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54 **Waterjet cutting system**

57 A waterjet cutting system (1) comprising a source of water (2), a cylinder piston pump (3), and a water delivery tube (4) with a jet nozzle (5) which can be directed to an object which is to be cut, wherein the piston (6) of the cylinder piston pump (3) is connected to a spring (7), and that the pump (3) is embodied as a one-stroke pump, wherein the piston (6) has a first position wherein the spring (7) is loaded and a second position wherein the spring (7) is relaxed, and that relaxing the spring (7) when the spring (7) is loaded drives the piston (6) from the first position to the second position.

Waterjet cutting system

The invention relates to a waterjet cutting system comprising a source of a fluid substantially comprising water, a cylinder piston pump, and a water delivery tube with a jet nozzle which can be directed to an object which is to be cut or drilled. Whenever in this application water is mentioned, it is not intended to refer to pure water, but to water which is suitable for medical applications and which accordingly usually comprises a saline solution. The term pump as used herein should be understood as a device that is equipped to receive a fluid substantially comprising water, and which is equipped to subsequently expel such fluid substantially comprising water. It will be obvious for the skilled person that neither the source of fluid nor the pump or any other part of the system is defined by the level of intentional or unintentional impurities that are present in the fluid comprised in it or flowing through it. Clearly a tube is a tube, and it will not change from being a tube depending on the substance that flows through it.

US 6,216,573 discloses such a waterjet cutting system. The challenge in using such a waterjet cutting system for cutting or drilling human tissue, in particular bone material, is to provide a high-pressure waterjet which is available with a large volume flow. It is a problem to provide a waterjet cutting system having such properties in combination. Another problem with existing waterjet cutting systems for medical applications is that they are bulky and noisy.

It is an object of the invention to provide a waterjet cutting system occupying only little space, wherein the system is relatively silent in operation, and that provide a waterjet with a large volume flow and at a high-pressure.

According to the invention a waterjet cutting system is proposed having the features of one or more of the appended claims.

The waterjet cutting system of the invention differentiates from the prior art in that the piston of the cylinder piston pump is connected to a spring, and that the pump is embodied as a one-stroke pump, wherein the piston has a first

position wherein the spring is or can be loaded and a second position wherein the spring is at least in part relaxed, and that relaxing the spring when the spring is loaded drives the piston from the first position to the second position there-
5 with expelling water through the delivery tube and out of the jet nozzle. The feature of the spring-loaded piston secures that water can be expelled from the jet nozzle in a large volume rate and at a high-pressure, whereas the operation of the system produces only a limited amount of noise.

10 After the pump has executed its stroke wherein the piston is driven from the first position to the second position, it is possible to move the piston back from the second position to the first position. If however in the second position the water is not completely expelled from the cylinder
15 piston pump, it is possible to load the spring again and relax it for expelling the remainder of the water from the cylinder piston pump.

It is preferable that drive means are provided to move the piston from the second position wherein the spring is relaxed to the first position wherein the spring is loaded.
20 After that the waterjet cutting system is ready for a normal further operational stroke of the piston.

Suitably the drive means comprises an electric motor that is connected to the piston. The word comprises means that
25 the electric motor may not be the only device that is connected to the piston, since preferably a transmission will be applied between the electric motor and the piston.

In another embodiment the drive means comprises an hydraulic pump for supply of water into the cylinder piston
30 pump so as to move the piston to the first position wherein the spring is loaded.

In still another embodiment the drive means comprises an hydraulic pump for directly loading the spring.

35 Preferably the spring is mounted in a frame, wherein on opposite sides of the spring the cylinder piston pump and the hydraulic pump are provided. This restricts the total height of the system. If height is not important than it is possible that the spring is mounted in a frame, wherein the

cylinder piston pump and the hydraulic pump are provided stacked upon each other.

It is possible to use any type of spring in the waterjet cutting system of the invention. Preferably however
5 the spring is embodied as a disc spring, which is advantageous because of its limited dimensions and low weight. A further advantage is that the cylinder piston pump and/or the hydraulic pump can be positioned in the central aperture of the disc spring, which reduces the overall height of the system.

10 The invention will hereinafter be further elucidated with reference to the drawing of some exemplary embodiments of a waterjet cutting system according to the invention that is not limiting as to the appended claims.

In the drawing:

15 -figures 1A/1B schematically show a first embodiment of the waterjet cutting system according to the invention;
-figures 2A/2B schematically show a second embodiment of the waterjet cutting system according to the invention;
-figures 3A/B/C show a third embodiment of the water-
20 jet cutting system according to the invention; and
-figures 4A/B/C show a fourth embodiment of the waterjet cutting system according to the invention.

Whenever in the figures the same reference numerals are applied, these numerals refer to the same parts.

25 As shown in the respective figures the waterjet cutting system 1 according to the invention comprises a source of water 2, a cylinder piston pump 3, and a water delivery tube 4 with a jet nozzle 5 which can be directed to an object which is to be cut or drilled. As already mentioned whenever in this
30 application water is mentioned, it is not intended to refer to pure water, but to water which is suitable for medical applications and which accordingly comprises a saline solution.

The piston 6 of the cylinder piston pump 3 is connected to a spring 7. The cylinder piston pump 3 is further
35 embodied as a one-stroke pump, wherein the piston 6 has a first position wherein the spring 7 is loaded (fig. 1A and fig. 2A) or can be loaded (fig. 3A and fig. 4A). The process of moving the piston 6 to a starting or first position at the beginning of a stroke is shown for different embodiments in

figures 1A, 2A, 3A/3B and 4A/4B. In the embodiments of figure 1A and figure 2A moving the piston 6 to the starting or first position is completed in figure 1B and figure 2B, respectively and loads the spring 7. In the embodiments of figure 3A and figure 4A moving the piston 6 to the starting or first position makes the system ready for loading the spring 7.

During the process of moving the piston 6 to the starting or first position, fluid enters into the cylinder piston pump 3 coming from the source of water 2. The process is completed in the situations depicted in figures 1B, 2B, 3B, and 4B. After that, i.e. when the piston 6 is in its first position the spring 7 is loaded as shown in figure 1B and figure 2B or the spring 7 can be loaded as is shown in figure 3B and figure 4B. In the embodiments of figure 3B and figure 4B a separate hydraulic pump 12 is applied for the pressurization of the spring 7. In the embodiment of figure 3B the hydraulic pump 12 is at a side of the spring 7 which is opposite to where the cylinder piston pump 3 is provided. In the embodiment of figure 4B the hydraulic pump 12 and the cylinder piston pump 3 are stacked upon each other at the same side of the spring 7.

After the pressurization of the spring 7 has been completed, a user 8 can initiate that the piston 6 will move to a second position wherein the spring 7 will be relaxed. This action of relaxing the spring 7 departing from the situation wherein the spring 7 is loaded drives the piston 6 from the first position to the second position. Accordingly water that is in advance of this operation collected in the piston cylinder pump 3 will be expelled at high pressure and in a large volume rate through the water delivery tube 4 towards and out of the water nozzle 5. This is symbolized with the arrows 9 in figures 1B, 2B, 3C, and 4C.

The different embodiments that are shown in the respective figures can thus be summarized to show the following features.

Figures 1A/1B and figures 2A/2B show that drive means are provided to move the piston 6 from the second position wherein the spring 7 is (at least in part) relaxed back to the first position wherein the spring 7 is loaded. Figures 1A/1B

show that the drive means 10 comprises an electric motor 11 provided with an intermediate transmission, which is connected to the piston 6. Figures 2A/2B show an alternative wherein the drive means 10 comprises an hydraulic pump 12 for supply of water into the cylinder piston pump 3 so as to move the piston 6 from the second position back to the first position wherein the spring 7 is loaded.

The third embodiment of figures 3A/3B/3C has the feature that the drive means 10 connects to an hydraulic pump 12, however at this time the hydraulic pump 12 serves for directly loading the spring 7. Figures 3A/3B/3C further depict that the spring 7 is embodied as a disc spring 13, and that the disc spring 13 is mounted in a frame 14, wherein on opposite sides of the disc spring 13 the cylinder piston pump 3 and the hydraulic pump 12 are provided.

A fourth embodiment is shown in figures 4A/4B/4C which show that drive means 10 are provided to move the piston 6 from the second position wherein the spring 7 (again embodied as a disc spring 13) is (at least in part) relaxed, back to the first position wherein the spring 7 is loaded. Figures 4A/4B show that the drive means 10 connects for that purpose to an hydraulic pump 12 which is placed in a stacked relation with the cylinder piston pump 3.

During its operation the hydraulic pump 12 moves the cylinder piston pump 3 with the piston 6 from the second position wherein the spring 7 is relaxed back to the first position wherein the spring 7 is loaded. Figure 4C depicts finally that a user 8 can initiate that the spring 7 will be relaxed to move the piston 6 to the second position, during which process water will be expelled through the water delivery tube 4 and the nozzle 5 at high pressure and in a large volume rate. This is symbolized with the arrows 9 in figure 4C.

Although the invention has been discussed in the foregoing with reference to exemplary embodiments of the waterjet cutting system of the invention, the invention is not restricted to these particular embodiments which can be varied in many ways without departing from the invention. The discussed exemplary embodiments shall therefore not be used to construe the appended claims strictly in accordance therewith.

On the contrary the embodiments are merely intended to explain the wording of the appended claims without intent to limit the claims to these exemplary embodiments. The scope of protection of the invention shall therefore be construed in accordance
5 with the appended claims only, wherein a possible ambiguity in the wording of the claims shall be resolved using these exemplary embodiments.

Aspects of the invention are itemized in the following section.

- 10 1. A waterjet cutting system (1) comprising a source of a fluid substantially comprising water (2), a cylinder piston pump (3), and a water delivery tube (4) with a jet nozzle (5) which can be directed to an object which is to be cut, characterized in that the piston (6) of the cylinder
15 piston pump (3) is connected to a spring (7), and that the pump (3) is embodied as a one-stroke pump, wherein the piston (6) has a first position wherein the spring (7) can be loaded and a second position wherein the spring (7) is at least in part relaxed, and that relaxing the spring (7)
20 when the spring (7) is loaded drives the piston (6) from the first position to the second position therewith expelling water through the delivery tube (4) and out of the jet nozzle (5).
- 25 2. Waterjet cutting system according to claim 1, characterized in that drive means (10) are provided to move the piston (6) from the second position wherein the spring (7) is relaxed to the first position wherein the spring (7) is loaded.
- 30 3. Waterjet cutting system according to claim 2, characterized in that the drive means (10) comprises an electric motor (11), and preferably a transmission, that is connected to the piston (6).
- 35 4. Waterjet cutting system according to claim 2, characterized in that the drive means (10) comprises an hydraulic pump (12) for supply of water into the cylinder piston pump (3) so as to move the piston (6) to the first position wherein the spring (7) is or can be loaded.

5. Waterjet cutting system according to claim 2, characterized in that the drive means (10) comprises an hydraulic pump (12) for directly loading the spring (7).
- 5 6. Waterjet cutting system according to any one of claims 1 - 6, characterized in that the spring (7) is mounted in a frame (14), wherein on opposite sides of the disc spring (13) the cylinder piston pump (3) and the hydraulic pump (12) are provided.
- 10 7. Waterjet cutting system according to any one of claims 1 - 6, characterized in that the spring (7) is mounted in a frame (14), wherein the cylinder piston pump (3) and the hydraulic pump (12) are provided stacked upon each other.
- 15 8. Waterjet cutting system according to any one of claims 1 - 7, characterized in that the spring (7) is embodied as a disc spring (13).

CONCLUSIES

1. Waterstraalsnijsysteem (1) omvattende een fluidumbron die in hoofdzaak water (2) bevat, een cilinderzuigerpomp (3) en een waterafgiftebuis (4) met een straalpijp (5) die richtbaar is op een te snijden object, **met het kenmerk, dat** de
5 zuiger (6) van de cilinderzuigerpomp (3) is verbonden met een veer (7) en dat de pomp (3) is uitgevoerd als een één-slagpomp, waarbij de zuiger (6) een eerste positie heeft waarin de veer (7) kan worden gespannen en een tweede positie waarin de veer (7) ten minste gedeeltelijk is ontspannen, en
10 het vrijgeven van de veer (7) wanneer de veer (7) is gespannen, de zuiger (6) van de eerste positie naar de tweede positie drijft, waardoor water door de afgiftebuis (4) en uit het jetmondstuk (5) wordt uitgestoten.

2. Waterstraalsnijsysteem volgens conclusie 1, **met**
15 **het kenmerk, dat** een aandrijfmiddel (10) is voorzien om de zuiger (6) te verplaatsen vanuit de tweede positie waarin de veer (7) is ontspannen naar de eerste positie waarin de veer (7) is gespannen.

3. Waterstraalsnijsysteem volgens conclusie 2, **met**
20 **het kenmerk, dat** het aandrijfmiddel (10) een elektrische motor (11) omvat, en bij voorkeur een transmissie, die is verbonden met de zuiger (6).

4. Waterstraalsnijsysteem volgens conclusie 2, **met**
25 **het kenmerk, dat** het aandrijfmiddel (10) een hydraulische pomp (12) omvat voor het toevoeren van water naar de cilinderzuigerpomp (3) om de zuiger (6) te verplaatsen naar de eerste positie waarin de veer (7) is of kan worden gespannen.

5. Waterstraalsnijsysteem volgens conclusie 2, **met**
30 **het kenmerk, dat** het aandrijfmiddel (10) een hydraulische pomp (12) omvat voor het direct spannen van de veer (7).

6. Waterstraalsnijsysteem volgens een van de conclusies 1 - 6, **met het kenmerk, dat** de veer (7) in een frame (14) is gemonteerd, waarbij aan tegenoverliggende zijden van de schijfveer (13) de cilinderzuigerpomp (3) en de hydraulische
35 pomp (12) zijn voorzien.

7. Waterstraalsnijsysteem volgens een van de conclusies 1 - 6, **met het kenmerk, dat** de veer (7) in een frame (14)

is gemonteerd, waarbij de cilinderzuigerpomp (3) en de hydraulische pomp (12) op elkaar zijn gestapeld.

8. Waterstraalsnijsysteem volgens een van de conclusies 1-7, **met het kenmerk, dat** de veer (7) is uitgevoerd als
5 een schijfveer (13).

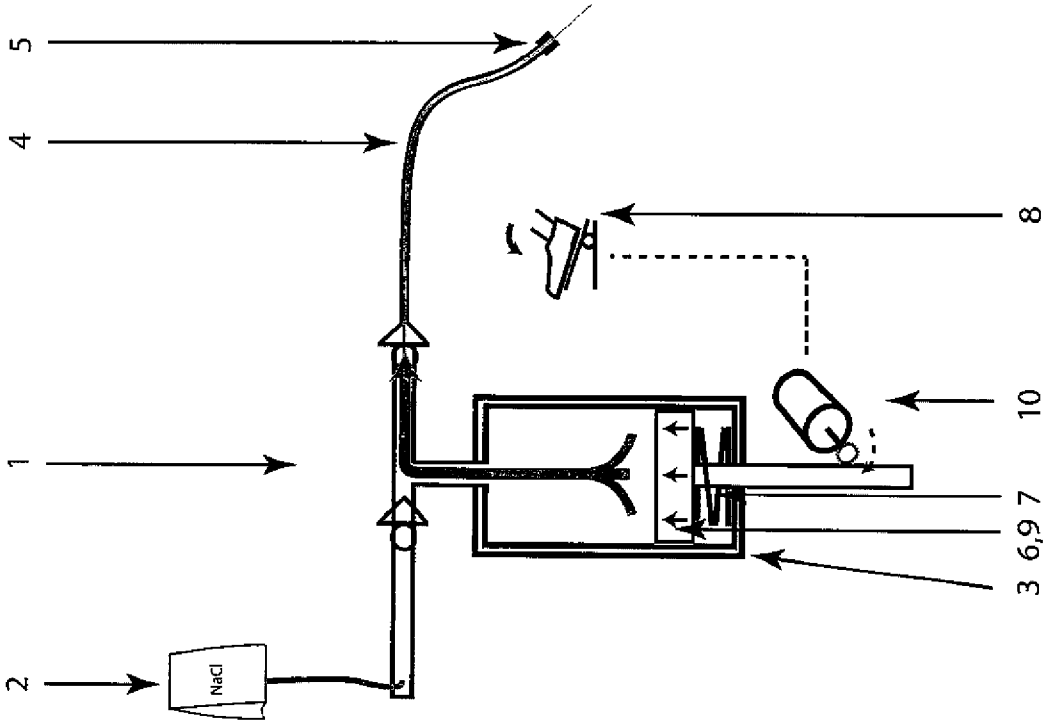


Fig. 1B

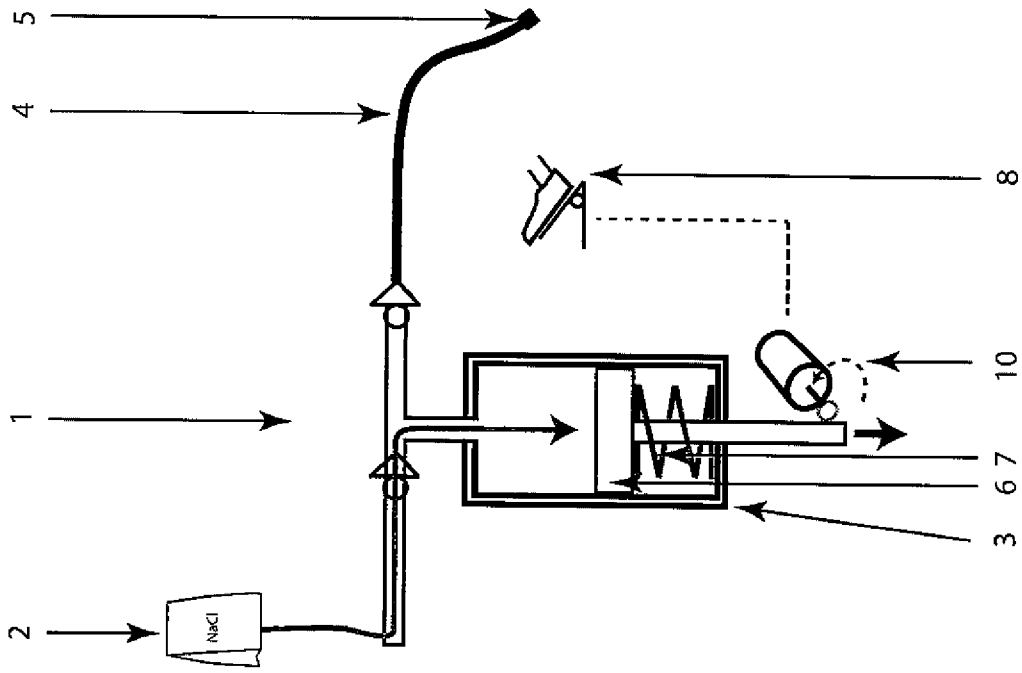


Fig. 1A

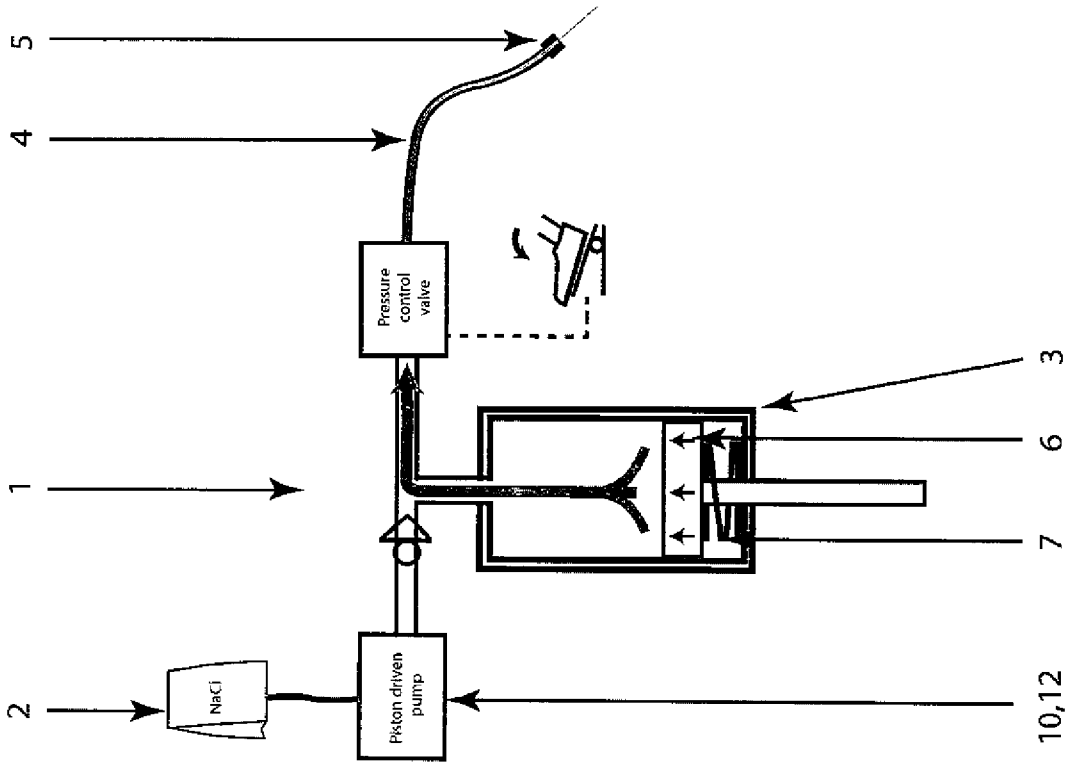


Fig. 2B

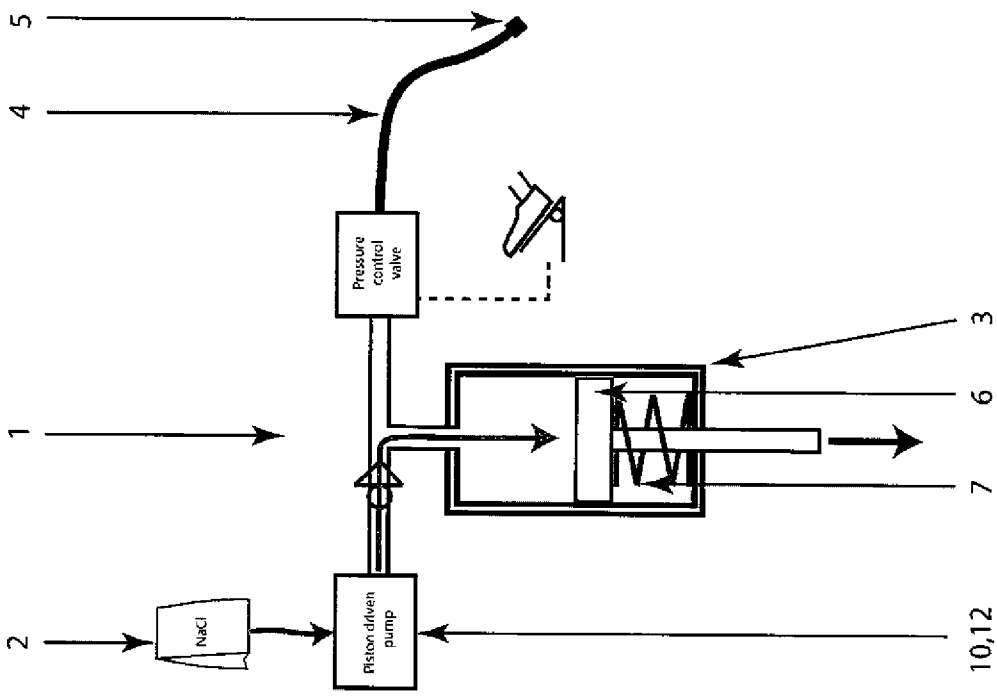


Fig. 2A

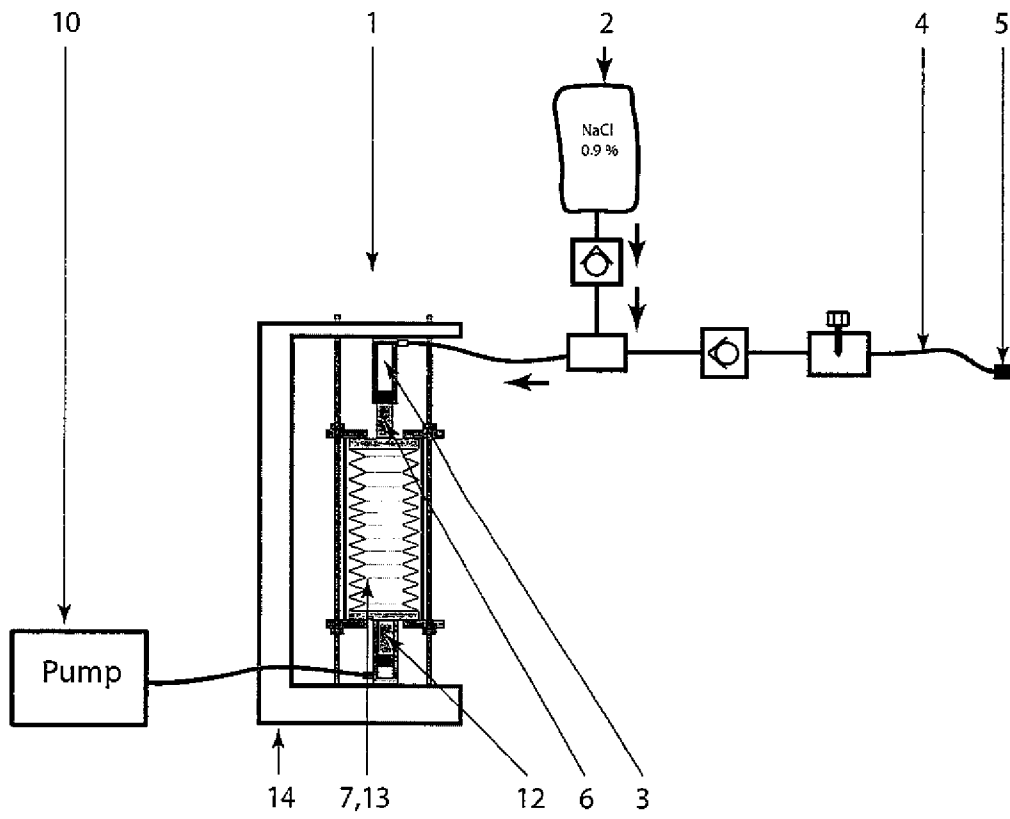
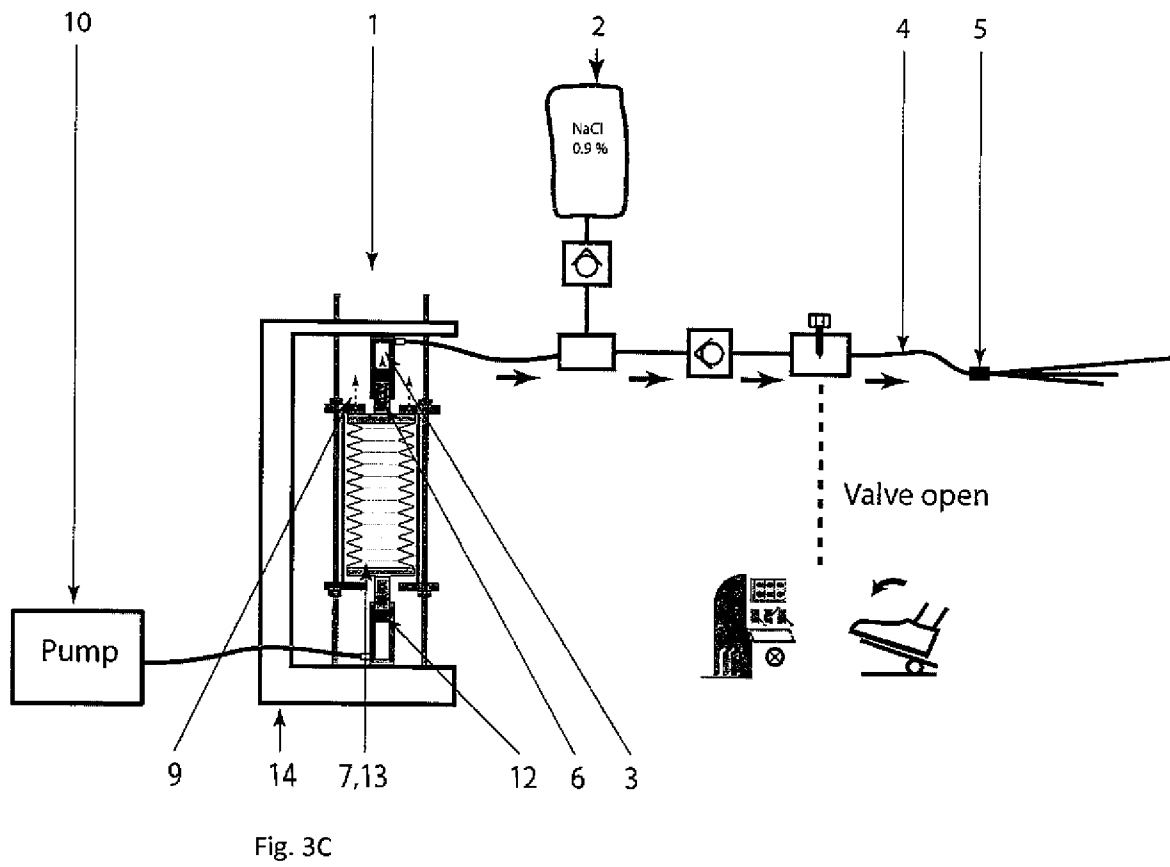
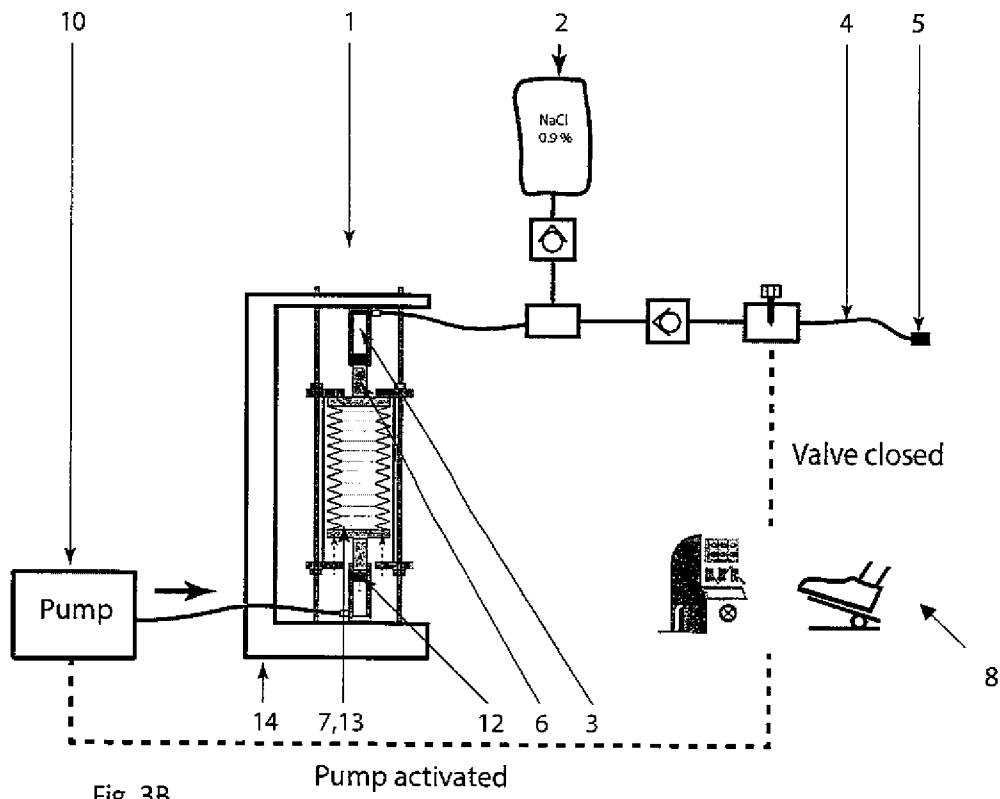


Fig. 3A



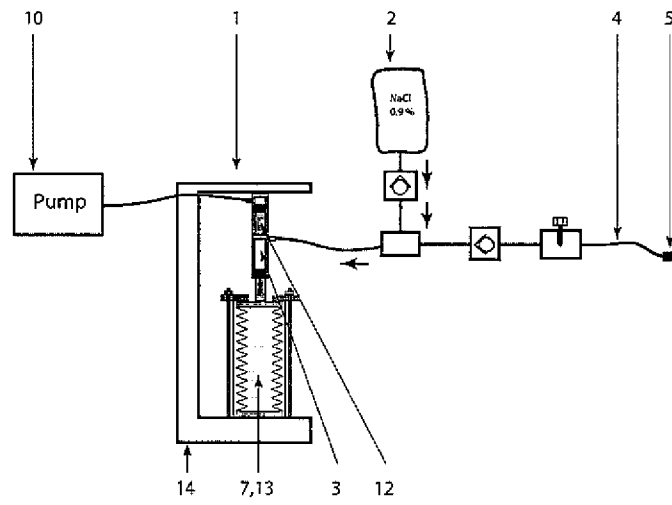


Fig. 4A

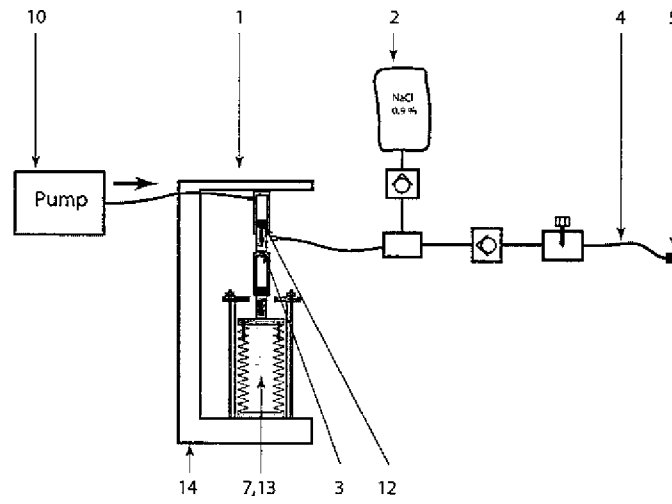


Fig. 4B

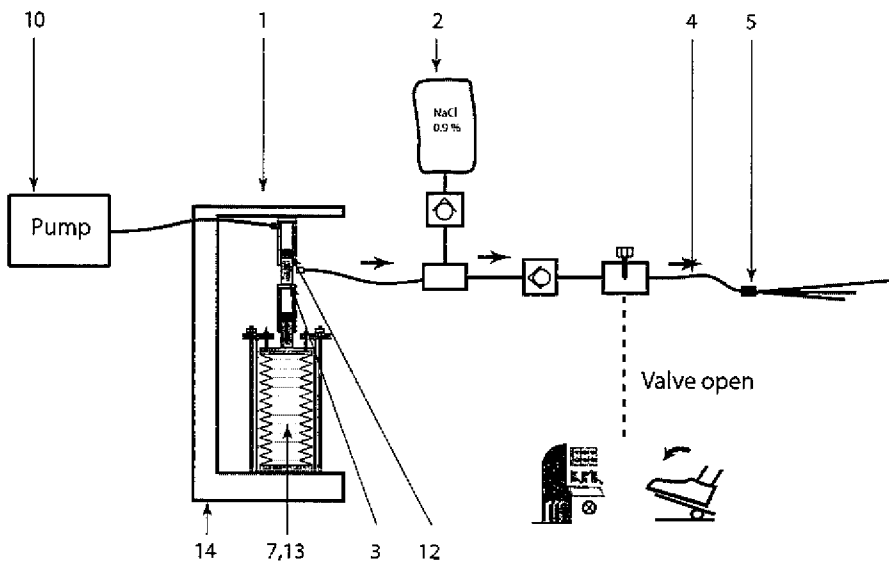


Fig. 4C

SAMENWERKINGSVERDRAG (PCT)

RAPPORT BETREFFENDE NIEUWHEIDSONDERZOEK VAN INTERNATIONAAL TYPE

IDENTIFICATIE VAN DE NATIONALE AANVRAGE	KENMERK VAN DE AANVRAGER OF VAN DE GEMACHTIGDE 018979NL-PD
Nederlands aanvraag nr. 2024158	Indieningsdatum 05-11-2019
	Ingeroepen voorrangsdatum
Aanvrager (Naam) Technische Universiteit Delft, et al	
Datum van het verzoek voor een onderzoek van internationaal type 07-12-2019	Door de Instantie voor Internationaal Onderzoek aan het verzoek voor een onderzoek van internationaal type toegekend nr. SN74979
I. CLASSIFICATIE VAN HET ONDERWERP (bij toepassing van verschillende classificaties, alle classificatiesymbolen opgeven)	
Volgens de internationale classificatie (IPC) Zie onderzoeksrapport	
II. ONDERZOCHE GEBIEDEN VAN DE TECHNIEK	
Onderzochte minimumdocumentatie	
Classificatiesysteem	Classificatiesymbolen
IPC	Zie onderzoeksrapport
Onderzochte andere documentatie dan de minimum documentatie, voor zover dergelijke documenten in de onderzochte gebieden zijn opgenomen	
III. <input type="checkbox"/>	GEEN ONDERZOEK MOGELIJK VOOR BEPAALDE CONCLUSIES (opmerkingen op aanvullingsblad)
IV. <input type="checkbox"/>	GEBREK AAN EENHEID VAN UITVINDING (opmerkingen op aanvullingsblad)

**ONDERZOEKSRAPPORT BETREFFENDE HET
RESULTAAT VAN HET ONDERZOEK NAAR DE STAND
VAN DE TECHNIEK VAN HET INTERNATIONALE TYPE**

Nummer van het verzoek om een onderzoek naar
de stand van de techniek

NL 2024158

<p>A. CLASSIFICATIE VAN HET ONDERWERP INV. A61B17/32 ADD.</p>		
<p>Volgens de Internationale Classificatie van octrooien (IPC) of zowel volgens de nationale classificatie als volgens de IPC.</p>		
<p>B. ONDERZOCHETE GEBIEDEN VAN DE TECHNIEK</p>		
<p>Onderzochte minimum documentatie (classificatie gevolgd door classificatiesymbolen) A61B</p>		
<p>Onderzochte andere documentatie dan de minimum documentatie, voor dergelijke documenten, voor zover dergelijke documenten in de onderzochte gebieden zijn opgenomen</p>		
<p>Tijdens het onderzoek geraadpleegde elektronische gegevensbestanden (naam van de gegevensbestanden en, waar uitvoerbaar, gebruikte trefwoorden) EPO-Internal, WPI Data</p>		
<p>C. VAN BELANG GEACHTE DOCUMENTEN</p>		
Categorie °	Geciteerde documenten, eventueel met aanduiding van speciaal van belang zijnde passages	Van belang voor conclusie nr.
X	US 2014/142536 A1 (HAGG MARTIN [DE] ET AL) 22 mei 2014 (2014-05-22)	1-3,5-8
Y	* alinea [0007] - alinea [0011]; figuren 1-2,6 * * alinea [0046] - alinea [0047] *	4
X	WO 2017/193026 A1 (WAZER INC [US]) 9 november 2017 (2017-11-09) * alinea [0001]; figuren 2-5B * * alinea [0019] * * alinea [0024] * * alinea [0035] * * alinea [0094] *	1-3,5-8
Y	US 2009/060764 A1 (MITZLAFF LOTHAR [PT] ET AL) 5 maart 2009 (2009-03-05) * alinea [0004]; figuur 3 * * alinea [0035] *	4
<p><input type="checkbox"/> Verdere documenten worden vermeld in het vervolg van vak C. <input checked="" type="checkbox"/> Leden van dezelfde octrooifamilie zijn vermeld in een bijlage</p>		
<p>° Speciale categorieën van aangehaalde documenten</p> <p>"A" niet tot de categorie X of Y behorende literatuur die de stand van de techniek beschrijft</p> <p>"D" in de octrooiaanvraag vermeld</p> <p>"E" eerdere octrooi(aanvraag), gepubliceerd op of na de indieningsdatum, waarin dezelfde uitvinding wordt beschreven</p> <p>"L" om andere redenen vermelde literatuur</p> <p>"O" niet-schriftelijke stand van de techniek</p> <p>"P" tussen de voorrangsdatum en de indieningsdatum gepubliceerde literatuur</p> <p>"T" na de indieningsdatum of de voorrangsdatum gepubliceerde literatuur die niet bezwarend is voor de octrooiaanvraag, maar wordt vermeld ter verheldering van de theorie of het principe dat ten grondslag ligt aan de uitvinding</p> <p>"X" de conclusie wordt als niet nieuw of niet inventief beschouwd ten opzichte van deze literatuur</p> <p>"Y" de conclusie wordt als niet inventief beschouwd ten opzichte van de combinatie van deze literatuur met andere geciteerde literatuur van dezelfde categorie, waarbij de combinatie voor de vakman voor de hand liggend wordt geacht</p> <p>"&" lid van dezelfde octrooifamilie of overeenkomstige octrooipublicatie</p>		
<p>Datum waarop het onderzoek naar de stand van de techniek van internationaal type werd voltooid</p> <p>18 juni 2020</p>		<p>Verzenddatum van het rapport van het onderzoek naar de stand van de techniek van internationaal type</p>
<p>Naam en adres van de instantie</p> <p>European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016</p>		<p>De bevoegde ambtenaar</p> <p>Martinez Ramos, A</p>

**ONDERZOEKSRAPPORT BETREFFENDE HET
RESULTAAT VAN HET ONDERZOEK NAAR DE STAND
VAN DE TECHNIEK VAN HET INTERNATIONALE TYPE**

Informatie over leden van dezelfde octrooifamilie

Nummer van het verzoek om een onderzoek naar
de stand van de techniek

NL 2024158

In het rapport genoemd octrooigeschrift	Datum van publicatie	Overeenkomend(e) geschrift(en)	Datum van publicatie	
US 2014142536	A1	22-05-2014	BR 102013029470 A2	07-10-2014
			CN 103816588 A	28-05-2014
			EP 2732770 A1	21-05-2014
			JP 5856132 B2	09-02-2016
			JP 2014100563 A	05-06-2014
			KR 20140063446 A	27-05-2014
			PL 2732770 T3	30-12-2016
			RU 2013150912 A	20-05-2015
			US 2014142536 A1	22-05-2014

WO 2017193026	A1	09-11-2017	CN 209273236 U	20-08-2019
			CN 210704342 U	09-06-2020
			GB 2564370 A	09-01-2019
			US 2020122295 A1	23-04-2020
			WO 2017193026 A1	09-11-2017

US 2009060764	A1	05-03-2009	AU 2005259594 A1	12-01-2006
			CN 1980609 A	13-06-2007
			DE 102004031673 A1	26-01-2006
			EP 1768580 A1	04-04-2007
			JP 4925213 B2	25-04-2012
			JP 2008504086 A	14-02-2008
			US 2009060764 A1	05-03-2009
WO 2006002817 A1	12-01-2006			

WRITTEN OPINION

File No. SN74979	Filing date (<i>day/month/year</i>) 05.11.2019	Priority date (<i>day/month/year</i>)	Application No. NL2024158
International Patent Classification (IPC) INV. A61B17/32			
Applicant Technische Universiteit Delft, et al			

This opinion contains indications relating to the following items:

- Box No. I Basis of the opinion
- Box No. II Priority
- Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- Box No. IV Lack of unity of invention
- Box No. V Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- Box No. VI Certain documents cited
- Box No. VII Certain defects in the application
- Box No. VIII Certain observations on the application

	Examiner Martinez Ramos, A
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WRITTEN OPINION**Box No. I Basis of this opinion**

1. This opinion has been established on the basis of the latest set of claims filed before the start of the search.
2. With regard to any **nucleotide and/or amino acid sequence** disclosed in the application and necessary to the claimed invention, this opinion has been established on the basis of:
 - a. type of material:
 - a sequence listing
 - table(s) related to the sequence listing
 - b. format of material:
 - on paper
 - in electronic form
 - c. time of filing/furnishing:
 - contained in the application as filed.
 - filed together with the application in electronic form.
 - furnished subsequently for the purposes of search.
3. In addition, in the case that more than one version or copy of a sequence listing and/or table relating thereto has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that in the application as filed or does not go beyond the application as filed, as appropriate, were furnished.
4. Additional comments:

Box No. V Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty	Yes: Claims	3-8
	No: Claims	1, 2
Inventive step	Yes: Claims	
	No: Claims	1-8
Industrial applicability	Yes: Claims	1-8
	No: Claims	

2. Citations and explanations

see separate sheet

WRITTEN OPINION

Application number

NL2024158

Box No. VIII Certain observations on the application

see separate sheet

Re Item V

Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1 Reference is made to the following documents:

D1 US 2014/142536 A1 (HAGG MARTIN [DE] ET AL) 22 mei 2014 (2014-05-22)

D2 WO 2017/193026 A1 (WAZER INC [US]) 9 november 2017 (2017-11-09)

D3 US 2009/060764 A1 (MITZLAFF LOTHAR [PT] ET AL) 5 maart 2009 (2009-03-05)

2 The present application does not meet the criteria of patentability, because the subject-matter of **claim 1 is not new**.

D1 discloses (the references apply to this document):

Waterstraalsnijsysteem (injection device 10, §7: "for the dissection of tissue") omvattende een fluïdum-bron die in hoofdzaak water bevat (§19: "the supply chamber may be filled with sodium chloride solution or another fluid"), een cilinderzuigerpomp (spring energy storage 29, fig.6) en een waterafgiftebuis (line 18) met een straalpijp (fluid exit opening 17, §27: "the fluid exit opening 17 is a nozzle") die richtbaar is op een te snijden object, met het kenmerk, dat de zuiger (plunger 25) van de cilinderzuigerpomp (29) is verbonden met een veer (spring 43) en dat de pomp is uitgevoerd als een één-slagpomp (fig.6), waarbij de zuiger een eerste positie heeft waarin de veer kan worden gespannen en een tweede positie waarin de veer ten minste gedeeltelijk is ontspannen, en het vrijgeven van de veer wanneer de veer is gespannen, de zuiger van de eerste positie naar de tweede positie drijft, waardoor water door de afgiftebuis en uit het jetmondstuk wordt uitgestoten (§47: " the pull rod 44 absorbs the force of the compression spring 43. If the locking arrangement 45 is released, for example, by tearing off or removing a blocking pin, the spring force acts on the plunger, thus pressurizing the fluid 21. In doing so, the fluid 21 can be released via the valve 23 and flow out in a controlled manner via the line 18").

3 The present application does not meet the criteria of patentability, because the subject-matter of **claim 1 does not involve an inventive step**.

- 3.1 **D2** may be regarded as being the prior art closest to the subject-matter of claim 1, and discloses (the references apply to this document):

Waterstraalsnijstelsysteem omvattende een fluïdum-bron die in hoofdzaak water (§1) bevat, een cilinderzuigerpomp (3015) en een waterafgiftebuis (high-pressure hose 1042) met een straalpijp (outlet nozzle 1033) die richtbaar is op een te snijden object, met het kenmerk, dat de zuiger (diaphragm 3016) van de cilinderzuigerpomp is verbonden met een veer (spring 3021) en dat de pomp is uitgevoerd als een één-slagpomp (fig.5B), waarbij de zuiger een eerste positie heeft waarin de veer kan worden gespannen en een tweede positie waarin de veer ten minste gedeeltelijk is ontspannen, en het vrijgeven van de veer wanneer de veer is gespannen, de zuiger van de eerste positie naar de tweede positie drijft, waardoor water door de afgiftebuis en uit het jetmondstuk wordt uitgestoten ("A compression spring 3021 is provided which engages the spring seat 3020 and the housing 3017 to bias the operating rod 3018.", "When the operating rod 3018 moves in a first direction (upwards in Fig. 5B), fluid enters the housing 3017 via an orifice 3024. The operating rod 3018 is then forced by the bias of the compression spring 3021 to move in a second direction (downwards in Fig. 5B), and the fluid is pressurized and exits the orifice 3024").

- 3.2 It is generally known to the person skilled in the art that the feature piston (of a piston pump) is an equivalent to the feature diaphragm (of a diaphragm pump) of D2 and can be interchanged with that feature where circumstances make it desirable.
- 3.3 For these reasons the solution proposed in claim 1 of the present application cannot be considered as involving an inventive step.

4 **Dependent claims 2-8** do not contain any features which, in combination with the features of any claim to which they refer, meet the requirements of **novelty** or **inventive step**.

4.1 **Re claim 2:** it is generally known to the skilled person that "drive means" are required in order to move the piston from the relaxed position to the loaded position, and therefore implicitly disclosed by D1 (§10,19,46), D2 (§35).

4.2 **Re claims 3, 5:** the use of an electric motor / hydraulic pump as drive means is merely one of several straightforward possibilities from which the skilled person would select, in accordance with circumstances, without the exercise of inventive skill. See also D2, §24.

- 4.3 **Re claim 4:** The features of dependent claim 4 have already been employed for the same purpose in a similar device (see D3, §35, fig.3, piston 22 acts as an hydraulic pump supplying water into 44 and loading spring 41). It would therefore be obvious to the person skilled in the art to apply these features with corresponding effect to a device according to D1, thus arriving at a device according to claim 4.
- 4.4 **Re claims 6-7:** see D1 (§46: "other end of said spring being supported by a housing wall"). It just implies a slight constructional change, which comes within the scope of the customary practice followed by persons skilled in the art, to place the **hydraulic pump** (a mechanical source of power that converts mechanical power into hydraulic energy = feature 10 in figs.3A-4C) in different positions. Consequently, the subject-matter of claims 6-7 also lacks an inventive step.
- 4.5 **Re claim 8:** the use of a well-known disc spring is merely one of several straightforward possibilities from which the skilled person would select, in accordance with circumstances, without the exercise of inventive skill.

Re Item VIII

Certain observations on the application

- 5 Claim 6 is not clear, because it refers to features according to claim 6 itself: "Waterstraalsnijstelsysteem volgens een van de conclusies 1 - **6**".
- 6 The term "of the disc spring" used in claim 6 refers to a technical feature not claimed before (but claimed later in claim 8) and leaves the reader in doubt as to the meaning of the technical feature to which it refers, thereby rendering the definition of the subject-matter of said claim unclear.