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(54) **Method, system and parts of said system for releasing a submergible load from a buoyant member**

(57) The invention relates to a method for releasing a submergible load from a buoyant member. The invention further relates to a plug for use in a system for releasing a submergible load from a buoyant member. The invention further relates to a system for releasing a submergible load from a buoyant member. The method comprises the steps of coupling the submergible load to the buoyant member with one or more releasable clips; providing a hose that extends through the releasable clips, wherein each releasable clip comprises a first clip member and a second clip member which are releasably engaged around the hose while leaving an intermediate space for accommodating said hose; and driving a plug through the hose, wherein the plug is dimensioned to fit through the hose in a release direction while the plug is too large to fit through the intermediate space between the engaged clip members.

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Method, system and parts of said system for releasing a submergible load from a buoyant member

BACKGROUND

The invention relates to a method, system and parts of said system for releasing a submergible load from a buoyant member.

GB 2 281 340 A discloses a number of clips between strops around supporting buoyancy and strops around a supported pipeline. A lay-flat inflatable tube extends from one clip to another. When the pipeline has been positioned as desired, resting on the sea-bed with the buoyancy remaining partially buoyant, the pneumatic or hydraulic pressure is applied into the lay-flat tube from one end. The nearest clip releases and the pressure builds up in the tube for release of the next clip. Thus all clips should release progressively and quickly.

In practice however, the clips do not fully close the lay-flat tube. Hence, the pressure tends to build up throughout the entire tube. Due to the overall pressure buildup, the release of consecutive clips may occur more rapidly and unpredictably than expected. In some cases, the clips are released almost simultaneously along the entire tube and there may be no way to slow down or stop the release process before the next clip.

It is an object of the present invention to provide a method, a system and parts of said system for releasing a submergible load from a buoyant member, wherein the controllability of the progressive release can be improved.

SUMMARY OF THE INVENTION

According to a first aspect, the invention provides a method for releasing a submergible load from a buoyant member, wherein the method comprises the steps of:

- coupling the submergible load to the buoyant member with the use of one or more straps retained by one or more releasable clips;
- providing a hose that extends through the one or more releasable clips, wherein each releasable clip comprises a first clip member and a second clip member which are releasably engaged to each other around the hose while leaving an intermediate space for accommodating said hose;
- inserting a plug into the hose in a release direction towards the one or more releasable clips, wherein the plug is dimensioned to fit through the hose in a release direction while the plug is too large to fit through the intermediate space between the engaged clip members;
- exerting a pressure onto the plug in the release direction, thereby driving the plug through the hose in the release direction towards and into contact with one of the one or more releasable clips; and
- exerting the pressure onto the plug in the release direction to force the plug through the intermediate space between the first clip member and the second clip member, thereby releasing or disengaging the first clip member and the second clip member.

In the prior art, a pressurized expansion of the hose is used which causes the simultaneous release of several releasable clips. In the method according to the present invention, a controlled, pressure driven movement of the plug through the hose can cause a controlled, one-by-one release of the releasable clips. In particular, the plug can prevent the pressure from travelling uncontrollably through the hose towards the releasable

clips.

In a preferred embodiment the method comprises the step of reducing the pressure or releasing the pressure that is exerted onto the plug to slow down or stop the driving of the plug through the hose. In the absence of a pressure force, the plug will stop moving through the hose and the release process can be interrupted almost instantaneously.

In a further embodiment the method comprises the step of providing the plug with a seal that divides the hose into a first section upstream and a second section downstream of the plug with respect to the release direction, wherein the seal prevents that pressure leaks from the first section to the second section. By sealing the hose, it can be prevented that pressure builds up in the second section, which pressure build up could prematurely release the releasable clips. Moreover, because of the sealing, the release process can be interrupted reliably.

In a further embodiment the plug is provided with a wedge that tapers towards the one releasable clip, wherein the step of forcing the plug through said one releasable clip comprises the step of forcing the wedge between the first clip member and the second clip member in the release direction, thereby effectively wedging open said one releasable clip. The wedge can reduce the amount of pressure required to force the plug through the releasable clip. In particular, the wedge can be shaped so as to effectively convert at least a part of the pressure into a release force acting transversely with respect to the release direction onto the clip members.

Preferably, the pressure for driving the plug through the hose is in the range of 0.5 to 1 bar. The pressure for forcing the plug through the one releasable clip is in the range of 2.0 to 10.0 bar, and preferably in the range of 2.0 to 8.0 bar. The difference in pressure can be observed and/or controlled by an operator to monitor

and/or control the release process. The upper limit of 10.0 bar should be sufficient in normal conditions to force the plug through the releasable clip without puncturing the hose.

In a further embodiment the pressure is a hydraulic or a pneumatic pressure. Hydraulic pressure, i.e. water pressure, is preferred because of the non-compressive nature of liquids and because it can be sealed more easily by the plug. However, pneumatic pressure can be just as effective to force the plug through the hose.

In a further embodiment the method further comprises the step of providing reinforcement or buoyancy to the hose upstream of said one releasable clip with respect to the release direction to prevent slacking of the hose. Slacking of the hose can make it harder to force the plug through the releasable clip. In an embodiment thereof the reinforcement or buoyancy is arranged for keeping the hose at an angle within zero to fifty degrees with respect the release direction. At angles greater than fifty degrees, the pressure required to force the plug through the releasable clip increases significantly and may exceed 10.0 bar.

In a practical embodiment the hose has a first end where the plug is inserted and a second end downstream of the first end in the release direction, wherein the method further comprises the step of providing a collection member at or near the second end of the hose for collecting the plug. Hence, it can be prevented that the plug is released uncontrollably at the second end, potentially creating a hazardous situation at the second end. Moreover, the collected plug can be reused for a next cycle of the method.

In an embodiment thereof the method comprises the step of reducing or releasing the pressure in the hose upstream of the collected plug with respect to the release direction. Thus, it can be prevented that the pressure builds up to hazardous levels behind the collected plug.

In a further embodiment the method further comprises the step of providing a lubricant between the plug and the hose to facilitate sliding of said plug within the hose.

In an embodiment thereof the lubricant is applied on the plug prior to insertion. Hence, the plug can carry the lubricant and apply it to the hose as the plug travels through the hose.

According to a second aspect, the invention provides a plug for use in a system for releasing a submergible load from a buoyant member, wherein the system comprises a buoyant member, one or more releasable clips for coupling the submergible load to the buoyant member and a hose extending through the one or more releasable clips, wherein each releasable clip comprises a first clip member and a second clip member which are arranged to be releasably engaged to each other around the hose while leaving an intermediate space for accommodating said hose, wherein the plug is dimensioned to fit through the hose in a release direction while the plug is too large to fit through the intermediate space between the engaged clip members.

The plug according to the invention can be used to obtain a one-by-one release of the releasable clips.

In a preferred embodiment the plug has a leading end that is arranged to face in the release direction and a trailing end that is arranged to face opposite to the release direction, wherein the plug is too large to fit through the intermediate space between clip members at or near the leading end. Hence, the part of the plug that comes into the contact with the releasable clip first can already force the clip members to disengage.

In an embodiment thereof the plug is provided with a wedge at the leading end, wherein the wedge is arranged to taper in the release direction. Preferably, the wedge tapers conically. The wedge can reduce the amount of pressure required to force the plug through the releasable

clip. In particular, the wedge can be shaped so as to effectively convert at least a part of the pressure into a release force acting transversely with respect to the release direction onto the clip members.

In a further embodiment the plug is provided with a seal that is arranged for closely abutting and/or sealing the hose. Preferably the seal has a circular cross section.

In a further embodiment thereof the seal is provided at or near the trailing end of the plug. Hence, the leading end of the plug can be used to force the release of the releasable clip, while the seal at the trailing end can keep the hose sealed. By sealing the hose, it can be prevented that pressure builds up in the second section, which pressure build up could prematurely release the releasable clips. Moreover, because of the sealing, the release process can be interrupted reliably.

In a further embodiment thereof the largest diameter of the part of the plug downstream of the seal in the release direction is smaller than the largest diameter of the plug at the seal. In particular, the largest diameter of the part of the plug downstream of the seal in the release direction is ninety percent or less, and preferably eighty percent or less, of the largest diameter of the plug at the seal. Hence, said part of the plug may be able to move and/or tilt with respect to the center of the hose to allow some degree of centering of the leading end of the plug relative to the releasable clip.

In a further embodiment the plug has a largest diameter of less than six centimeters, and preferably less than three centimeters. Hence, the plug is able to fit in a correspondingly dimensioned hose.

In one embodiment the plug comprises a plug body, wherein the plug body comprises or forms a lubrication surface for receiving an amount of lubricant to reduce the resistance to sliding of the plug with respect to the hose. Hence, the plug can carry the lubricant and apply it to the hose as the plug travels through the hose.

In an embodiment thereof the lubrication surface is recessed with respect to the adjacent parts of the plug for easy application and/or gradual release of the lubricant into the space between the plug and the hose.

According to a third aspect, the invention provides a system for releasing a submergible load from a buoyant member, comprising a buoyant member, one or more releasable clips for coupling the submergible load to the buoyant member and a hose extending through the one or more releasable clips, wherein each releasable clip comprises a first clip member and a second clip member which are arranged to be releasably engaged to each other around the hose while leaving an intermediate space for accommodating said hose, wherein the system further comprises a plug that is insertable into the hose in a release direction towards the one or more releasable clips, wherein the plug is dimensioned to be fit through the hose in the release direction while the plug is too large to fit through the intermediate space between the engaged clip members, wherein the system comprises a pressure source that is connectable to the hose at a first end thereof upstream of the plug with respect to the release direction, wherein the pressure source is arranged for exerting a pressure onto the plug in the release direction to drive the plug through the hose in the release direction towards and into contact with one of the one or more releasable clips and through the intermediate space between the engaged clip members of said one releasable clip, to release said clip members.

In the system according to the present invention, the plug can be controllably driven with pressure through the hose, thereby causing a controlled, one-by-one release of the releasable clips. In particular, the plug can prevent the pressure from travelling uncontrollably through the hose towards the releasable clips.

In a preferred embodiment of the system the pressure source comprises a control member for controlling the pressure of the pressure source. Hence, the pressure

can be increased, reduced or released to control the rate of the release.

In a further embodiment of the system the pressure source is a pneumatic or a hydraulic pressure source. Hydraulic pressure, i.e. water pressure, is preferred because of the non-compressive nature of liquids and because it can be sealed more easily by the plug. However, pneumatic pressure can be just as effective to force the plug through the hose.

In a practical embodiment of the system the hose has a second end downstream of the first end in the release direction, wherein the system comprises a collection member for collecting the plug at or near the second end. Hence, it can be prevented that the plug is released uncontrollably at the second end, potentially creating a hazardous situation at the second end. Moreover, the collected plug can be reused for a next cycle of the method.

In an embodiment thereof the hose is provided with one or more perforations which are arranged to be upstream of the collected plug at or near the second end. Thus, pressure can escape through the perforations such that it can be prevented that the pressure builds up to hazardous levels behind the collected plug.

In a further embodiment of the system the hose is provided with a reinforcement element, preferably a rib, for increasing the rigidity of the hose against slacking. Slacking of the hose can make it harder to force the plug through the releasable clip. The reinforcement element can increase the rigidity of the hose against slacking.

In an alternative embodiment of the system the hose is a primary hose, wherein the system further comprises an auxiliary hose that is connected to the primary hose and that is arranged to provide buoyancy and/or stiffness to the primary hose once the primary hose is released from the buoyant member. The buoyancy and/or stiffness can prevent or reduce the amount of the slacking

of the hose once it is released from the buoyant member.

The various aspects and features described and shown in the specification can be applied, individually, wherever possible. These individual aspects, in particular the aspects and features described in the attached dependent claims, can be made subject of divisional patent applications.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will be elucidated on the basis of an exemplary embodiment shown in the attached schematic drawings, in which:

figure 1 shows a side view of a system according to a first embodiment of the invention for releasing a submergible load from a buoyant member during a first step of a method for releasing said submergible load from the buoyant member;

figure 2 shows a detail of the system according to the circle II in figure 1;

figure 3 shows a side view of the system of figure 1 during a second step of the method for releasing said submergible load from the buoyant member;

figure 4 shows a cross section of the system according to the line IV-IV in figure 1;

figure 5 shows a cross section of the system according to the line V-V in figure 2;

figure 6 shows a side view of an alternative system according to a second embodiment of the invention for releasing the submergible load from the buoyant member;

figure 7 shows a side view of a further alternative system according to a third embodiment of the invention for releasing the submergible load from the buoyant member; and

figure 8 shows an optional collecting member for use in combination with the system according to any one of

the aforementioned embodiments.

DETAILED DESCRIPTION OF THE INVENTION

Figures 1 and 3 show a system 1 for releasing a submergible load 2 from a buoyant member 3 according to a first exemplary embodiment of the invention. The submergible load 2 can be a pipeline or a cable for a subsea infrastructure, e.g. a cable for data communication. The buoyant member 3 is formed by an inflatable or air-filled tube 30 with a buoyancy that is sufficient to at least partially support the submergible load 2 at sea. The buoyant member 3. The buoyant member 3 is releasably coupled to the submergible load 2. In the coupled state, the buoyant member 3 has a longitudinal direction L that extends parallel or substantially parallel to the elongate direction of the submergible load 2. Typically, the submergible load 2 and the buoyant member 3 are deployed together from a vessel or the shore. The submergible load 2 is initially positioned above the sea bottom. The load 2 is then dropped onto the sea bottom by terminating the coupling between the buoyant member 3 and the submergible load 2, thereby releasing the submergible load 2 from the buoyant member 3.

As shown in figure 1, the submergible load 2 is coupled to the buoyant member 3 with a plurality of straps 4. In this exemplary embodiment, as best seen in the cross section of figure 4, each strap 4 is arranged circumferentially and/or in a loop around the combination of the submergible load 2 and buoyant member 3. However, it is noted that different strap configurations, e.g. a configuration in which one or more straps are looped individually around the submergible load 2 and the buoyant member 3, are also feasible. Each strap 4 or a combination of straps is coupled with a releasable clip 5 to retain the buoyant member 3 to the submergible load 2. The submergible

load 2 is coupled to the buoyant member 3 at a plurality of consecutive coupling positions, distributed evenly along and/or spaced apart over the length of the buoyant member 3. Typically, the buoyant member 3 is coupled to the submergible load 2 with a spacing of one meter or less.

The release clip 5, which is known per se from GB 2 281 340 A, comprises a first clip member 51 and a second clip member 52. Each clip member 51, 52 is connected to an end of the strap 4. The clip members 51, 52 are arranged to releasably engage each other, thereby closing and/or completing the loop of said strap 4 and/or retaining the strap 4 around the combination of the submergible load 2 and the buoyant member 3.

In this exemplary embodiment, each clip member 51, 52 comprises a hook 53 at one end, an aperture 54 at another end and a reaction surface 55 extending in between both ends. The hook 53 of each clip member 51, 52 releasably snap-fits into the aperture 54 of the other clip member 51, 52. Other configurations of mutually engaging and releasable clip members 51, 52 will be apparent to one skilled in the art and would yet be encompassed by the scope of the present invention. Between the reaction surfaces 55, the release clip 5 defines an intermediate space H from which a release force F can be applied onto the reaction surfaces 55 for releasing and/or disengaging the clip members 51, 52.

As shown in figure 1, the system 1 further comprises a hose 6 extending in a release direction R alongside, substantially parallel to and/or in the longitudinal direction L of the buoyant member 3. Preferably, the hose 6 is of the lay-flat type, meaning that in a resting state, in which the pressure inside the hose 6 is equal or substantially equal to the ambient pressure, the hose 6 is arranged to lie flat or substantially flat. Said resting state is shown in cross section in figure 3. The hose 6 may be expanded from the resting state into an expanded state, in which the hose 6

has a substantially circular cross section. In the expanded state, as shown in cross section in figure 5, the hose 6 is considerably smaller in diameter than the buoyant member 3 and does not serve to contribute buoyancy to the buoyant member 3. Preferably, the diameter of the hose 6 is equal or less than six centimeters, most preferably equal or less than three centimeters.

As shown in figure 1, the hose 6 has a first end 61 that is connected to a source 7 of pneumatic or hydraulic pressure upstream with respect to the release direction R and a second end 62 that is located downstream of the pressure source 7 in the release direction R. The second end 62 can be a free or distal end. Alternatively, the second end 62 may be attached to a vessel or the shore (not shown). Furthermore, the second end 62 may be an open end or a closed end. The hose 6 is arranged to extend alongside the submergible load 2 and/or the buoyant member 3 in the release direction R from one releasable clip 5 to the next along a plurality of the clips 5. At each releasable clip 5, the hose 6 is inserted, accommodated, enclosed and/or sandwiched between the respective clip members 51, 52 of the releasable clip 5. In its resting state, the hose 6 is arranged to lie flat or substantially flat in between the opposite reaction surfaces 55 of the respective clip members 51, 52 without exerting any substantial forces onto the reaction surfaces 55.

The pressure source 7 comprises a manually controllable pump 70 with an output opening 71 for connection to the first end 61 of the hose 6, a control member 72 for controlling the pressure of the pump 70 through the output opening 71, a flow meter, a pressure sensor or a pressure gauge 73 and a pressure release opening 74 for releasing the pressure inside the hose 6. The pump 70 is preferably connected to a source of hydraulic fluid, most preferably water. Alternatively, the pump 70 may be arranged to provide pneumatic pressure by drawing air from the environment.

As shown in detail in figure 2, the system 1 according to the invention further comprises a pig or a plug 8 that is insertable into the hose 6 at the first end 61 and that is dimensioned to travel inside and/or through the hose 6 in the release direction R towards the second end 62. To insert the plug 8 into the hose 6 at the first end 61, the first end 61 can be temporarily disconnected from the output opening 71 of the pump 70. The plug 8 has a substantially circular cross section with a largest diameter D1 that is equal, substantially equal or slightly smaller than the inside diameter of the hose 6. Preferably, the largest diameter D1 of the plug 8 is equal to or less than six centimeters and most preferably equal to or less than three centimeters.

The plug 8 has a leading end 81 that is arranged to face in the release direction R and a trailing end 82 that is arranged to face opposite to the release direction R. At the leading end 81, the plug 8 is provided with a wedge 83 that tapers in the release direction R and that is arranged to be driven into the space H between the first clip member 51 and the second clip member 52. Preferably, the wedge 83 is conically shaped. The largest diameter D2 of the wedge 83 is larger than the intermediate space H between the first clip member 51 and the second clip member 52 so that the wedge 83 can only forcefully pass through or in between the clip members 51, 52 when said clip members 51, 52 while exerting release forces F onto the reaction surface 55 thereof. At the trailing end 82, the plug 8 is provided with a seal 84 that is arranged to closely abut and/or seal the hose 6. In particular, the seal 84 has a circular cross section that is arranged to seal the hose 6 at the location of the plug 8 in a substantially fluid-tight and/or air-tight manner. Preferably, the seal 84 forms the largest diameter D1 of the plug 8. As such, the hose 6 is divided at the seal 84 into a first section S1 upstream and a second section S2 downstream of the plug 8 with respect to the release direction R.

As can be seen in figure 2, the part of the plug 8 upstream of the seal 84 with respect to the release direction R, and in particular the wedge 83, has a smaller largest diameter D2 than the largest diameter D1 of the plug 8 at the seal 84. In this exemplary embodiment, the diameter D2 of the wedge 83 is approximately eighty percent of the diameter D1 of the seal 84. Hence, the part of the plug 8 upstream of the seal 84 has some freedom of movement within the hose 6 and may be tilted slightly within the hose 8 with respect to the center of the hose 6. This freedom of movement allows the wedge 83 to automatically align and/or self-center with respect to the intermediate space H between the reaction surfaces 55 of the clip members 51, 52, rather than the center of the hose 6.

The plug 8 comprises a plug body 80 extending between the leading end 81 and the trailing end 82, and more in particular between the wedge 83 and the seal 84. In this exemplary embodiment, the plug body 80 is integrally formed or formed as a single piece with the wedge 83. The seal 84 is a separate member that is attached to the plug body 80 at the trailing end 82. Alternatively, the seal 84 may also be integrally formed as a single piece with the plug body 80. The plug body 80, comprises or forms a lubrication surface 85 for receiving an amount of lubricant, in particular grease, to reduce the resistance to sliding of the plug 8 with respect to the hose 6. Said lubrication surface 85 is preferably recessed with respect to the adjacent parts of the plug 8 for easy application and/or gradual release of the lubricant into the space between the plug 8 and the hose 6.

A method for releasing the submergible load 2 from the buoyant member 3 with the use of the aforementioned system 1 will be described hereafter with reference to figures 1-5.

Figures 1 and 3 show the situation in which the submergible load 2 is coupled to the buoyant member 3 with the use of a plurality of the straps 4 looped around the

combination of the submergible load 2 and the buoyant member 3. The straps 4 are held or retained by a plurality of the previously discussed releasable clips 5. Before bringing together of the clip members 51, 52 of each releasable clip 5, the hose 6 is interposed and/or positioned in the intermediate space H between the reaction surfaces 55 of the respective clip members 51, 52. As best seen in figure 3, after the clip members 51, 52 have been engaged, the hose 6 is inserted, accommodated, enclosed and/or sandwiched in the intermediate space H between respective clip members 51, 52. The hose 6 lies substantially flat between the opposing reaction surfaces 55.

As best seen in figures 1 and 2, the plug 8 is inserted into the hose 6 at or near the first end 61 thereof, e.g. by temporarily removing said first end 61 from the output opening 71 of the pressure source 7. The plug 8 is inserted into the hose 6 with its leading end 81 facing in the release direction R. With the first end 61 reconnected, the control member 72 of the pressure source 7 can now be operated to increase the pressure P in the first section S1 of the hose 6 upstream of the plug 8.

Figures 2 and 5 shows the situation in which the pressure P has been increased to an extent in which the plug 8 has started to travel through the hose 6. The plug 8 has already passed and released the first of the releasable clips 5. The first clip member 51 and the second clip member 52 of said released clip 5 have been disengaged, resulting in the ends of the strap 4 being disconnected. The submergible load 2 becomes separated from the buoyant member 3 at the location of said released clip 5 and starts to sink under the influence of its own weight. The hose 6 is pulled downwards slightly and now extends under an angle A with respect to the release direction R.

As shown in figure 2, the plug 8 has moved beyond the released clip 5 and is now in abutment with the next releasable clip 5 in the release direction R. The steps of

releasing the releasable clips 5 will be described in more detail hereafter with respect to this next releasable clip 5. In particular, one may observe that the intermediate space H between the clip members 51, 52 of each clip 5 is very narrow, e.g. less than one centimeter wide. The plug 8 has a largest diameter D2 at the wedge 83 that is considerably larger, e.g. in the range of two to five centimeters, than the intermediate space H. Hence, the plug 8, and in particular its wedge 83, is too large to fit through the intermediate space H defined by the engaged clip members 51, 52. Once, the plug 8 is in abutment with one of the releasable clips 5, the pressure P starts to build. The pressure P is deflected by the wedge 8 onto the reaction surfaces 55 of the respective clip members 51, 52 in the form of oppositely directed release forces F. Quickly, the pressure P will reach a threshold at which the plug 8 is forcefully forced through the intermediate space H between the respective clip members 51, 52. The release forces F are sufficient to terminate the snap-fit between the hooks 53 and apertures 54 and consequently disengage and/or release the clip members 51, 52. This in effect causes the release of the respective releasable clip 5.

After the releasable clip 5 has been released, the plug 8 is free to travel through the hose 6 towards and into abutment with the next releasable clip 5, after which the steps of the method above are repeated. In this manner, the plurality of releasable clips 5 can be released progressively and the submergible load 2 can be released and submerged successfully in a controlled manner.

The aforementioned method may be completed at a steady rate. However, there may be situations in which there is a need to adjust and/or control the release. The release may need to be interrupted temporarily or permanently as soon as possible in unexpected or hazardous situations. Contrary to the prior art in which the releasable clips are released simultaneously by inflation of the hose along its entire length, the plug 8 in the

system 1 according to the invention can release the releasable clips 5 progressively and in a controlled manner. In particular, it is no longer a pressurized expansion of the entire length of the hose 6 that causes the almost instantaneous release of several releasable clips 5. Instead, the pressure P is merely used to advance the plug 8 into abutment with one of the releasable clips 5. The wedge 83 of the plug 8 is arranged to reliably wedge open said one releasable clip 5 while the seal 84 simultaneously prevents that the pressure in the hose 6 upstream of the plug 8 with respect to the release direction R leaks into the part of the hose 6 downstream of the plug 8 in the release direction R. Hence, the release can be interrupted instantly and uncontrolled release of the releasable clips 5 downstream of the already released clips 5 can be prevented.

Tests by the Applicant have revealed that a pressure P in the range of 0.5 bar to 1.0 bar is required behind the seal 84 of the plug 8 to make the plug 8 travel through the hose 6 towards one of the releasable clips 5. When the wedge 83 of the plug 8 reaches said one release clip 5, the pressure increases and a pressure in a range of 2.0 to 6.0 bar, and in extreme cases up to 8.0 bar or even 10.0 bar, is required to force the wedge 83 through said one releasable clip 5. Within the aforementioned ranges, the plug 8 was observed travelling at an average speed in the range of two to four meters per second through the hose 6. Hence, with a spacing of one meter between each release clip 5, the plug 8 is capable of releasing between approximately two to four releasable clips 5 per second.

It was found that the amount of pressure required to drive the wedge 83 through the releasable clips 5 depends on the angle of hose 6 with respect to the releasable clips 5. In practice, when several releasable clips 5 upstream of an unreleased releasable clip 5 have already been released, the positioning of the hose 6 with respect to the buoyant member 3 upstream of the unreleased

releasable clip 5 becomes undefined. In particular, the hose 6 tends to either slack downwards or float upwards. An angle A of the hose 6 with respect to the release direction R is acceptable in a range up to approximately fifty degrees. When the angle approaches or exceeds sixty degrees, the wedge 83 of the plug 8 may bite into the wall of the hose 6. In extreme cases, the plug 8 may even puncture the hose 6.

Figures 6 and 7 show alternative embodiments of the system 101, 201 that aim to improve the positioning of the hose 6 with respect to the releasable clips 5 and/or to reduce the slacking of the hose 6.

Figure 6 shows an alternative system 101 according to a second embodiment of the invention, which differs from the previously discussed system 1 in that the hose 106 is provided with one or more reinforcement elements 163 for increasing the rigidity of the hose 106 against slacking. In this exemplary embodiment, the reinforcement element 163 is formed by a rib 164 extending on the outside of the hose 6 in the longitudinal direction of said hose 6.

Figure 7 shows a further alternative system 201 according to a second embodiment of the invention, which differs from the previously discussed systems 1, 101 in that – in addition to the hose 6 being the primary hose 6 – the system 201 comprises an auxiliary hose 264 that is connected to the primary hose 6 and that provides buoyancy and/or stiffness to the primary hose 6 once the primary hose 6 is released from the buoyant member 3. By providing additional buoyancy and/or stiffness, slacking of the primary hose 6 can be prevented.

Figure 8 shows an optional collection member 9 that can be applied to the systems 1, 101, 201 according to any of the previously discussed embodiments of the invention. The collection member 9 is arranged to be placed at and/or mounted to the second end 62 of the hose 6 to collect the plug 8 once it reaches said second end 62. The

collection member 9 can be formed by a capping element 91 that closes off the second end 62 of the hose 6. To prevent an uncontrolled buildup of pressure behind the collected plug 8, the hose 6 can be provided with perforations 65 upstream of the collected plug 8 at or near the second end 62, to allow the pressure to escape from the hose 6. Alternatively, the collection member 9 can be formed by a suitable container (not shown), e.g. a bag, a basket or a cage.

In an optional embodiment, the flow meter, the pressure sensor and/or the pressure gauge 73 may be used in combination with a control unit (not shown - representable by a schematic box that is electronically connected to the flow meter, the pressure sensor and/or the pressure gauge 73) to control the pressure and/or the flow of the pneumatic or hydraulic medium, so as to accurately control the speed and/or position of the plug 8 in the hose 6. For example, the flow rate of the medium can be measured and used to control the speed of the plug 8 and/or based on the volume that is supplied into the hose 6 over time, one can calculate the position of the plug 8 along the length of the hose 6, provided that there is no or minimal leaking at the plug 8 and assuming that the hose 6 does not stretch.

It is to be understood that the above description is included to illustrate the operation of the preferred embodiments and is not meant to limit the scope of the invention. From the above discussion, many variations will be apparent to one skilled in the art that would yet be encompassed by the scope of the present invention.

C O N C L U S I E S

1. Werkwijze voor het vrijgeven van een afzinkbare lading van een drijvend deel, waarbij de werkwijze de stappen omvat van:

- het koppelen van de afzinkbare lading aan het drijvend deel met gebruikmaking van één of meer omsnoeringen die worden vastgehouden door één of meer vrijgeefbare clips;
- het verschaffen van een slang die zich uitstrekt door de één of meer vrijgeefbare clips, waarbij elke vrijgeefbare clip een eerste clipdeel en een tweede clipdeel omvat welke vrijgeefbaar aan elkaar aangegrepen zijn rond de slang terwijl zij een tussengelegen ruimte openlaten voor het accommoderen van de slang;
- het inbrengen van een plug in de slang in een vrijgaverichting in de richting van de één of meer vrijgeefbare clips, waarbij de plug gedimensioneerd is teneinde door de slang te passen in een vrijgaverichting terwijl de plug te groot is om door de tussengelegen ruimte tussen de aangegrepen clipdelen te passen;
- het uitoefenen van een druk op de plug in de vrijgaverichting, waardoor de plug aangedreven wordt door de slang in de vrijgaverichting in de richting van en in contact met één van de één of meer vrijgeefbare clips; en
- het uitoefenen van de druk op de plug in de vrijgaverichting teneinde de plug door de tussengelegen ruimte tussen het eerste clipdeel en het tweede clipdeel te forceren, waardoor het eerste clipdeel en het tweede clipdeel vrijgegeven worden.

2. Werkwijze volgens conclusie 1, waarbij de werkwijze de stap omvat van het reduceren van de druk of het vrijgeven van de druk die wordt uitgeoefend op de plug teneinde het aandrijven van de plug door de slang te vertragen of te stoppen.

3. Werkwijze volgens conclusie 1 of 2, waarbij de werkwijze de stap omvat van het verschaffen van de plug met een afdichting die de slang opdeelt in een eerste sectie stroomopwaarts en een tweede sectie stroomafwaarts van de plug ten opzichte van de vrijgaverichting, waarbij de afdichting tegengaat dat de druk lekt van de eerste sectie naar de tweede sectie.

4. Werkwijze volgens één der voorgaande conclusies, waarbij de plug is verschaft met een wig die toeloopt in de richting van de ene vrijgeefbare clip, waarbij de stap van het forceren van de plug door de enen vrijgeefbare clip de stap omvat van het forceren van de wig tussen het eerste clipdeel en het tweede clipdeel in de vrijgaverichting, waardoor de ene vrijgeefbare clip open gewrikt wordt.

5. Werkwijze volgens één der voorgaande conclusies, waarbij de druk voor het aandrijven van de plug door de slang in het bereik van 0,5 - 1 bar ligt.

6. Werkwijze volgens één der voorgaande conclusies, waarbij de druk voor het forceren van de plug door de ene vrijgeefbare clip in het bereik van 2,0 - 10,0 bar ligt, en bij voorkeur in het bereik van 2,0 - 8,0 bar.

7. Werkwijze volgens één der voorgaande conclusies, waarbij de druk een hydraulische of een pneumatische druk is.

8. Werkwijze volgens één der voorgaande conclusies, waarbij de werkwijze verder de stap omvat van het verschaffen van versteviging of drijfkracht aan de slang stroomopwaarts van de ene vrijgeefbare clip ten opzichte van de vrijgaverichting teneinde het doorhangen van de slang tegen te gaan.

9. Werkwijze volgens conclusie 8, waarbij de versteviging of drijfkracht is ingericht voor het houden van de slang binnen een hoek van nul tot vijftig graden ten opzichte van de vrijgaverichting.

10. Werkwijze volgens één der voorgaande conclusies, waarbij de slang een eerste uiteinde heeft waar

de plug wordt ingebracht en een tweede uiteinde stroomafwaarts van het eerste uiteinde in de vrijgaverichting, waarbij de werkwijze verder de stap omvat van het verschaffen van een collecteer deel bij of nabij het tweede uiteinde van de slang voor het collecteren van de plug.

11. Werkwijze volgens conclusie 10, waarbij de werkwijze de stap omvat van het reduceren of vrijgeven van de druk in de slang stroomopwaarts van de gecollecteerde plug ten opzichte van de vrijgaverichting.

12. Werkwijze volgens één der voorgaande conclusies, waarbij de werkwijze verder de stap omvat van het verschaffen van een smeermiddel tussen de plug en de slang teneinde het glijden van de plug in de slang te faciliteren.

13. Werkwijze volgens conclusie 12, waarbij het smeermiddel wordt aangebracht op de plug voorafgaand aan het inbrengen.

14. Plug voor gebruik in een systeem voor het vrijgeven van een afzinkbare lading van een drijvend deel, waarbij het systeem een drijvend deel omvat, één of meer vrijgeefbare clips voor het koppelen van de afzinkbare lading aan het drijvend deel en een slang die zich uitstrekt door de één of meer vrijgeefbare clips, waarbij elke vrijgeefbare clip een eerste clipdeel en een tweede clipdeel omvat welke zijn ingericht teneinde vrijgeefbaar aan elkaar te worden aangegrepen rond de slang terwijl zij een tussengelegen ruimte vrijlaten voor het accommoderen van de slang, waarbij de plug gedimensioneerd is teneinde door de slang te passen in de vrijgaverichting terwijl de plug te groot is om door de tussengelegen ruimte tussen de aangegrepen clipdelen te passen.

15. Plug volgens conclusie 14, waarbij de plug een voorlopend uiteinde heeft dat is ingericht teneinde in de vrijgaverichting gericht te zijn en een achterlopend uiteinde dat is ingericht teneinde tegengesteld aan de vrijgaverichting gericht te zijn, waarbij de plug te groot

is om door de tussengelegen ruimte tussen de clipdelen te passen bij of nabij het voorlopende uiteinde.

16. Plug volgens conclusie 15, waarbij de plug is verschaft met een wig aan het voorlopende uiteinde, waarbij de wig is ingericht teneinde in de vrijgaverichting toe te lopen.

17. Plug volgens conclusie 16, waarbij de wig conisch toeloopt.

18. Plug volgens één der conclusies 15-17, waarbij de plug is verschaft met een afdichting die is ingericht voor het dicht aanliggen op en/of afdichten van de slang.

19. Plug volgens conclusie 18, waarbij de afdichting een cirkelvormige dwarsdoorsnede heeft.

20. Plug volgens conclusie 18 of 19, waarbij de afdichting verschaft is bij of nabij het achterlopende uiteinde van de plug.

21. Plug volgens één der conclusies 18-20, waarbij de grootste diameter van het deel van de plug stroomafwaarts van de afdichting in de vrijgaverichting kleiner is dan de grootste diameter van de plug bij de afdichting.

22. Plug volgens conclusie 21, waarbij de grootste diameter van het deel van de plug stroomafwaarts van de afdichting in de vrijgaverichting 90% of minder, en bij voorkeur 80% of minder, is van de grootste diameter van de plug bij de afdichting.

23. Plug volgens één der conclusies 15-22, waarbij de plug een grootste diameter van minder dan 6 cm, en bij voorkeur minder dan 3 cm heeft.

24. Plug volgens één der voorgaande conclusies, waarbij de plug een pluglichaam omvat, waarbij het pluglichaam een smeermiddeloppervlak omvat of vormt voor het ontvangen van een hoeveelheid smeermiddel voor het reduceren van de weerstand tegen schuiven van de plug ten opzichte van de slang.

25. Plug volgens conclusie 24, waarbij het

smeermiddeloppervlak terug gelegen is ten opzichte van de naastgelegen delen van de plug.

26. Systeem voor het vrijgeven van een afzinkbare lading van een drijvend deel, omvattend een drijvend deel, één of meer vrijgeefbare clips voor het koppelen van de afzinkbare lading aan het drijvende deel en een slang die zich uitstrekt door de één of meer vrijgeefbare clips, waarbij elke vrijgeefbare clip een eerste clipdeel en een tweede clipdeel omvat welke zijn ingericht teneinde vrijgeefbaar aan elkaar te worden aangegrepen rond de slang terwijl deze een tussengelegen ruimte vrijlaten voor het accommoderen van de slang, waarbij het systeem verder een plug omvat die inbrengbaar is in de slang in een vrijgaverichting in de richting van de één of meer vrijgeefbare clips, waarbij de plug gedimensioneerd is teneinde te passen door de slang in de vrijgaverichting terwijl de plug te groot is om te passen door de tussengelegen ruimte tussen de aangegrepen clipdelen, waarbij het systeem een drukbron omvat die verbindbaar is met de slang aan een eerste uiteinde daarvan stroomopwaarts van de plug ten opzichte van de vrijgaverichting, waarbij de drukbron is ingericht voor het uitoefenen van een druk op de plug in de vrijgaverichting teneinde de plug door de slang aan te drijven in de vrijgaverichting in de richting van en tot in contact met één van de één of meer vrijgeefbare clips en door de tussengelegen ruimte tussen de aangegrepen clipdelen van de ene vrijgeefbare clip, teneinde de clipdelen vrij te geven.

27. Systeem volgens conclusie 26, waarbij de drukbron een regeldeel omvat voor het regelen van de druk van de drukbron.

28. Systeem volgens conclusie 26 of 27, waarbij de drukbron een pneumatische of een hydraulische drukbron is.

29. Systeem volgens één der conclusies 26-28, waarbij de slang een tweede uiteinde heeft stroomafwaarts van het eerste uiteinde in de vrijgaverichting, waarbij het

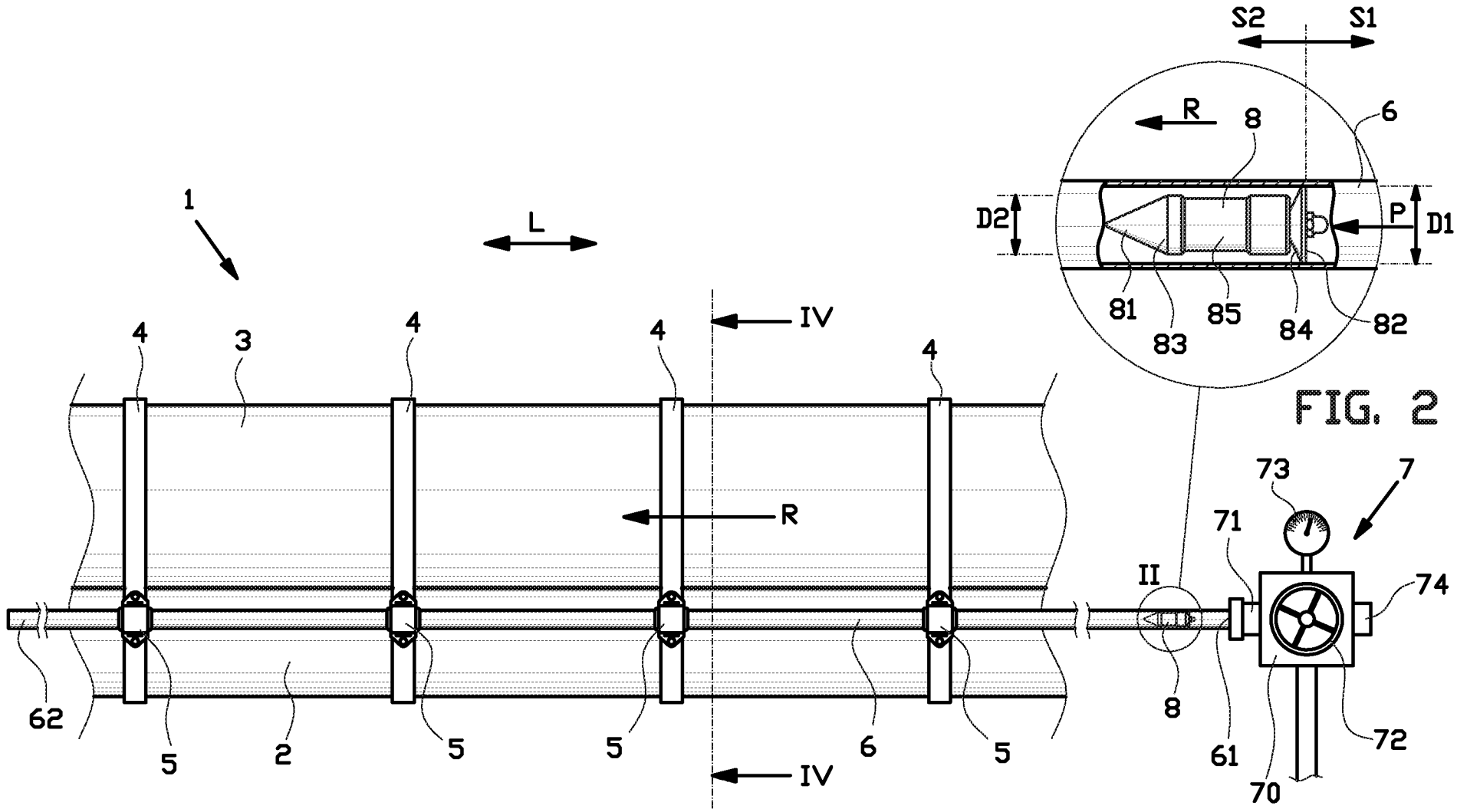
systeem een collecteer deel omvat voor het collecteren van de plug bij of nabij het tweede uiteinde.

30. Systeem volgens conclusie 29, waarbij de slang is verschaft met één of meer perforaties welke zijn ingericht teneinde stroomopwaarts te zijn van de gecollecteerde plug bij of nabij het tweede uiteinde.

31. Systeem volgens één der conclusies 26-30, waarbij de slang is verschaft met een verstevigingselement, bij voorkeur een rib, voor het laten toenemen van de starheid van de slang tegen doorhangen.

32. Systeem volgens één der conclusies 26-31, waarbij de slang een primaire slang is, waarbij het systeem verder een hulpslang omvat die verbonden is met de primaire slang en die is ingericht teneinde drijfkracht en/of stijfheid aan de primaire slang te verschaffen vanaf het moment dat de primaire slang is vrijgegeven van het drijvend deel.

-o-o-o-o-o-o-o-o-o-


S2
S1
R
8
6
D2
P
D1
81
83
85
84
82
1
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IV
4
3
4
4
4
R
II
73
7
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74
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70
IV

FIG. 2

FIG. 1

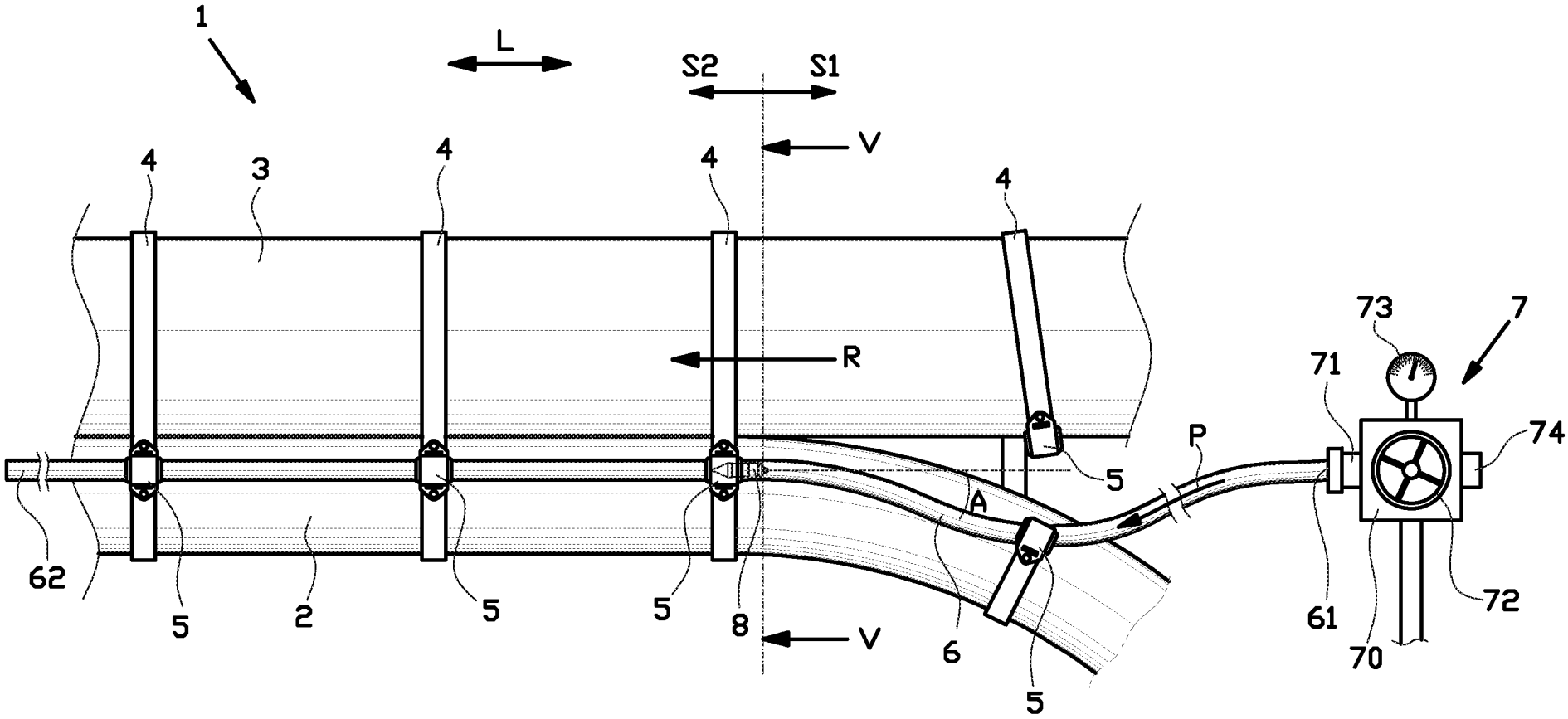

FIG. 3

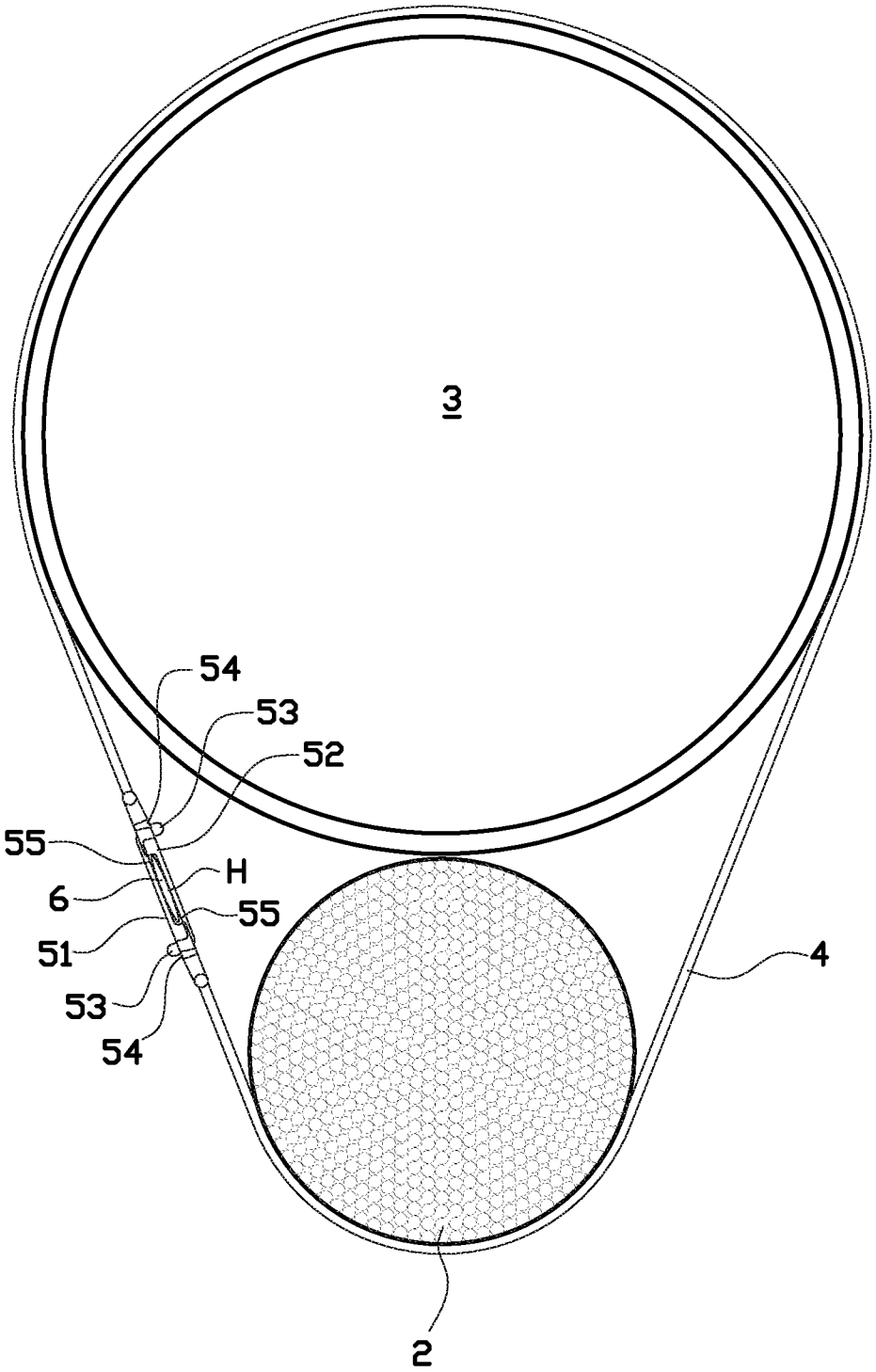

FIG. 4

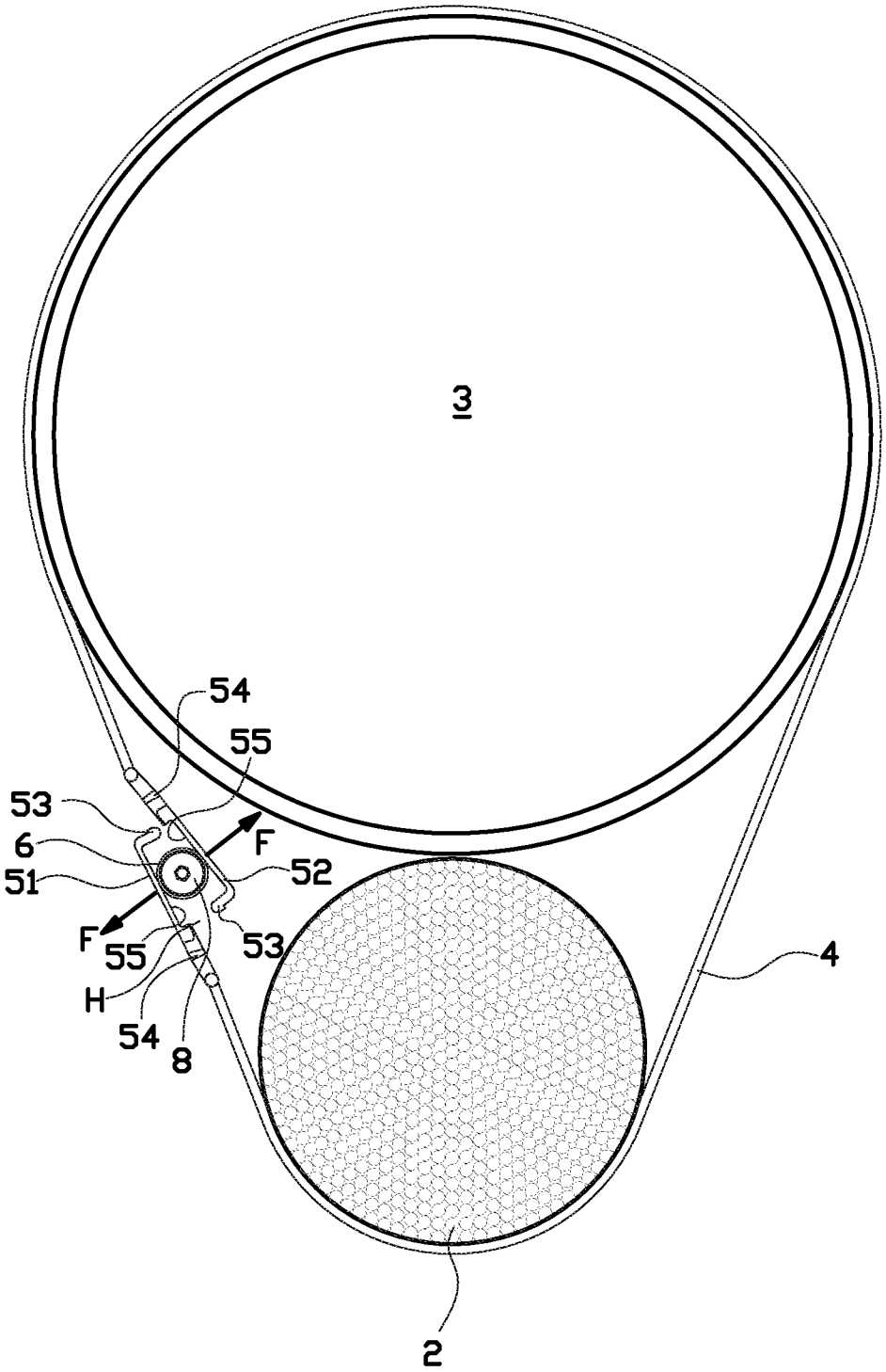

FIG. 5

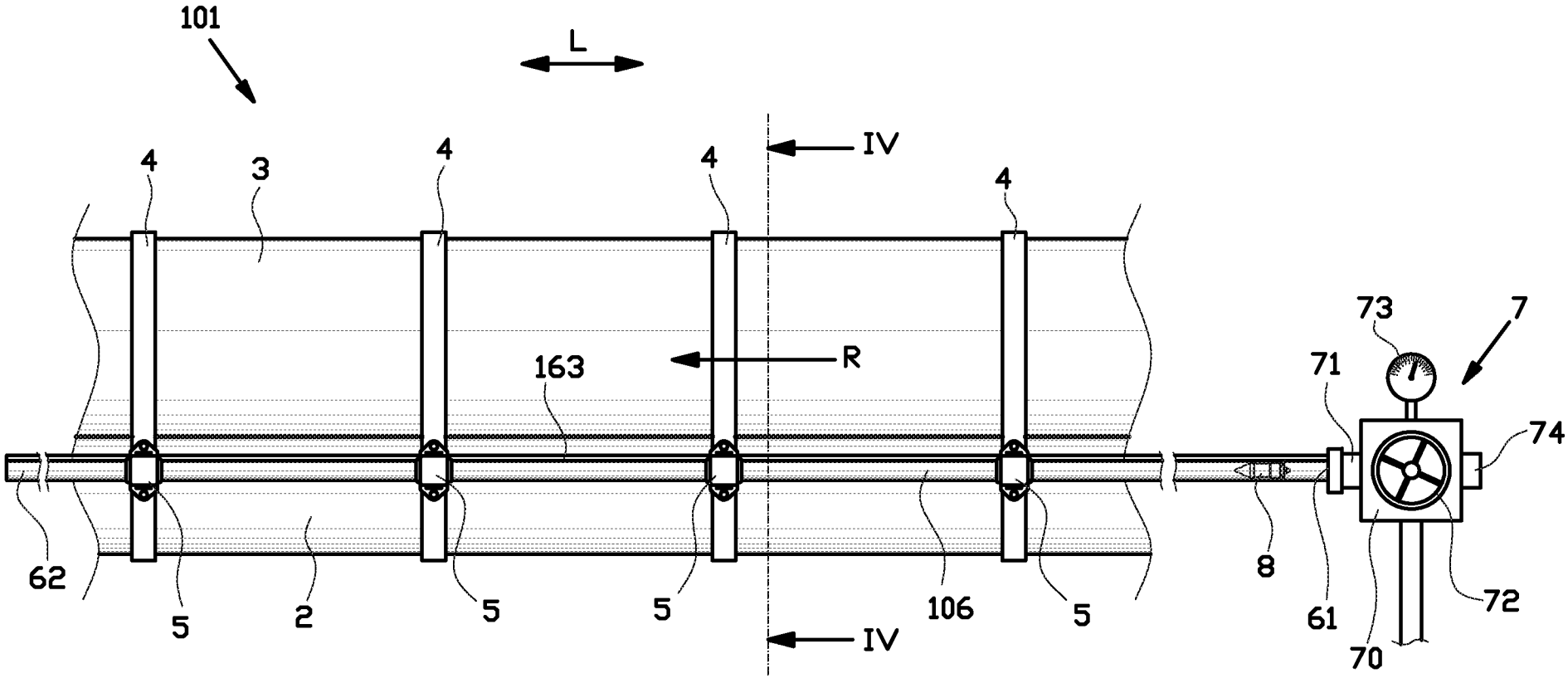

FIG. 6

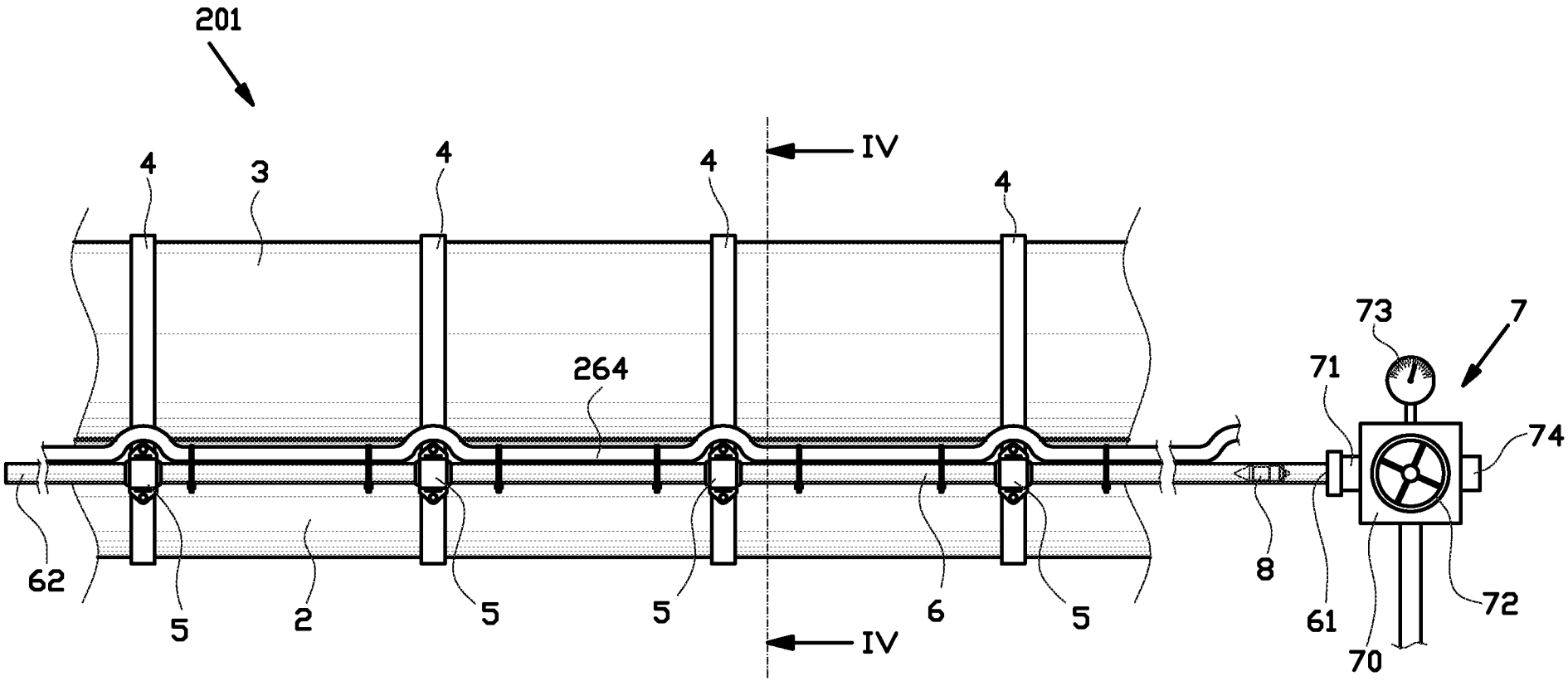

FIG. 7

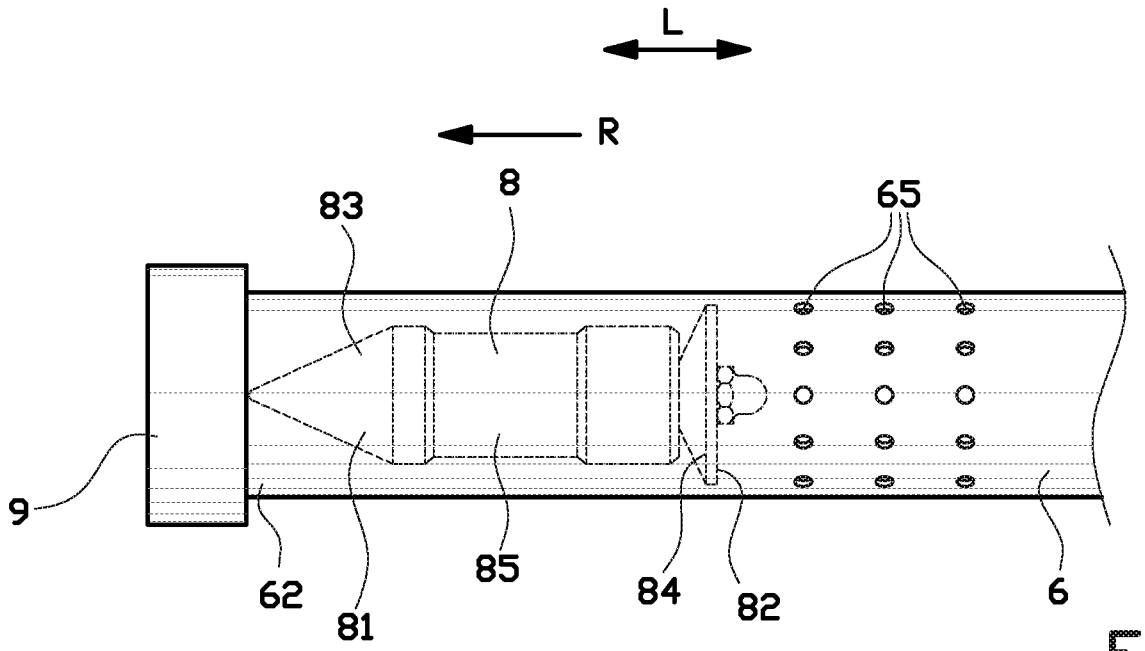

FIG. 8

A B S T R A C T

The invention relates to a method for releasing a submergible load from a buoyant member. The invention further relates to a plug for use in a system for releasing a submergible load from a buoyant member. The invention further relates to a system for releasing a submergible load from a buoyant member. The method comprises the steps of coupling the submergible load to the buoyant member with one or more releasable clips; providing a hose that extends through the releasable clips, wherein each releasable clip comprises a first clip member and a second clip member which are releasably engaged around the hose while leaving an intermediate space for accommodating said hose; and driving a plug through the hose, wherein the plug is dimensioned to fit through the hose in a release direction while the plug is too large to fit through the intermediate space between the engaged clip members.

SAMENWERKINGSVERDRAG (PCT)

RAPPORT BETREFFENDE NIEUWHEIDSONDERZOEK VAN INTERNATIONAAL TYPE

IDENTIFICATIE VAN DE NATIONALE AANVRAGE	KENMERK VAN DE AANVRAGER OF VAN DE GEMACHTIGDE
	NLP199897A
Nederlands aanvraag nr. **2017332**	Indieningsdatum **18-08-2016**
	Ingeroepen voorrangsdatum
Aanvrager (Naam) **Baggermaatschappij Boskalis B.V.**	
Datum van het verzoek voor een onderzoek van internationaal type **08-10-2016**	Door de Instantie voor Internationaal Onderzoek aan het verzoek voor een onderzoek van internationaal type toegekend nr. **SN67539**

I. CLASSIFICATIE VAN HET ONDERWERP (bij toepassing van verschillende classificaties, alle classificatiesymbolen opgeven)

Volgens de internationale classificatie (IPC)

F16L1/16;F16L1/24;F16L55/38;F16L55/40;B63B22/06

II. ONDERZOCHTE GEBIEDEN VAN DE TECHNIEK

Onderzochte minimumdocumentatie

Classificatiesysteem	Classificatiesymbolen
IPC	**F16L;B63B;B08B;F28G**

Onderzochte andere documentatie dan de minimum documentatie, voor zover dergelijke documenten in de onderzochte gebieden zijn opgenomen

III. ☐	**GEEN ONDERZOEK MOGELIJK VOOR BEPAALDE CONCLUSIES**	(opmerkingen op aanvullingsblad)
IV. ☐	**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 2017332

A. CLASSIFICATIE VAN HET ONDERWERP
INV. F16L1/16 F16L1/24 F16L55/38 F16L55/40 B63B22/06
ADD.

Volgens de Internationale Classificatie van octrooien (IPC) of zowel volgens de nationale classificatie als volgens de IPC.

B. ONDERZOCHTE GEBIEDEN VAN DE TECHNIEK

Onderzochte minimum documentatie (classificatie gevolgd door classificatiesymbolen)
F16L B63B B08B F28G

Onderzochte andere documentatie dan de minimum documentatie, voor dergelijke documenten, voor zover dergelijke documenten in de onderzochte gebieden zijn opgenomen

Tijdens het onderzoek geraadpleegde elektronische gegevensbestanden (naam van de gegevensbestanden en, waar uitvoerbaar, gebruikte trefwoorden)
EPO-Internal

C. VAN BELANG GEACHTE DOCUMENTEN

Categorie *	Geciteerde documenten, eventueel met aanduiding van speciaal van belang zijnde passages	Van belang voor conclusie nr.
A,D	GB 2 281 340 A (SEAFLEX LIMITED [GB]) 1 maart 1995 (1995-03-01) in de aanvraag genoemd * samenvatting; figuren * * bladzijde 5, regels 12-25; figuur 5 *	1-32
A	GB 2 221 247 A (SAIPEM SPA [IT]) 31 januari 1990 (1990-01-31) * samenvatting; figuren * * bladzijde 6, regel 17 - bladzijde 7, regel 6 *	1-32
A	JP H06 213372 A (NIPPON STEEL CORP) 2 augustus 1994 (1994-08-02) * samenvatting; figuren *	1-32

-/--

[X] Verdere documenten worden vermeld in het vervolg van vak C.

[X] Leden van dezelfde octrooifamilie zijn vermeld in een bijlage

* Speciale categorieën van aangehaalde documenten

"A" niet tot de categorie X of Y behorende literatuur die de stand van de techniek beschrijft

"D" in de octrooiaanvrage vermeld

"E" eerdere octrooi(aanvrage), gepubliceerd op of na de indieningsdatum, waarin dezelfde uitvinding wordt beschreven

"L" om andere redenen vermelde literatuur

"O" niet-schriftelijke stand van de techniek

"P" tussen de voorrangsdatum en de indieningsdatum gepubliceerde literatuur

"T" na de indieningsdatum of de voorrangsdatum gepubliceerde literatuur die niet bezwarend is voor de octrooiaanvrage, maar wordt vermeld ter verheldering van de theorie of het principe dat ten grondslag ligt aan de uitvinding

"X" de conclusie wordt als niet nieuw of niet inventief beschouwd ten opzichte van deze literatuur

"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

"&" lid van dezelfde octrooifamilie of overeenkomstige octrooipublicatie

Datum waarop het onderzoek naar de stand van de techniek van internationaal type werd voltooid	Verzenddatum van het rapport van het onderzoek naar de stand van de techniek van internationaal type
6 april 2017	

Naam en adres van de instantie	De bevoegde ambtenaar
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Untermann, Nils

1

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 2017332

C.(Vervolg). VAN BELANG GEACHTE DOCUMENTEN

Categorie *	Geciteerde documenten, eventueel met aanduiding van speciaal van belang zijnde passages	Van belang voor conclusie nr.
X	EP 2 039 440 A1 (COKEBUSTERS LTD [GB]) 25 maart 2009 (2009-03-25) * samenvatting; figuren * * alineas [0020], [0070] - [0073]; figuren 1,2 *	14-25
X	FR 2 492 281 A1 (SAXON GEORGE [US]) 23 april 1982 (1982-04-23) * bladzijden 4-7; figuren *	14-25
X	FR 643 717 A (HOOS, M. ERNST) 21 september 1928 (1928-09-21) * bladzijden 1,2; figuren *	14-25
X	US 4 069 535 A (CATO BENNIE D) 24 januari 1978 (1978-01-24) * samenvatting; figuren * * kolom 2, regel 18 - kolom 3, regel 18; figuren 1,2 *	14-25

1

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 2017332

In het rapport genoemd octrooigeschrift	Datum van publicatie	Overeenkomend(e) geschrift(en)	Datum van publicatie
GB 2281340 A	01-03-1995	GEEN	
GB 2221247 A	31-01-1990	AT 397548 B	25-04-1994
		BE 1003076 A4	12-11-1991
		BR 8903700 A	02-10-1990
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		DE 3923957 A1	08-02-1990
		DK 373789 A	30-01-1990
		ES 2014915 A6	16-07-1990
		FI 893552 A	30-01-1990
		FR 2634854 A1	02-02-1990
		GB 2221247 A	31-01-1990
		GR 1000590 B	26-08-1992
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		IT 1226554 B	24-01-1991
		LU 87558 A1	07-02-1990
		NL 8901920 A	16-02-1990
		NO 893061 A	30-01-1990
		PT 91298 A	08-02-1990
JP H06213372 A	02-08-1994	GEEN	
EP 2039440 A1	25-03-2009	DK 2039440 T3	05-12-2016
		EP 2039440 A1	25-03-2009
		ES 2603409 T3	27-02-2017
		US 2009078283 A1	26-03-2009
FR 2492281 A1	23-04-1982	GEEN	
FR 643717 A	21-09-1928	GEEN	
US 4069535 A	24-01-1978	GEEN	

WRITTEN OPINION

File No.	Filing date *(day/month/year)*	Priority date *(day/month/year)*	Application No.
SN67539	18.08.2016		NL2017332

International Patent Classification (IPC)
INV. F16L1/16 F16L1/24 F16L55/38 F16L55/40 B63B22/06

Applicant
Baggermaatschappij Boskalis B.V.

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
	Untermann, Nils

Application number

WRITTEN OPINION

NL2017332

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	1-13, 26-32
	No:	Claims	14-25
Inventive step	Yes:	Claims	1-13, 26-32
	No:	Claims	14-25
Industrial applicability	Yes:	Claims	1-32
	No:	Claims	

2. Citations and explanations

see separate sheet

WRITTEN OPINION

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

Reference is made to the following documents:

D1 GB 2 281 340 A (SEAFLEX LIMITED [GB]) 1 maart 1995 (1995-03-01)

D2 GB 2 221 247 A (SAIPEM SPA [IT]) 31 januari 1990 (1990-01-31)

D3 JP H06 213372 A (NIPPON STEEL CORP) 2 augustus 1994 (1994-08-02)

D4 EP 2 039 440 A1 (COKEBUSTERS LTD [GB]) 25 maart 2009 (2009-03-25)

D5 FR 2 492 281 A1 (SAXON GEORGE [US]) 23 april 1982 (1982-04-23)

D6 FR 643 717 A 21 september 1928 (1928-09-21)

D7 US 4 069 535 A (CATO BENNIE D) 24 januari 1978 (1978-01-24)

1 **Claim 14-25**

1.1 The present application does not meet the criteria of patentability, because the subject-matter of claim 14 is not new.

1.2 Document D4 discloses (the [insert references in brackets applying to this document):

a plug ("intelligent pig (IP) 1", [0012]; figures 1, 2; [0020], [0070] - [0073]) suitable for use in a system for releasing a submergible load from a buoyant member,

the plug also being suitably dimensioned for the intended purpose.

As a matter of fact, the nose cone 6 with the tractor sleeve 9 shown in figures 1, 2 of D4 are substantially identical to the plug 8 shown in figure 2 of the present application.

1.3 Furthermore, the subject matter of claim 14 lacks novelty over

D5, figures 1-3, "projectile P";

D6, figures 1-4, "écouvillon";

D7, figures 1, 2, "pipeline pig 11".

1.4 Dependent claims 15-25 do not contain any features which, in combination with the features of any claim to which they refer, meet the requirements of novelty and/or inventive step, see the plugs shown in documents D4, D5, D6 and D7.

2 **Claims 1-13**

2.1 Document D1, cited on page 1 of the present application, is regarded as being the prior art closest to the subject-matter of claim 1. It discloses (the references in brackets applying to this document):

a method for releasing a submergible load from a buoyant member (figure 5, page 5, lines 12-25), wherein the method comprises the steps of:

coupling the submergible load ("pipeline 105") to the buoyant member ("supporting buoyancy 103" with the use of one or more straps ("strops 104") retained by one or more releasable clips (figures 1-4, "clip members 1, 2");

providing a hose (figures 4, 5, "lay-flat tube 106") that extends through the one or more releasable clips (figures 4, 5), wherein each releasable clip comprises a first clip member (1) and a second clip member (2) which are releasably engaged to each other around the hose while leaving an intermediate space for accommodating said hose (figure 4, page 4, line 26 - page 5, line 10).

2.2 The subject-matter of claim 1 therefore differs from this known method in the following steps:

inserting a plug into the hose in a release direction towards the one or more releasable clips, wherein the plug is dimensioned to fit through the hose in a release direction while the plug is too large to fit through the intermediate space between the engaged clip members;

exerting a pressure onto the plug in the release direction, thereby driving the plug through the hose in the release direction towards and into contact with one of the one or more releasable clips; and

exerting the pressure onto the plug in the release direction to force the plug through the intermediate space between the first clip member and the second clip member, thereby releasing or disengaging the first clip member and the second clip member.

Hence, the subject matter of claim 1 is new.

2.3 The technical effect of these distinguishing features can be seen in that a controlled, pressure driven movement of the plug through the hose causes a controlled, one-by-one release of the releasable clips. In particular, the plug can prevent the pressure from travelling uncontrollably through the hose towards the releasable clips, see page 2, line 30 - page 3, line 1 of the present application.

2.4 The problem to be solved by the present invention may be regarded as providing a method for releasing a submergible load from a buoyant member, wherein the controllability of the progressive release can be improved, see page 1, lines 33-37 of the present application.

2.5 The solution to this problem proposed in claim 1 of the present application is considered as involving an inventive because none of the cited documents discloses or fairly suggests the solution according to claim 1.

2.6 Claims 2-13 are dependent on claim 1 and as such also meet the requirements of novelty and inventive step.

3 **Claims 26-32**

3.1 Independent claim 26 is directed to a system for releasing a submergible load from a buoyant member. It essentially corresponds to method claim 1. Hence, the reasoning with respect to claim 1 applies *mutatis mutandis* to system claim 26, which is therefore considered to be new and inventive.

3.2 Claims 27-32 are dependent on claim 26 and as such also meet the requirements of novelty and inventive step.

Re Item VIII

Certain observations on the application

4 Although product claims 14 and 26 have been drafted as separate independent claims, they appear to relate effectively to the same subject-matter and to differ from each other only with regard to the definition of the subject-matter for which protection is sought and/or in respect of the terminology used for the features of that subject-matter. The aforementioned claims therefore lack conciseness.

5 Claim 14 is not clear.

Claim 14 is directed to a plug as such. Most of the features of claim 14 are directed to the intended use of the plug in a system for releasing a submergible load from a buoyant member. The only constructional features effectively relating to the plug as such are the following:

> "wherein the plug is dimensioned to fit through the hose in a release direction while the plug is too large to fit through the intermediate space between the engaged clip members."

However, these features not only define the plug itself but also specify its relationship to a hose and an intermediate space between engaged clip member, which are not part of the claimed plug.

When analysing novelty of claim 14, the features relating to the hose and the engaged clip members are considered as not limiting.