall upon receipt of these send the materials of said Engine, as noted in your list, to Hull; to Hull (*sic*) to be skipt from there by a Vessel send from here to that place, which by its arrival there, will easily be found out by your friends; this will now be the most expeditious and safest wajj to get said Engine over. In the mean time wishing you health and happiness I remain with much Esteem —

Yours very Sincerely
J:D:Huichelbos van Liender

HvL to BW&C 1807-06-06

AoS ref. MS 3147/3/507/30. *Docket:* Name of the Vessel and Captain now at Hull, who are to take over the Katwyk & Rhine engine. Enquires about the payment of the account owing to him by Boulton & Co. of Liverpool.

Mess^{rs} Boulton Watt & C^o at Soho near Birmingham

at Rotterdam 6th off June 1807

Very Dear Friends !

According what I have had the honour of mentioning to you, by mine letter of 2^d of this month; I can assure you now that the permission for importing the so much mentioned Steam Engine for the Katwyk Canal, is obtained for the Vessel De Vrouw Libergina; schipper Wolter Harms laying now in the port of Hull. — Be now so kind, upon receipt of these, to recommend to your friends at Hull; of loading all the materials of said Engine, as speedij as possible on board of said Vessel; The master of which is already advised from here, to take the same on board on the first application. — I refer myself further to my former letter and its duplicate; only adding, that yesterday I received a letter from Mess^{rs} G:F:Kinloch & Sons in London. telling me that to that moment, they had not received any letter or bill of M^r John Boulton of Liverpool; — pray be so kind as to exhort said gentleman to close finally our mutual account, as the balance he owes me is but a trifling sum.

Expecting in short your much desired answer, I remain very Sincerely

Yours

J:D:Huichelbos van Liender

HvL to BW&C 1807-06-12

AoS ref. MS 3147/3/507/31. *Docket:* Misunderstanding of our former letter, as to the time of the engine being ready for Katwyk & Rhine. Urges its completion etc.

at Rotterdam 12th of June 1807

Mess^{rs} Boulton Watt & C^o at Soho near Birmingham

Dear Gentlemen

Your letter of 27th past was received by me this morning, and has greatly Surprised and Stunned me, by now being for certain advised, the Katwyk Engine was far from being finished, as your letter of the last of April did leave one in the dark upon that head; and as I afterwards was assured by Mess^{rs} Collings Bowden and Mungay, the said Engine was quite ready and could be shipped as soon as any opportunity should offer

I have been induced, to make th'Engagements of which mine letters of 2^d and 6th of this month have given you the communication; and have procured th'Insurance, and all this now being done in vain; I do not know how to extricate myself out of this difficulty and exculpate myself by such an Eminent bodij as the High Heemraedschip of Rhymland is; who never could have been frustrated from the means of claiming and obtaining the permission for importation of an Engine they wanted for an object of their capital undertaking, about which I have never in my letters made the least difficulty; The only measure that occurs now to me will be that you send off to Hull and have shipped there as much of the materials as are readij and can be made readij, If the Vessel will stay some time for them; If you had only in time given me notice about your fears upon this head, I should then already have obtained the permission, or a full certaintij from the Government but not to write me, and not to go on with the work, Is what I cannot conceive; — In short I hope you maij redress this mistake in the best way possible; — About th'other contents of your letter I write you next and remain with much Esteem Yours very Sincerely

J:D:Huichelbos van Liender

BW&C to HvL 1807-06-15

AoS ref. MS3147/3/103/257

Badly faded, not copyable, readable portions transcribed directly from letter book in the AoS

(Ed.Note: the top two thirds of the first page apparently contained, or were meant to contain, a copy of an earlier letter; this, however, is now totally blank)

M^r J.D.H. van Liender
Rotterdam

Soho 15th June 1807

Dear Sir

Since writing the above we are favoured with your esteemed letter of the 19th Ult^o and informing us of your having obtained permission to import the Katwijk (.....) Engine direct from Hull. We shall of course send it to that port as soon as it is fully ready, which we expect it will be in the Course of a fortnight, or three weeks from this time. We shall consign it to the care of Mess^{rs} R. Southern & Pearson to whom you will please to direct the Captain of the Vessel to apply, or to favour us with his name and the designation of the ship.

(Ed.Note: another blank space of about two thirds of a page; it is not clear of this was left blank in the copying process, or if there is faded writing here)

Waiting for your friend's intentions (.....) for the position of the boilers, we are with due regard,

Dear Sir
Yours Sincerely
Boulton Watt & C^o

HvL to BW&C 1807-06-17

AoS ref. MS 3147/3/507/32. Docket: Surprised at the interruption in proceeding with the Katwyk & Rhine engine. Will endeavour to send a vessel to Sunderland to take in part of her cargo of coals. Determines on Plan No.1 for the position of the 14 horse engine for his friend.

at Rotterdam 17th of June 1807

Mess^{rs} Boulton Watt & C^o at Soho near Birmingham

Dear Gentlemen

Your letter of 27th past was partially answered, by the mine of 12th of this month; mentioning my surprise of being acquainted that you had interrupted the construction of the Katwyk Steam Engine since that time. I have endeavoured to make that the Vessel designed for bringing over Said Engine, shall sail to Sunderland, to get there the principal part of his cargo in coals, and if that happens, you shall certainly have time enough for compleating Said Engine which then would be a happy circonstance; — I should wish that you would put a bundle or rouleau of best drawing paper of different sizes, but the most part of the largest one, in one of the pipes or any other good place; of the metal materials for mine account; and now going over to answer you upon the subject of the Engine equal to the power of 14 horses, my friend is determined to adopt the plan N^o 1. as the building in which he intends to put it up is a square measuring 36 Rhynl: feet in length and breadth, So that he can give it a place where he likes, which makes it quite indifferent to him, at what side the boiler is placed, as likewise the fly wheel, and its turning round, and as you will see, he is not pinched for room, you may lengthen it two feet for a staircase, these being the determinations you did want; I pray you to go on with that Engine, with everij possible speed, and send over the drawings we are in want of, to forward the preparations for receiving th'Engine;

Mean while I remain with due Esteem Yours sincerely

J:D:Huichelbos van Liender

BW&C to HvL 1807-06-29

AoS ref. MS 3147/3/103/275.

M^r J.D.H. Van Liender
Rotterdam

Soho 29th June 1807

Dear Sir

Your favours of the 6th & 12th Inst^l were received a few days ago from M^r J.G.Cankrein of Hull and we have now the pleasure to inform you that the whole of the Materials of the Engine & Pump for the Katwyk & Rhine Engine were forwarded to Mess^{rs} R. Southern & Pearson of Hull on the 24th & 27th Inst^l with Instructions to ship them on board the Vrouw Libergina, consigning them to you in Rotterdam, where we hope they will reach you in safety and without delay.

We do not conceive upon what grounds Mess^{rs} Collins & C^o would state the Engine to have been ready so long ago as April, as no intimation to that effect was ever given by us. In consequence of some inquiries, which we made about that time through our agent in London, respecting the mode of shipment to Holland, he informed us that the above Gent^l were about to apply for the permission of the Government to ship some goods from Portsmouth, and suggested that there might be a good opportunity of forwarding the Goods for Katwyk & Rhine. We however informed him in reply that as there was no communication by inland navigation from London to Portsmouth, the expence of shipping from Bristol or Liverpool to that port, would be considerable besides the risks of injuring the goods by repeated loading & unloading; and at all accounts the goods would not be ready in less than two to 3 Months. — In our letter to you of 18th April, we also explicitly mentioned, that in consequence of the time that had been lost from the causes there mentioned, a prolongation of the period originally fixed for the completion of the Materials was rendered necessary and we therefore begged of you to solicit the indulgence from the Gentlemen concerned. —

We have since then been unremitting in our endeavours to get these Materials compleated and as they were sent off within two or three(?) days of the time of our receiving advice of the ship to which they were to go, we hope the Directors will be satisfied that every diligence has been used and which it was in our power (*Ed.Note: one entire line inaccessible, hidden in spine of letter book*) every intention has been paid to the materials & workmanship, to render this Engine as compleat as possible. — The Nozzles & working Gear are packed together in one box every part in its proper place, so that your Engineer will have nothing more to do, than to offer them to the Cylinder in the state in which they are in the box. This will render farther drawings unnecessary, and be a saving both of time and trouble.

We shall have the pleasure of addressing you in the course of a week with a duplicate of this, and with any thing further that may occur, remaining respectfully

Dear Sir

Your ob^l Serv^{ts}
Boulton Watt & C^o

P.S. In consequence of your letter of 29th Sep^r last informing us of the debt due to you from M^r John Blount of Liverpool, we caused inquiries to be made, but could not hear of any such person there.

We now see from your favour of the 6th Inst^l, that there was a mistake as to the name, and have caused application to be made to M^r John Boulton, of the result of which we hope to inform you in our next. —

HvL to BW&C 1807-06-30

AoS ref. MS 3147/3/507/33. Docket: Duplicates of his letters of 6, 12 and 27 Jun.

Copies not strictly verbatim

The copy dated 27th June, is in fact of the letter of 17th June.

Coppij

at Rotterdam 6th of June 1807

Mess^{rs} Boulton Watt & C^o at Soho

According what I had the honour of mentioning to you, by mine letter of 2^d of this month, I can assure you now that the permission for importing the so much mentioned Steam Engine for the Katwyck Canal, is obtained for the Vessel De Vrouw Libergina, schipper Wolter Harms or any other Vessel if this was sailed, or could not load it, laying now in the port of Hull. be now so kind, upon receipt of these, to recommend to your friends at Hull; of loading all the materials of said Engine, as speedij as possible on board of said Vessel; The master of which is already advised from here, to take the same on board on the first application. — I refer myself further to my former letters and duplicate, only adding, that yesterday I received a letter a letter from Mess^{rs} G:F:Kinloch & Sons in London, telling me that to that moment, they had not received anything of M^r John Boulton of Liverpool; — pray be so kind as to exhort said gentleman to close finally our mutual account, as the balance he owes me is but a trifling sum.

Expecting in short your much desired answer, I remain very Sincerely Yours

at Rotterdam 12th of June 1807

Coppy as above

Your letter of 27th past was received by me this morning, and has greatly surprised and stunned me, by now being for certain advised the Katwyk Engine was far from being finished, as your letter of last of April did leave me in uncertainty upon that head; and as I afterwards was assured by Mess^{rs} Collings Bowden and Mungay, that said Engine was quite ready and could be shipped as soon as any opportunity did offer

I have been induced, to make th' Engagements of which mine letters of 2^d and 6th of this month have given you the communication; and have procured th' Insurance, and all this now being done in vain; I do not know how to extricate myself out of this difficulty and extricate myself by such an Eminent Bodij as the board of the High Heemraedschip of Rhymland is; who never could have been frustrated from the means of obtaining the permission for importing an Engine they wanted for an object of their capital undertaking, about which I never have in my letters made the least doubt or difficultij; The only measure that occurs now to me will be that you shall send of to Hull and have shipped there as much of the materials as are readij and can be made readij, If the Vessel will stay some time for them; — If you had only in time given me notice about your fears upon that head, I should then already have obtained the permission, or a full certaintij from the Government; But not to write me, and not to go on with the work, is what I cannot conceive; — In short I hope you maij redress this mistake in the best way possible; about th' other contents of your letter I write you next and remain with much esteem

a Third Coppij

at Rotterdam 27th of June 1807. (Ed. Note: 27th should read 17th)

The twelvth of this month I wrote you my last letter, and answered partialle your letter of 27th past, mentioning my surprise of being acquainted that you had interrupted the construction of the Katwyk Steam Engine, since that time I have endeavoured to make that the Vessel destined for bringing over Said Engine, shall sail to Sunderland, to get there the principal part of its Cargo in coals, and if that happens, you shall certainly have time enough for compleating Said Engine which then would be a happy circumstance; I should wish that you would put a bundle or rouleau of best drawing paper of different sizes, but the most part of the largest one, in one of the pipes or any other good place or box of the metal materials for mine account; and now going over to answer you upon the subject of the Engine equal to the power of 14 horses, my friend is determined to adopt the plan quoted in your letter N^o 1 as the building in which he intends to put it up is a square measuring 36 Rhynl: feet in length and breadth, So that he can give it a place where he pleases or likes, which makes it quite indifferent to him, at what side the boiler is placed, as likewise the flywheel, and its turning round, and as you will see, he is not pinched for room, you may lengthen it two feet for a staircase, these being the determinations you did want; I pray you to go on with that Engine, with everij possible speed, and send over the desired drawings, that here likewise everij preparation may be made to forward the construction of the building, mean while I remain with due regard

at Rotterdam 30th of June 1807

Mess^{rs} Boulton Watt & C^o at Soho near Birmingham

Dear Gentlemen !

The 25th curr^t I was favoured with your letter of 15th of the same covering the Duplicate of your letter of 27th Maij, informing me of the good receipt of mine letter of the 2^d instant, which had advised you of mij obtaining the Royal Permission of importing the Steam Engine wanted for the operations of the Katwyk Canal of exoneration, and that you should send it off to Hull when fully readij which you did expect, would be in a fortnight or three weeks from the time of your letter; I hope the Vessel chartered for bringing over Said Engine, may have gone to Sunderland for taking a loading of coals, and therebij given a sufficient time for compleating th'Engine in full order; I have taken due notice of your friends firm at Hull; and have joined to this letter the coppies of three of my last letters; and referring further to their contents I remain with everij consideration

Dear Gentlemen

Your m^t ob: H^c Servant

J:D:Huichelbos van Liender

BW&C to HvL 1807-08-19

AoS ref. MS 3147/3/104/20.

The BW&C letters of 16 and 30 July 1807 have not been found in the AoS.

M^r J.D.H. van Liender
Rotterdam

Soho 19th August 1807

Dear Sir

We addressed you 29th June, 6th 16th & 30th Ult^o which we hope have reached you in safety, although your acknowledgement has not come to hand. The two former contained list & duplicate list of of the materials of the Katwyk & Rhine Engine & Pumps, & a drawing of such parts of the Engine as were different from what had been before sent. Those of the 16th & 30th Ult^o apprized you of the shipment of the Katwyk & Rhine Materials at Hull, on board the Minerva, Johannes Poort Master, then detained by the embargo, but which we hope have since reached you. — They contained also drawings of the Engine House & Engine of 14 Horse Power for your friend, with such explanations as appeared requisite and informed you that the materials would be ready early in September, and that if you chartered a Vessel from your side to take them, the hatchways should be large enough to receive the Boiler whole. We may now add that the weight of the whole materials will be from 15 to 16 Ton and that we see nothing to prevent them being ready to send from hence at the above period. —

We annex statement of your account for the Materials of the Engine for the Katwyk & Rhine Canal with the addition of £ 10..0..6 paid in London for the License to ship it direct. We also annex copy of the account transmitted us by Mess^{rs} Southern Pearson & C^o of paper shipped for you with the above, remaining very truly

Dear Sir

Your sincere friends
Boulton Watt & C^o

HvL to BW&C 1807-08-29

AoS ref. MS 3147/3/507/34. Docket: Arrival of the Katwyk & Rhine materials and satisfaction given by them to the Directors. Mr. J. Duyster does not fully understand the hot water pump apparatus. Receipt of drawings of 14 horse engine and progress made with the house. Will charter a vessel to take the boiler whole. Desires to have 2 dozen of best black lead pencils. Remits bills for £1270.

Note that for the 14 horse engine nothing about formal Royal permission etc. is mentioned.

at Rotterdam 29th of August 1807

Mess^{rs} Boulton Watt & C^o at Soho near Birmingham

Dear Friends !

I have still to answer some of your Agreeable favours to know (*Ed. Note: a too literal translation of a Dutch idiom meaning "that is" or "i.e."*) from 29th June 6th 16th and 30th of July and their duplicates which all are well received, as likewise the several drawings inclosed in them; This answer has been deferred, by a little indisposition and by the trouble and bustle th' arrival of the Minerva and the discharging of its cargo the materials of th' Engine etc have occasioned; that Vessel has made a prosperous voyage, being arrived in the Maeze the 9th of this month, and every part of th' Engine materials safely landed, and sent to Katwyk. — Messrs Collins Bowden etc have not been Able to obtain a permission of entry for the goods they intended to get over here, they flattered themselves to obtain such a permission under our Sollicitations, and by a prospect of bringing over th' Engine at a moderate freight; — The directors of the Katwyk Undertaking are very well contented with the superior skill and attention you have displayed in the workmanship of these materials all done in a masterly manner; and take therefore easily patience with the longer time absorbed by its fabrication; — I hope your application to M^r John Boulton of Liverpool for the debt he owes to our firm of Peter van Liender and Son, will not have been unsuccessfull, and that I may once close that long and tedious account.

Your following letter of 6th of July containing duplicate of the former, was likewise well received, as was the duplicate of the list of materials; and the drawing of some parts differing from these before send, which alterations were well liked by our Engineer M^r J. J. Duyster and are intelligible enough for him, except the fountain and air Vessel apparatus Upon the boiler, of which he desires a more extended explication and description to direct him fully in its application.

Your following letter of 16th of July, which confirmed me the passing of th' Engine materials near Gainsborough and their arrival at Hull on the 6th of July and your mentioning of having well received all my letters to you, which was very grateful to me, and that M^r Cankrien of Hull had engaged the Minerva Captⁿ John Poort for taking on board the much mentioned materials of the Katwyk Engine which was confirmed by letters received here from said M^r Cankrien, and for relieving the freights as much as possible, we have obtained from our Government permission of filling up the Vessel with Coals, which has been allowed ; and their importation permitted together with the Engine materials; with both these objects I have likewise well received the roll of drawing paper, for which I thank you and shall pay it with pleasure. — With your said letter of 16th of July I have well received the drawings of the now expected Engine of 14 horses power, of which the building is on hand to found and erect it according your prescription bij said drawings, and my friend was very much pleased to understand that you was so very forward in preparing the parts of said Engine, and I shall be attentive in chartering a vessel for its transportation here, to take one that is capable of taking in the boiler whole; I wish you will pak up here or there in one of the boxes 2 dozen of your best drawing blacklead pencils; as we cannot get here good ones. — I have taken good notice of the drawing and description of the cold water cistern, send in the same letter; and I now go over to Answer your last received letter of 30th past, containing likewise the duplicate of that of the 16th; You offer me by that letter to send duplicates of the same drawings of my friends Engine, or of some parts of the Katwyk Engine; If the first were not well received by me, but as it seems to me, that everything of that kind you have directed to me, has been well received, I thank you kindly; as I likewise do for you furnishing me with so much dedailed drawing of said 14 horses Engine, which will enable us to erect it in the compleatest manner, and shall with pleasure receive the explication of the modern working gear, of this Engine; — And now having answered Your letters as far as was needfull, I shall proceed to another point, which is to make you remittances for the greatest part of th' amount of the Katwyk Engine, as being due; I send you then by these a first of exchange drawn from here the 28th of August at two usances by Mess^{rs} Jay & C^o to mine order Upon Mess^{rs} John Kirwan & Sons in London for the sum of 800 £St: — A second of exchange drawn from Hamburg 24th of August at two months after date by Hendrik van Niervaart to his own order upon M^r John Whitton at Hull payable in London endorsed to mine order for the sum of 250 £St: the first accepted at Mess^{rs} Jos: Peel & C^o in London; — Another second of exchange in every part like the former of the sum of 220 £St: the three bills making together the sum of 1270 £St: of which you please to

procure the needfull and given mine account credit for it; as I intend within a few days to make a little tour of some weeks in Germanij I shall take care to remit you after my return the remaining part of your due. — And now not finding any thing more wanted to join to this letter, I remain with wishing health and happiness to all my good friends in your quarter verij Sincerely Yours

Dear Gentlemen

M^t ob: H^e S^t

J:D:Huichelbos van Liender

P:S: there is a Vessel ready to sail from here to the port of Hull; which will be able to carry th'Engine and bring it over here, I shall endeavour to charter it as cheap as I can of which I shall given you notice.

HvL to BW&C 1807-09-02

AoS ref. MS 3147/3/507/35. *Docket:* Incloses Duplicate of his letter of 29 Aug. — Sends seconds and thirds of the bills then remitted. — Will engage a vessel to take the 14 horse engine upon learning that it is ready.

Duplicate not strictly verbatim

Papenburg is a smallish town in Lower Saxony, connected to the Ems river by a canal. It did not get a city charter until 1861, but it was apparently flying its own colours in 1807. Its ships would be “neutral vessels” as far as Holland and England were concerned. The name of the Master looks decidedly Dutch, and the vessel’s name was probably translated from Dutch “Vriendschap”. In [Meijer, 1990] the ship is stated to fly the flag of Knipphausen, a small town just N of Wilhelmshaven.

Duplicate

at Rotterdam 29th of August 1807

Mess^{rs} Boulton Watt & C^o at Soho near Birmingham

I have still to answer some of your Agreeable favours to know (*Ed.Note: a Dutchism meaning “that is” or “i.e.”*) from 29th June 6th 16th and 30th of July and their duplicates which all are well received, as likewise the several drawings inclosed in them; This mine answer has been deferred, by a little indisposition, and by the trouble and bustle th’arrival of the Minerva and the discharging of its cargo, the materials of th’Engine etc have occasioned; that Vessel has made a prosperous and speedy voyage, being arrived in the Maze the 9th of this month, and every part of th’Engine materials safely landed and send to Katwyk. — Messrs Collins Bowden etc have not been able to obtain a permission of entry for the goods they intended, to get over here, they flattered themselves to obtain such a permission under our Sollicitations, and by a prospect of bringing over th’Engine at a moderate freight; — The directors of the Katwyk Canal Undertaking are well contented with the Superior care and attention, you have displayed in the workmanship of these materials all done in a masterly manner; and take therefore easily patience with the longer time absorbed by its fabrication; I hope your application to M^r John Boulton of Liverpool for the dept (*sic*) he owes to our firm of Peter van Liender and Son, will not have been unsuccessful, and that I may once close that long and tedious account. Your following letter of 6th of July containing duplicate of the former, was likewise well received, as was the duplicate of the list of materials; and the drawing of some parts differing from those before sent, which alterations were well liked by our Engineer M^r J.J:Duyster and are intelligible enough for him, except the fountain apparatus upon the boiler, of which he desires a more extended explication and description to direct him fully in its application. Your following letter of 16th of July, which confirmed me the passing of th’Engine materials near Gainsborough and their arrival at Hull on the 6th of July, and your mentioning of having well received all my letters to you, and that M^r Cankrien of Hull had engaged the Minerva Captⁿ John Poort for taking on board the so much mentioned materials of the Katwyk Engine = which was confirmed by the letters received here from said M^r Cankrien, and for relieving the freight as much as possible, we have obtained from our Government permission of filling up the Vessel with Coals, which has been allowed ; and their importation permitted together with the Engine materials; with both these objects I have well received the roll of drawing paper, for which I thank you and shall pay it with pleasure; With your said letter of 16th of July I have well received the drawings of the now expected Engine of 14 horses power, of which the building is now in hand to found and erect it according your prescription by said drawings, and my friend was very much pleased to understand that you was so very forward in preparing the parts of this Engine, and I shall be attentive in chartering a vessel for its transportation here to take one, that is capable of taking in the boiler whole; I wish you will pak up here or there in one of the boxes 2 dozen of your best drawing blacklead pencils; — I have taken good notice of the drawing and description of the cold water cistern, send in the same letter; — I now go over to answer your last received letter of 30th past, containing likewise the duplicate of that of the 16th; You offer me by that letter to send duplicates of the several drawings of mij friends Engine, or of some parts of the Katwyk Engine, If the first send were not well received by me, but as it seems to me, that everything of that kind you have directed to me, has been well received, I thank you kindly; as I likewise do for your furnishing me with so much detailed drawing of said 14 horses Engine, which will enable us to erect it in the completest manner, and I shall receive with pleasure the explication of the working gear of this Engine;

And now having answered Your letters as far as was needfull, I shall procede to another point, which is to make you remittances for the greatest part of th’Amount of the Katwyk Engine, as being due; I send you then by these a first of exchange drawn from here the 28th of this month at two usances by Mess^{rs} Jay & C^o to mine order Upon Mess^{rs} John Kirwan & Sons in London for the sum of 800 £St: a second of exchange drawn from Hamburg 24th of August at two months after date by Hendrik van Niervaart to his own order Upon M^r John Wilton at Hull payable in London endorsed to mine order for the sum of 250 £St: the first accepted at Mess^{rs}

Jos: Peek & C^o in London; and another second of exchange in all of the same tenor but for the sum of 220 £St: the three bills making together the sum of 1270 £St: of which you please to procure the needfull and given mine account credit for it; as I intend within a few days to make a little tour of some weeks in Germanij I shall take care to remit you after mij return the remaining part of your due. And now not finding any thing more wanted to join to this letter, I remain with wishing health and happiness to all my good friends in your quarter verij Sincerely Yours.

P:S: there is now a Vessel here loading for Hull which I shall endeavour to charter for bringing over the 14 horses Engine.

at Rotterdam 2^d of September 1807

Dear Friends.

Above you have the duplicate of my former letter to you, by which I have remitted you the sum of =1270 £St: at two usances in three bills one first of 800 £St: and two seconds of 250 and 220 £St: of these I send you under cover of this letter the second of the bill of 800 £St: and the thirds of the two bills off 250 and 230(*sic*) £St: of which you may make use in case of necessitij; — I hope now to receive soon your advice of the 14 horses Engine being ready; that I may engage the Vessel under papenburger Colours the Friendship Capt^e Willem Melles Pot I send you this letter under cover of your friends at Hull, to forward it directly to you at his arrival; And now being without anij of your letters,

I may Shorten these after assuring you that I sincerely remain Yours

J:D:Huichelbos van Liender

(Ed.Note: the "dotted" area left free of writing is probably an area which may be damaged by the breaking of the letter's seal)

HvL to BW&C 1807-09-03

AoS ref. MS 3147/3/507/36. *Docket:* Receipt of our letter and account. Has engaged a Papenburger vessel to bring over the 14 horse engine.

at Rotterdam 3th of September 1807

Mess^{rs} Boulton Watt & C^o
at Birmingham

Dear Gentlemen !

After my letter of Yesterdays date was ready to send off I received your favour of 19th past handing me your account of the Katwyk Engine materials and the disbursements occasioned by its expedition , at London and Hull, and the bill of the drawing paper, for one and other (*Ed.Note: another "Dutchism", meaning here "for all these"*) I have given you credit conformly; and as the Vessel mentioned in my former letter I (*Ed.Note: probably should read "is"*) to go from here to morrow, I send my letters by it under cover of Mess^{rs} Rich^d Southern & Pearson; to whom I have likewise given notice, that I had engaged said Vessel for taking in the Engine, which I am glad to find that will be ready at the Stated time, and now having nothing more to add I remain very sincerely

Yours

J:D:Huichelbos van Liender

Mees&Sons to BW&C 1807-09-08a

AoS ref. MS 3147/3/507/37. Docket: Remit 2nd of exchange for £250 on account of Mr.J.D.H. van Liender.

HvL has obviously left on his Germany trip. R.Mees & Zoonen was one of the larger banking firms.

Mess^{rs} Boulton Watt & C^o at Soho near Birmingham

Rotterdam 8 September 1807

Gentlemen !

M^r J:D:Huichelbos van Liender of this Citij, being at present from Home, & having charged us with his procuration, we have the honour to remit to you by these presents for his account the inclosed Bill of Exchange £ 250.- (Prima) on Minet & Fector at London 8 September 1807 on two Months date, for the amount of which, you will be pleased to credit the account off said M^r van Liender

We have the honour to be

Your Most humble Servants

R: Mees & Sons

Mees&Sons to BW&C 1807-09-08b

AoS ref. MS 3147/3/507/38. Docket: Remit £250 on account of Mr. van Liender. Marked Duplicate.

Duplicate not strictly verbatim. Amount initialled J:P:.

Duplicate

Mess^{rs} Boulton Watt & C^o at Soho near Birmingham

Rotterdam 8 September 1807

Gentlemen !

M^r J:D:Huichelbos van Liender of this citij, being at present from home, & having charged us with his procuration, we have the honour to remit to you by these presents for his account the inclosed Bill of Exchange £ 250.- (Secunda) on Minet & Fector at London 8 September 1807 on two Months date, for the amount of which you will be pleased to credit the account of said M^r van Liender

We have the honour to be

Your most humble Servants

R: Mees & Sons

BW&C to HvL 1807-10-29

AoS ref. MS 3147/3/104/69

Badly faded, not copyable, decipherable portions transcribed directly from letter book in the AoS.

M^r J.D.H. van Liender
Rotterdam

Soho 29 Oct^r 1807

Dear Sir

We wrote to you (.....) the 7th Inst^t which was (.....) at hand. By the Postscript to the letter you (*wrote us?*) that the Firsts of the (.....) bills drawn by M^r Neervaart had come to hand by M^r Whitton which rendered the forwarding of the Protest unnecessary.

We shall send explanation of this Invoice by the Friendship (*Ed.Note: the ship initially planned to bring over the 14 horse engine*) with the (.....) explanation of the Working gear of the 14 horse Engine (.....) Not having any (.....) the load parcels(?) (.....) the goods were forwarded (.....) from London and (.....) remaining (.....)

Yours truly
Boulton Watt & C^o

BW&C to HvL 1807-11-02

AoS ref. MS 3147/3/104/71.

With this letter (on its verso?) a copy of 1807-10-29 was sent, but that duplicate did not find its way into the letter book.

M^r J.D.H. van Liender
Rotterdam

Soho 2nd Nov^r 1807

Dear Sir

On the (*verso?*) you have Duplicate of a letter which was forwarded per Post on the 29th Ult^o along with the Invoice of the 14 horse Engine.

The (.....) will be sent in a (*parcel?*) to Hull to go by the Friendship and in the same parcel you will find a Duplicate of the Invoice of Materials, and a drawing of the Excentric Working Gear with a detailed description of the construction and mode of operation which we hope will make it perfectly intelligible to yourself and M^r Duyster, more particularly as you will find the Valves & rods all ready put into their places in the nozzles which may be fixed to the Cylinder without taking any of these parts asunder.

We shall be glad to learn their safe arrival; and should you feel any difficulty in understanding the construction and use of the different parts, we request you will write for explanation. Meantime we remain

D^r Sir

Your ob^t Serv^t
Boulton Watt & C^o

BW&C to HvL 1807-11-16

AoS ref. MS 3147/3/104/92.

M^r J.D.H. van Liender D^r To Boulton Watt & C^o
1807
Sep^r 30 To the Metal Materials of a 14 Horse Engine delivered at Hull £ 947. –. –
To Cash price Licence to Ship d^r 15. –.16
£ 962. –.16

Mr J.D.H. Van Liender
Rotterdam

Soho 16th Nov^r 1807

D^r Sir

We wrote to you on the 29th Ult^o with Invoice of the Materials of the 14 Horse Engine, a Duplicate of which was also sent to Hull to go by the Friendship on the 2nd Inst^t along with a drawing and explanations of the Working Gear.

We shall hope soon to hear of the arrival of the whole in good condition, and in the mean time transmit you the above statement of your Account for the last Engine.

Your Acct will be duly credited with the usual Comⁿ as (.....) for (.....) & we remain respectfully

D^r Sir Your ob^t Serv^{ts}
Boulton Watt & C^o

HvL to BW&C 1807-11-25

AoS ref. MS 3147/3/507/39. Docket: Receipt of sundry of our letters. - Difficulty of epistolary intercourse and of making remittances. - Cannot at present procure a Passport for the 14 horse Engine. - Remarks upon the system of the English Ministry & the Progress making in Manufactures on the Continent. - Description of the Imperial foundry at Liege. - Progress made in the Katwyk & Rhine Canal. Much pleased with the Engine, wch. will be started next month. - Mr. Duyster understands the Hot water pump, but wants explanation of what he calls the Steam Fountain. *Stamp C JAN 22 1808. Copy from J.L.Meijer.*

Judging by the stamp, the letter seems to have taken 2 months to reach Birmingham, illustrating what HvL writes about difficulties. The 14 horse engine for De Heus had been ready for despatch from September 1807, and was eventually imported with great difficulty. It started working a copper plate rolling mill late 1808 or early 1809 [Meijer, 1990]. Work on the Katwijk engine did not progress as quickly as HvL had envisaged. Due to various problems (including difficulties with erector Duijster) the first trials did not start until late 1808.

Mess^{rs} Boulton Watt & C^o.
at Soho near Birmingham

at Rotterdam 25th of November 1807

Dear Gentlemen

Since my return from the little excursion I have made to Liege and through parts of Germany In the Months of September and October I have been favoured with your very agreeable letters of 24th of September off 7th and 19th of October which I now go over address you an answer. - It is now very plain that all our interchanged letters are duly received by us both. I have thus only to meddle with the three last received. The first of 24th September gave me knowledge of your having well received the bills of 250 £St: remitted you by Mess^{rs} Rich^d Mees & Sons for mine account which was very agreeable as likewise I learned by your letters of October with satisfaction the due receipt off the several bills remitted you by my former letters amounting to the sum of 1270 £St: Since my return the publicq circumstances have so greatly interrupted our correspondance with your Country that I should not dare to remit you at this time more bills; all intercourse, even of letters is so severely forbidden with England that only by some fortunate circonstance a letter may be brought over and notwithstanding I have given myself all possible trouble, and that several of my friends members of the Government are greatly disposed to do my Service, I cannot obtain a free passport of entry for the 14 horses Engine; which vexes me the more as you have executed this order so uncommonly speedy, and that my friend's building is ready to receive it; mine Engagement with Captain Melles Pot will therefore be of no utility, and we can do nothing but taken patience and you will keep this machinerij under your own care and not send it to Hull before we can with safety have brought it over; In hope that Your perverse ministry resolve to quit their condemnable System which undoubtedly will occasion the ruin of your happy Country, If under an equitable administration all your lucrative manufactures will go over in the hands of other nations. I have been struck during my little tour, to see the growing activitij and industrij, in many parts of Germanij the woollen manufactures of Aix la Chapelle (*Borchet?*) and its environs, of MountJoy and its neighbourhood have never been so flourishing The wool which I have seen transporting from many parts of Germany to these countries is immense; Several of the Cotton spin machines of Arkwrights invention are in France and Flanders erected, who cannot furnish the cotton thread which is daily commanded; and what shall I say of the Iron founderies at Liege; who are all in full vigour. Th'Imperial foundry is an establishment of which I never saw the like. four double furnaces are arranged round halv a circle, dug out of the ground, in which the models are placed of eight heavy pieces of cannon (*sic*), and eight pieces of cannon are thus cast in one moment by the eight furnaces; and brought over in a very large building; where they are bored and polished by eight steam engines, placed in one row against the wall of this large building their working beams reaching through the wall some way within the building; and in the same space (*Ed.Note: place meant*) are several other founderies for cannon shot, and many other parts of th'artillery business; and in the neighbourhood of Liege I have seen and examined at a Colliery a new constructed Steam Engine; with a Cylinder of 64 inches diameter, cast by the brothers Perrier of Superior Workmanship; off whose good working th'overseer gave me a laudable testimonium. Last week I have taken a cursory view of the Katwijk Engine, which M^r Duyster is now very bussij in erecting and hopes to have it quite ready before the end of next month; it is really a Chef d'Oeuvre and so eminently finished that every amateur must greatly admire it. Since about one month the exoneration canal was opened and the water let out by the great sluice into the North Sea with every wished for good Success; the quite finishing of this great undertaking will be the good working of the Steam Engine.— The construction of the hot water pump is now quite well understood by M^r Duyster but he does not so well conceive th'application of the Steam fountain which is to be placed at th'apparatus of the Safety valve; this being quite a new application he wishes to have some explanation off.— And now having nothing more to add to this letter— I remain with every regard— Dear Gentlemen - Your m^t ob^d H^s Serv^t

J:D: Huichelbos van Liender

HvL to BW&C 1807-12-22

AoS ref. MS 3147/3/507/40. Docket: Duplicate of his letter of 25 Nov. Complains much of Mr. Cankrien's having forwarded the 14 horse engine during the prohibition. Difficulty of preventing the ship and cargo from being confiscated and consequences likely to ensue. Receipt of sundry of our letters.

Duplicate not strictly verbatim.

In view of HvL's complaint about the long delays (up to six weeks) in the post, it seems possible that [1807-11-25], asking BW&C to postpone sending the materials, was not received until after the goods had been sent off.

(Duplicate)

at Rotterdam 25th of November 1807

Since my return from the little excursion I have made to Liege and through part of Germany In the Months of September and October I have been favoured with your very agreeable letters off 24th of September 7th and 19th of October to which I now go over to address you an answer. - It is now very plain that all our interchanged letters are duly received by us both. I have thus only to meddle with the three last received. The first of 24th September gave me knowledge of your having well received the bills of 250 £s remitted you by Mess^{rs} Richd: Mees & Sons for mine account, which was very agreeable as likewise I learned by your letters of October with satisfaction the due receipt of the several bills remitted you by mij former letters amounting to the sum of 1270 £St: Since these remittances publicq circonstances have so greatly altered our correspondance with your Countrij that I should not dare to remit you at this time more bills; all intercourse, even of letters, is now so severely forbidden with England that onlij by some fortunate circonstance a letter may be brought over; and notwithstanding I have given myself all possible trouble, and that several of my friends, members of the Government are greatly disposed to do mij Service, I cannot obtain a free pasport of entry for the 14 horses Engine; which vexes me the more as you have executed this order so uncommonly speedy, and that my friend's building is ready to receive it; my Engagement with Captain Melles Pot will therefore be of no Utilitij, and we can do nothing than take patience, and that you may keep this machinerij under your own care, and not send it off to Hull, before we can with safetij have brought it over; In hope that Your perverse ministrij resolve to quit their condemnable System which undoubtedly will occasion the ruin of your happy Countrij, If under an equitable administration all your lucrative manufactures will go over in the hands of other nations. I have been struck in my little tour to see the growing activity and industrij, in many parts of Germanij, the woollen manufactures of Aix la Chapelle and its environs, of MountJoy and its neighbourhood have never been so flourishing, the wool which I have seen transporting from manij parts of Germany to these countries is immense; — Several of the Cotton spin machines of Arkwrights invention are in France and Braband constructed, who cannot furnish the continual demands for cotton thread; — And what shall I say of the Iron founderi's at Liege; who are all in full vigour. Th'Imperial founderij is an establishment of which I never saw the Like; four double furnaces are arranged round half a circle, in which the models of eight heavij pieces of cannon are placed, and those eight pieces of cannon cast in one moment by the eight furnaces; and brought over in a very large building; Where they are bored and polished by eight steam engines, placed in one row against the wall of this large building; and in the same place are several other founderies for cannon shot, and manij other parts of th'artillery business; — and in the neighbourhood of Liege I have examined at a collierij a new constructed Steam Engine; with a Cylinder of 64 inches diameter, cast by the brothers Perier of Superior Workmanship; of whose good working th'overseer gave me a laudable testimonium.

Last week I have taken a cursori view of the Katwijk Engine, which M^r Duyster is now very bussij in erecting and hopes to make it quite ready before the end of next month; it is really a Chef d'Oeuvre and so eminently finished that every amateur must greatly admire it. — Since about one month the exonerating canal was opened and the water let out by the great sluice into the North Sea with every wished for good Success; the quite finishing of this great undertaking will be the good working of the Steam Engine; the construction of the hot water pump is now quite well understood by M^r Duyster but he does not so well understand th'application of the Steam fountain, which is to be placed at th'apparatus of the Safety valve; this being quite a new application he wishes to have some application (*Ed.Note: should read explanation*) of; and now having nothing more to add to this letter I remain with every regard

Messieurs Boulton Watt & C^o at Soho near Birmingham

a Rotterdam 22^d of December 1807

Dear Gentlemen.

Since I have send off to your direction the letter of which you have a duplicate above; some things have happened which give me much uneasiness, and of which I can given the fault to nobodij else than to th'unpermitted eagerness of M^r Cankrien, who being a Dutchman born in this town, and associated with his father here in commerce, and thereby knowing very well all circonstances of the present prohibition of every

intercourse with England, has very imprudently engaged Captain Pott to take a loading coals and the Steam Engine with it hoping that when once arrived I should by instances (*another "Dutchism" — HvL means to say "authorities"*) obtain the free entrij of the ship and cargo, having made an agreement with the said Captain by which the receiver of the Steam Engine should paj an enormous freight, three times more than I had agreed with his broker here, and as mine agreement with the said Captain, has never been otherwise, than under the express stipulation, when I could obtain a free passport of entrij, of which I should given him notice; this agreement of M^t Cankrien is of no Value, and all the damages incurred by his rash action, must be repeated (*Ed. Note: recuperated?*) from him; as the said ship the Friendship Capt^d Mellis Pott has been carried by assistance at the Isle off Terschelling greatly damaged and leakij, and without any insurance, of the Steam Engine; so he must likewise make good all the Average, which may have happened to the Steam Engine It has given me much trouble to persuade the Minister of finance, that I have not given anij orders for shipping the said Engine, without being certain of obtaining a free pasport, the Copy of mine letter to you, has been the means of my defence, with great pains I have obtained the permission of having the said ship brought up to Amsterdam to be repaired; and as the Minister seems determined to have the ship and cargo confiscated, or at least when repaired condemned to sail back with its cargo to Hull; I am greatly (*em*)barassed how to extricate ourself from this difficulty; the more as I have not in the least contributed in any manner to this mischief; the only measure, which I can devise, is to gain time by the reparation of the Vessel, and mean while to endeavour by repeated instances to obtain a more favourable disposition of the Minister; I hope heartily that I may be able to give you this good tiding; This prohibitive Law is prosecuted in the most rigid manner; Letters must go a great waij round about, Your letter of 29th October has reached me only the 18th of this month, & your duplicate of 29th October and that of 2^d of November, with the other Papers the drawing or sketch of the eccentric circle and the dozen of black lead pencils, have been handed me by Captain Melles Pott; the second of this month, all your letters and their duplicates are thus come to mij hands; and having now nothing more to add to these bad tidings I remain very Sincerely

Dear Gentlemen

Your m^t ob^t H^s Serv^t

J:D:Huichelbos van Liender

HvL to BW&C 1808-01-07

AoS ref. MS 3147/3/507/41. *Docket:* Will send a remittance for the 14 horse engine as soon as he can with safety. Has obtained the King's order for the release of the *Friendship* and her cargo. Complains of the high freight and want of insurances. Wants explanation of the throttle valve of the Katwyk & Rhine engine.

at Rotterdam 7th Januarij 1808

Mess^{rs} Boulton Watt & C^o at Soho near Birmingham

Dear Sirs !

Your favour of 16th off November, was received by me the 28th of last month, handing me th'account of the 14 horse Engine, for which I have given your account credit and intend to do you remittances for its amount, as soon as I think that I can do it with safetij; both my letters of 25th of November and 22^d of December I hope shall have been received bij you before this; — Since the sending of off (*sic*) the last mentioned letter; I have given myself every possible trouble for obtaining from the Minister the release of the ship the *Friendship* and its cargo, but all in vain, so that I have been obliged to address myself to the King with a Request for obtaining his Majesty's permission, for having the property of said ship and loading restored to the Owners; and by the help and sollicitations of many of my friends, who have employements in the Kings Service, I have had the good luck of succeeding in mij Endeavours, and obtaining his Majesty's gracious assent to my demand; of which I heartily give you Joij and my sincere compliments; and indeed I am greatly pleased with this happy issue, as this so very bad management could have turned out, very unluckily for us both, and entirely without any fault on our side; my friend shall now be obliged to pay his part for the Engine in the damage suffered by the ship and cargo, without being insured in any way for it; and paying besides an extravagant high freight, to which Mess^{rs} Southerne and Pearson never should have consented, as the freight of the coals is regulated for a trifling, and all the burthen falls on the Engine; — I expect now th'explanation of the throthle valve of the Katwyk Engine; and remain with wishing you constant health and happiness

Your m^t ob: H^e Serv^t

J:D:Huichelbos van Liender

P:S: Your answer to mine letters may safely be given to Mess^{rs} Jerson & Cohen Minners Square N^o 3 London; but with some management; as the correspondence is so severely forbidden; and those Gentlemen will not be known to meddle with it.

HvL to BW&C 1808-01-18

AoS ref. MS 3147/3/507/42. *Docket:* Remits bill for £220. The landing of Mr. Cankrien's cargo of coals refused. Progress made in the Katwyk & Rhine undertaking.

Duplicate not strictly verbatim.

Duplicate
Mess^{rs} Boulton Watt & C^o at Soho near Birmingham

at Rotterdam 7th Januarij 1808

Dear friends !

Your favour of 16th November last was received by me the 28th of last month, handing me th'account of the 14 horse Engine, for which I have given your account Credit, and intend to do you remittances for its amount, as soon as I think that I can do it with safetij; both my letters of 25th of November and 22^d of December I hope shall have been received bij you before this; — Since the sending off, of the last mentioned letter; I have given myself every possible trouble for obtaining from the Minister the release of the ship and Cargo but all in vain so that I have been obliged to address myself to the King with a Request for obtaining his Majesty's permission, for having the property of said ship and loading restored to the Owners; and by the help and sollicitations of manij of mij friends, who have employments in the Kings Service, I have had the good luck of succeeding in mij sollicitations, of which I give you my compliments; and indeed I am greatly pleased with this happy issue, as this very bad management could have turned out very unluckily for us both, and entirely without anij fault on our side, my friend shall now be obliged to pay his part for th'Engine in the damage suffered by the ship and cargo, without being insured in any way for it; and paying besides an extravagant high freight, to which Mess^{rs} Southerne and Pearson never should have consented; as the freight of the coals is regulated for a trifling, and all the burthen falls on the Engine

I expect the explanation of the throttle Valve of the Katwyk Engine; and remain with wishing you constant health and happiness

P:S: Your answer to mine letters may be given to Mess^{rs} Jerson & Cohen Miners Square N^o 3 London; but with some management; as the correspondence is so severely forbidden; and those Gentlemen will not be known to meddle with it.

Mess^{rs} Boulton Watt & C^o
at Soho near Birmingham

Rotterdam 18th of Januarij 1808

Dear friends !

Th'above is a duplicate of mij last letter of which I hope th'original may have reached Your hands very quickly, to participate to you the good tidings contained in it, which afterwards turned out to concern only the Steam Engine, which has been delivered, and is now in my friends possession; but for the loading coals all our pains have been unsuccessfull, the king is quite severe upon that article, as being not of anij necessity; french coals are now here in abundance, which will make M^r Cankrien's imprudent speculation verij unpropitious. — I shall now make a tryall to do you on account a first remittance, In a second letter of exchange dated Hamburgh 15th Januarij at two months after date by Hend^k van Niervaart, to his own order for the sum of =220 £St: on M^r John Witton Sen^r at Hull payable in London first accepted at Mess^{rs} Jos: Peel & C^o of which you please to procure the needfull, and after getting th'amount, given mine account Credit for it; — In about a fortnights time M^r Duyster is in hope to set the Katwyk Engine â going, the season has not been very favourable for his repeated Courses to Katwyk, th'exonerating Canal has been during this autumn of great Service for the Country along the left border of the Rhine; the right border Country exonerating itself in the lake of Haarlem; which loses its water bij five outlets or sluices in the Ye; but not with so much avantage, than the new Canal, which has but a short run to the North Sea.

Hoping to hear verij soon from you, I remain with everij regard

Dear Friends

Your ob^d Serv^t

J:D:Huichelbos van Liender

BW&C to HvL 1808-01-25

AoS ref. MS3147/3/104/137,138.

Badly faded, draft transcript made directly from letter book in the AoS.

M^r J.D. van Liender
Rotterdam

Soho 25th Jan^y 1808

Dear Sir

Your respective favours of the 25th Nov^r 23 Dec^r and 7th January Inst^t (*sic*) have just reached us together and we extremely concerned to learn the trouble which your entry of the 14 horse Engine has occasioned. — The materials of that Engine were not forwarded from here until we learned the arrival of the ship at Hull, which we supposed to be sent over for the purpose of conveying it and to be provided with the requisite Passport from your side. Indeed, as you are (*same as ourselves?*) perfect strangers to the agreement(?) made respecting the freight as well as to the provision(?) of Insurance (.....) concerning those matters to be placed in M^r Cankriens hands, we did not interfere. However, it is well the affair has turned no worse, which we are sensible must be ascribed chiefly, if not solely, to your exertions; and with respect to the remittance we must have patience until you can have an opportunity of making it with perfect safety to yourself(?).

We should fear that the wrought Iron work of the Engine must have suffered(?) from the Average of the Vessel and presume you have lost no time in having it taken out of the ship and clean'd and those parts fresh polished which required it. We do not think the cast iron work, or brasses, would suffer any material damage from temporary exposure to the salt water. —

We are at a loss to understand what is meant in your favour of the 25th Nov^r by “the Steam fountain which is to be placed at the apparatus of the Safety Valve”. We can only suppose you can mean the apparatus for the Damper (*Ed.Note: the regulator in the flue between the boiler and the chimney*), but there is no connection between that and the Safety Valve and the use of it was explained in the directions sent for the Crimpenrewaard Engine (.....) only the fireman in the present one, is (.....) by the chain instead of by the shaft. — There is also nothing new in the throttle valve, which has been sent upon former occasions, and is introduces to regulate the greater or less admission of steam according to the load upon the Engine, being set by hand to give as much steam as is required; & (.....) at that spinning until a variation in the load renders any alteration(?) necessary.

If this is not (.....) please to state to us the nature of your difficulties and we shall with much pleasure explain (.....) remaining

D^r Sir

Yours Truly
Boulton Watt & C^o

BW&C to HvL 1808-03-09

AoS ref. MS3147/3/104/171.

M^r J.D.H. Van Liender
Rotterdam

Soho 9th March 1808

Dear Sir

We annex Duplicate of our last of the 25th January and are now favoured with yours of the 18th of the same month, covering bill of £ 220 as advised, which at maturity will be duly at your Credit.

We are glad to learn the progress made in the Katwyk Engine & hope you next will bring us an account of its successful performance. —

We are with much regard

D^r Sir

Yours Truly
Boulton Watt & C^o

HvL to BW&C 1808-05-31

AoS ref. MS 3147/3/507/43. Docket: Remittance of £25 (Ed.Note: actually £225)

The two amounts mentioned are initialled J:P: (= clerk James Pearson).

Mess^{rs} Boulton Watt & C^o
at Soho near Birmingham

at Rotterdam Last of Maij 1808

Dear Gentlemen !

After a very long expectation, I have received the 10th of this month your favour of 9th of March accompagnyed by the duplicate of your letter of 25th January; It gave me good satisfaction, that my letter with the bill of exchange of 18th Januarij has reached your hands in due time; which has encouraged me to venture of sending you another being a first drawn from Dordrecht the 28th of this month at three days after Sight, by Mess^{rs} Justus de Buyn & C^o to their own order, upon Mess^{rs} Kops & Cousse-makers in London of the value of 200 £St: of which you please to procure the needfull, and after getting th'amount, give mine account credit for it; bills upon London are very scarce, and extremely difficult to have; — till now the Katwyk Engine has not yet been set a going; M^r Duyster being now so much occupied with the 14 horses Engine and other Avocations;

After having wishing a continuing good health, I remain with every regard.

Yours very Sincerely
J:D:Huichelbos van Liender

P:S: after my having wrote this letter; I received another first bill of exchange, drawn from Louvain Le 21 Maij par J:Quintens a l'ordre de Mess^{rs} Les Freres Peecmans sur Mons^r L'Eveque Douglass a Londres de la Somme de 25 £St: — of this bill you will procure the needfull, and give mine account credit for it, remaining further as above . J:D:H:vL:

BW&C to HvL 1808-06-23

AoS ref. MS 3147/3/104/223.

Badly faded, not copyable, decipherable portions transcribed directly from letter book in the AoS.

M^r J.D.H. van Liender
Rotterdam

Soho 23 June 1808

Dear Sir

Your favour of the 31th Ult^o (.....) two Bills as advised valued £ 220 & (200) for the amount of which your account shall at maturity be duly credited. We observe the (*progress making*) in the different Engines and with hopes of (.....) receiving a favourable (*report?*) of them (.....) remain

Dear Sir

Yours Sincerely
Boulton Watt & C^o

HvL to BW&C 1808-11-01

AoS ref. MS 3147/3/507/44. *Docket:* Has not received an acknowledgement of remittances transmitted to us. Favourable report of the Katwyk engine.

at Rotterdam 1st of November 1808

Mess^{rs} Boulton Watt & C^o
at Soho near Birmingham

Dear Gentlemen !

I have had the pleasure of writing you the last of Maij and the 17th of August but without that of receiving any answer from your side; by these letters I have send you a first and a second bill of exchange, from Dordrecht, at three days Sight by Mess^{rs} Justus de Buyn & C^{ie} to their own order upon Mess^{rs} Kops & Koussemakers in London of the value of 200 £St: and another drawn from Louvain 21th Maij par J:Quintens a l'ordre de Mess^{rs} Les Freres Pecmans sur Mons^r L'Eveque Douglas a Londres de la Somme de 25 £St: and having heard nothing from you, I am not without any fear my letters having miscarried or being intercepted notwithstanding that so many letters from your side have been received here.

The Katwyk Engine has been set a going and answers extremely well; — Meydrecht Engine has suffered greatly for its wooden parts by a fire, occasioned by a fracture in the Chimneij; this misfortune is nearly remedied, having a new condensor and air pump been cast for it at Amsterdam at the expence of about 800 £St:

Wishing to be shortly favoured with one of your so much desired answers; I remain with every regard

Dear Gentlemen

Your m^t ob^t H^c Serv^t

J:D:Huichelbos van Liender

BW&C to HvL 1808-12-16

AoS ref. MS 3147/3/105/21.

With this letter a duplicate of [1808-06-23] was sent, which was however not copied into the BW&C letter book; see the transcript of the original letter.

M^r J.D.H. Van Liender

Dear Sir

Within these few days we have been favored with your Letter of 1st Ult^o from which we are sorry to perceive that our letter (.....) of the 23rd June last had not been received. The purport of it as will appear from the annexed copy was the acknowledg^t of the receipt of your remittance, which we now confirm —

Your favorable report of the performance of the Katwyk Engine gives us pleasure & we hope it will long continue (.....) from (.....) fate of the Mydrecht Engine.

With the (.....) respects & best wishes of your friends here

We remain respectfully

Dr Sir

Yours sincerely
Boulton Watt & Co

(Soho) Dec^r 16th 1808

HvL to BW&C 1809-04-12

AoS ref. MS 3147/3/507/45. Docket: Remits £300.

Amounts for the two new bills initialled J:P: (= James Pearson)

at Rotterdam 12th off April 1809

Messrs Boulton Watt & Co
at Soho near Birmingham

Dear Gentlemen !

It was the third of february that I was favoured with your original off 16th off December and copij of 23th June last Year; by their contents I was informed off your receiving mine remittances to th' amount of =225 £St: which being joined by the first 220 £St: makes together the sum remitted for the 14th (*sic*) horses power Engine £St: 445... - - and as there seems to be a little more remisness for neutral vessels going and coming I take this opportunity of remitting you 2 bills of exchange viz^t one off =100 and one off =200 £St: both first bills drawn from Hambro 17th March at two months after date by Hend^k van Neervaart his own order on M^r Benj^d Boyes London at Mess^{rs} Barvis and Charnleij, to whom a letter of advice is joined;

I beg you will do the needfull of these bills and given mine account credit for it; and as soon as my letter has been received by you, be so kind as to let me have advice of it, and do me the pleasure of letting me know how my old good friends M^r Boulton and M^r and M^{rs} Watt and you Young Gentlemen are doing, with this severe winter which has lasted so long a time; In expectation of your favourable answer I remain with particular regard.

Dear Gentlemen

Your m^t ob: H^s Serv^t

J:D:Huichelbos van Liender

BW&C to HvL 1809-04-27

AoS ref. MS 3147/3/105/99.

Mathew Boulton died on 17 August 1809 of a kidney disease.

M^r J.D.H. van Liender
Rotterdam

Soho 27 April 1809

Dear Sir

We have great pleasure in acknowledging the receipt of your favour of the 12th Inst^d covering two bills of Exchange, as advised, making together the amount of £ 300, for which sum we duly credit your account, and have forwarded the letter of advice to its direction.

Both M^r and M^{rs} Watt are well, and desire to be remembered to you and your sister, in the kindest manner. Poor M^r Boulton has been a great martyr to his complaint and has for a long time been confined to his room and generally to his bed. His son has had a tedious illness, from which he is now recovered, and with the writer of the present unites in the expression of sincere regard and best wishes.

I am Dear Sir Yours truly
for Boulton Watt & C^o
J. Watt Jun^r

HvL to BW&C 1809-05-04

AoS ref. MS 3147/3/507/46. Docket: Enclosing a bill of exchange for £217.11 and seconds for £300 remitted 12 Apr. last.

This letter includes a (not strictly verbatim) copy of [1809-4-12]; it is the last HvL letter in the AoS. HvL died 3 Dec. 1809.

Amount £217 initialled "Ent^d 17 May 1809 J:P:"

Coppij
Mess^{rs} Boulton Watt & Co:
at Soho near Birmingham

at Rotterdam 12th off April 1809

Dear Gentleman (*sic*) !

It was the third of februarij that I was favoured with your Original off 16th of December and coppij of 23th June last Year; by their contents I was informed of your receiving mine remittances to th' amount of=225 £St: which being joined by the first of 220 £St: makes together the sum remitted for the 14th (*sic*) horse power Engine £St: 445.- and as there seems to be a little more remisness for neutral Vessels going and coming I take this opportunity of remitting you 2 bills viz^t one off=100 and one off=200 £St: both first bills drawn from Hambro 17th March at two months after date by Hend^l van Neervaart his own order on M^r Benjamin Boyes London at Mess^{rs} Barvis and Charnleij, to whom a letter of advice is joined; — I beg you will do the needfull of these bills and given mine account credit for it; and as soon as my letter has been received by you, be so kind as to let me haven advice of it, and do me the pleasure of letting me know how my old friends Mess^{rs} Boulton and Watt and you are doing, with this severe winter which has lasted so long a time; In Expectation of your favourable answer I remain with particular regard.

at Rotterdam 4th off Maij 1809

Mess^{rs} Boulton Watt & C^o at Soho near Birmingham

Dear Gentlemen !

My last letter to you was of the 12th of April of which I send you a Coppij by these, which will serve principally for sending you the 2^d bills of Exchange, of which I have send you the firsts by mij letter mentioned above; and a first drawn from here 24th April, at thirty days sight by G^l van Dulken per Procur: Jay & C^o to mine order Upon Mess^{rs} G:F:Kinloch & Sons of the sum of=217 £St: which will balance th' amount of the 14 horses power Engine which Engine being of perfect workmanship, and answering certainly its intended power; has not fully the power wanted for its operations, which we have been necessitated to supply by a wheel; the calculations upon the power desired for it; have been made or taken to narrow for the purpose; we had better done to give them more space; without considering to much the first cost, as plenty of power will never do any harm; This will serve for a lesson in the future. (*Ed.Note: eventually in 1816 the engine's power was increased to a nominal 18 hp by replacing the cylinder by a larger one*)

I hope to receive soon your desired answers and remain mean while with sincere regard

Dear Gentlemen !

Your m^l ob: H: Serv^t
J:D:Huichelbos van Liender

(notes on this letter)

There seems a bal: of £74.6.- now in favour of M^r van Liender, but query, what In^t is to be charged ag^t him, if any? May 18. 1809. J:P:

Bill of £217 delivered to Msr^s (?) B Watt & C^o 20th May 1809