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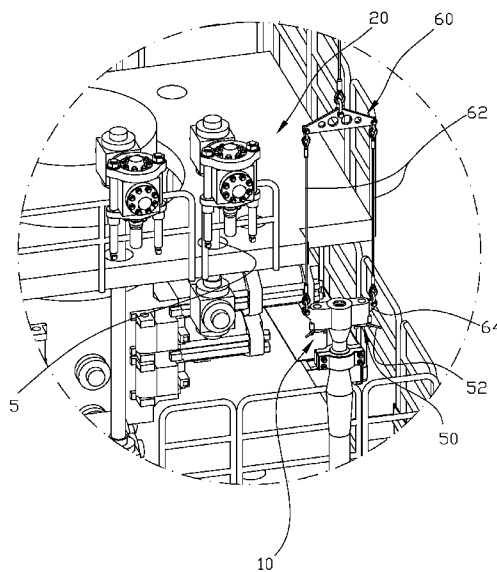


Fig. 3a

(57) Abstract: A system (1) and a method for facilitating connection of a first fluid line (3) to a second fluid line (5, 5'), the system comprising: a first connection means (10) provided with a flow channel (12) and configured for being secured to the first fluid line; a second connection means (20) provided with a flow channel and configured for being secured to the second fluid line, the flow channel of one of the first and second connection means is provided with a male tubing portion (32) for mating with the flow channel of the other one of the connection means, wherein one of the first and second connection means is provided with a guide pin (40) for mating with a receptacle arranged in the other one of the connection means, wherein the system has a pivotable locking means (50) movable around a longitudinal axis (L) of the guide pin from an inactive position to an active position to lock the guide pin with respect to the receptacle (16) when fully inserted therein, and pivotably movable to release the guide pin with respect to the receptacle.



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A SYSTEM AND A METHOD FOR FACILITATING CONNECTION OF FLUID LINES

The present invention is related to a system and a method for facilitating connection of a first fluid line to a second fluid line for providing fluid communication therebetween. More specifically, the system and the method comprise arranging connection means on an end portion of the first fluid line and the second fluid line, and securing the connection means together.

When connecting a first fluid line to a second fluid line, for example securing a first fluid line in the form of a flexible hose to a second fluid line of a BOP (Blow Out Preventor), drilling riser or surface flow tree, an end portion of the hose is moved by a handling device into abutment with an end portion of the second fluid line. For a BOP, drilling riser or a surface flow tree, the second fluid line is a substantially stationary fluid line. The handling device for moving the flexible hose may typically be a tugger winch, a crane, or a handling arm. When the end portions of the first fluid line and the second fluid line abut each other, fastening means are used to secure the hose and pipe together. Such known fastening means typically comprises bolts for connection flanges, or a so-called hammer lug or hammer union.

There are some drawbacks related to the known fastening means. The skilled person will appreciate that it is oftentimes challenging to fully align bolt holes of a flanged connection prior to inserting bolts therethrough. This may for example be due to any movement of the handling device when the end portions of the fluid lines abut each other, and/or due to challenges for an operator to prevent such movement or to move the end portions of the pipe into fine alignment sufficient to enter the bolts through the flanges. A bolted connection of this type may therefore be time consuming to establish, and represents a negative HES (Health, Environment and Safety) aspect in that there is a risk of trap or crush injury of an operator involved in establishing the connection.

Further, a bolted connection typically requires a plurality of bolts/nuts, and tools for fas-

tening the connection. A hammer lug or hammer union requires a tool, such as a hammer or sledge, to operate the lug. Thus, these connection methods represent a negative HES aspect in that there is a high risk of falling objects.

Publication WO2017155415 A1 discloses a subsea wellhead assembly for reducing riser induced loads onto a subsea wellhead, i.e. providing a wellhead load relief.

Publication US 4120171 A discloses an apparatus and a method for attaching and securing one end of a flexible cable to a subsea station. A guide frame structure is guided to guide posts on the subsea station by a pair of guide cables. The apparatus comprises locking means in the form of a latch member for providing a locking engagement of guide frame structure to the guide posts.

Publication US4525101 A discloses a method and apparatus are provided for positioning, aligning and interfacing a towed pipe segment to a previously installed pipe segment utilizing mating alignment sleds. The two pipe segments are locked to each other by means of snap rings on male probes for lock into mating alignment with probe-receiving funnels.

Publication CN 204805511 discloses a connection module comprising two connection units where guide pins can be locked by means of locking balls and a corresponding sleeve.

Publication WO 2018144372 A1 discloses a coupler assembly for a connector for installing the coupler from the rear side of a stab plate for subsea applications.

The invention has for its object to remedy or to reduce at least one of the drawbacks of the prior art, or at least provide a useful alternative to prior art.

The object is achieved through features, which are specified in the description below and in the claims that follow.

The invention is defined by the independent patent claims. The dependent claims define advantageous embodiments of the invention.

In a first aspect the invention there is provided a system for facilitating connection of a first fluid line to a second fluid line for providing fluid communication therebetween, the system comprising:

a first connection means provided with a flow channel and configured for being secured to an end portion of the first fluid line;

a second connection means provided with a flow channel and configured for being secured to an end portion of the second fluid line,
wherein the flow channel of one of the first and second connection means is provided with a male tubing portion for mating with the flow channel of the other one of the connection means, wherein one of the first connection means and the second connection means is provided with a guide pin for mating with a receptacle arranged in the other one of the connection means. The system is provided with a pivotable locking means movable around a longitudinal axis of the guide pin from an inactive position to an active position to lock the guide pin with respect to the receptacle when fully inserted therein, and pivotably movable to release the guide pin with respect to the receptacle.

Preferably, the locking means forms an integrated part of the connection means. By the term integrated part is meant that the locking means is prevented from being unintentionally separated from the connection means. The risk of the locking means representing a risk of a falling object is thereby prevented.

The locking means may be provided in conjunction with the receptacle and being movable from the inactive position to the active position wherein the locking means in its active position engages a portion of the guide pin.

Although "a" guide pin and "a" receptacle are mentioned above with regards to the first aspect of the invention, it should be clear that two or more guide pins may be provided, each of which are configured for mating with a respective receptacle. In one embodiment, there is provided two guide pins for mating with respective receptacles. In such an embodiment, at least one of the pairs of guide pin and receptacle is provided with locking means.

In one embodiment, the guide pin is provided with a recess for receiving the locking means when in the active position. In another embodiment the guide pin is provided with a substantially radial bore for receiving the locking pin when in the active position. The bore may be a throughbore configured for being aligned with a recess in a wall of the receptacle when the guide pin is fully inserted in the receptacle.

The locking means may forms part of the guide pin, the guide pin being pivotable with respect to a longitudinal axis of the guide pin between the inactive position and the active position wherein a portion of the guide pin in its active position is configured for engaging a portion of the receptacle. In an alternative embodiment, the locking means forms part of the guide pin wherein the guide pin comprises a sleeve having a first end portion and a second end portion and is configured for housing a rod protruding from the second end

portion of the sleeve. In such a rod/sleeve arrangement, the rod is pivotable with respect to a longitudinal axis of the sleeve between an inactive position and an active position wherein a portion of the rod in its active position is configured for engaging a portion of the receptacle when fully inserted therein.

5 The guide pin and the male tubing portion may form part of the second connection means. The guide pin and the male tubing portion are in such an embodiment connected to an end portion of the second fluid line. Such a second fluid line may form part of an installation, such as for example a BOP (blow out preventor), a drilling riser, or a so-called surface flow tree, used in the oil and gas industry. Thus, a second fluid line forming part of
10 such an installation may be regarded as fixed as compared with the hose to be connected thereto. An advantage of arranging the guide pin and male tubing portion protruding from a face of the second, fixed connection means is that the risk of the guide pin and male tubing portion hitting objects and possibly being damaged, is therefore eliminated. In an embodiment wherein the guide pin and the male tubing portion form part of the second
15 connection means, the first connection means is provided with the receptacle and a female flow channel that both/all are protected within a housing of the first connection means. In the event of the first connection means hits or smashes into an object during its movement, any damage of the receptacle and flow channel is unlikely to occur.

In one embodiment, second connection means may be provided with a clamping device
20 configured for being secured to for example a junction, such as a studded block, that may form an end part of an end portion of the second fluid line. The first connection means may be configured for being secured to a clamp forming part of the end portion of the first fluid line.

Such securing of the first and second connection means may require use of bolts and
25 tools. However, such an operation may be performed in a controlled manner and independently from each other. A controlled and independent securing of the first and second connection means strongly reduces the risk of falling objects. Once connected, the first and second connection means will typically remain in place and several connection and disconnecting operations may take place.

30 In one embodiment, the locking means may be configured for being moved to and from its active position by a manual operation by an operator, for example by hand. When activating the locking means, the guide pin is fully inserted into the receptacle. Thus any "side-way" relative movement between the connection means is prevented. An operator may

therefore activate the locking means in a safe way.

As an alternative to a manual operation by an operator, the locking means may be configured for being moved to and from its active position by an actuator. Such an actuator may be an electrically, hydraulically or pneumatically operated actuator. An actuator may be of particular interest if the locking means are practically without reach from an operator. An actuator may be manually controlled for example from an operating panel.

In a second aspect the invention there is provided a method for connecting a first fluid line to a second fluid line for providing fluid communication therebetween. The method comprises the steps of:

connecting the first connection means and the second connection means according to first aspect of the invention to the first fluid line and second fluid line, respectively; moving the connection means into engagement with each other; and when the connection means are fully engaged, activating the locking means to lock the guide pin with respect to the receptacle.

In one embodiment, the method may comprise moving the first connection means while the second connection means is substantially stationary.

In the following is described an example of a preferred embodiment illustrated in the accompanying drawings, wherein:

Fig. 1 shows a top portion of a BOP jack-up rig prior to installing a first connection means on an end portion of a first fluid line, here in the form of a flexible hose, and second connection means on an end portion of fluid lines comprising junctions in the form of studded blocks;

Fig. 2 shows in larger scale a detail of fig. 1 after a first connection means has been installed on the flexible, first fluid line, and a second connection means has been installed on each one of the studded blocks terminating the fluid lines;

Figs. 3a - 3b show the same as fig. 2 but where the first connection means is connected to and moved by means of a lifting device towards one of the second connection means;

Fig. 4 shows the first connection means when fully connected to the second connection means and an operator has moved the locking means into an active position;

5 Fig. 5 shows the same as fig. 4 but after the lifting device has been removed and an operator has moved towards a second studded block;

Fig. 6a – 6b show in larger scale and partly in cut, a detail of one embodiment of the connection;

Fig. 6c shows a locking means seen from A-A in fig. 6b; and

10 Fig 7a – 7b show an alternative embodiment of the connection means shown in figures 6a and 6b, wherein the locking means are operated from the second connection means.

Any positional or directional specifications such as top, vertical, etc. refer to the positions or directions shown in the figures.

15 In the figures, the same reference numerals indicate the same or corresponding elements. Not all elements are indicated by reference numerals in all the figures.

In the figures (from fig. 3b), reference numeral 1 denotes a system for connecting a first fluid line 3, here in the form of a flexible hose 3, to a second fluid line 5 for providing fluid communication therebetween. In the embodiment shown, the second fluid line 5 terminates in a junction, here shown as a 4-way studded block 5', and may therefore be re-
20 regarded as a stationary fluid line 5. In the embodiments shown, the fluid line 5 comprises two 4-way studded blocks 5', 5'' that form part of the fluid line 5.

In what follows, the first fluid line 3 will also be denoted flexible hose 3, or simply hose 3.

In fig. 1, the hose 3 is to be connected to a fluid line 5 arranged on a rig R.

25 In the embodiment shown in figures 2 *et seq.*, a first connection means 10 is secured to the flexible hose 3 by means of a clamp 103. The first connection means 10 is provided with a flow channel 12 configured for communication with the flexible hose 3. The flow channel 12 has an inlet at an end face 14 of the first connection means 10. The first connection means 10 is further provided with spaced apart receptacles 16 having an inlet at said end face 14. The end face 14 forms an upper end portion of the assembly comprising
30 the flexible hose 3 and the first connection means 10.

In the embodiment shown in figures 2 -5, the second connection means 20 comprises a main flange 22 and a supporting flange 24 arranged on opposite sides of the studded block 5'. However, if the second connection means 20 is to be connected to a second fluid line 5 directly, *i.e.* without using a studded block 5', a flange- or clamp connection may be used.

The supporting flange 24 is secured to the main flange 22 by means of two bolts 26. In one embodiment, the bolts 26 are in threaded engagement with the main flange 22, and nuts 28 screwed onto an end portion of the bolts 26 and abutting a top surface 30 of the supporting flange 24. By tightening the bolts 26, the second connection is clamped to the studded block 5'. In another embodiment, the bolts 26 form part of guide pins 40 as will be discussed below.

The main flange 22 is further provided with a male tubing 32 protruding from and forming part of the main flange 22. The tubing 32 provides a flow channel configured for providing fluid communication with a fluid channel (not shown) through the studded block 5'. In the embodiment shown, the studded block 5' is in fluid communication with another studded block 5'' which is connected to the fluid line 5.

The male tubing 32 is configured for mating with the flow channel 12 of the first connection means 10.

In figures 2 - 6a and 7a, two guide pins 40 protrude from the main flange 22 and spaced apart on opposite sides of the male tubing 32. As mentioned above, the guide pins 40 may be connected to the main flange 22 for example by means of threads arranged in an upper end portion 42 of the guide pins 40. A guide pin 40 being in threaded engagement with the main flange 22 allow easy replacement of the guide pin 40 in the event of for example any damage to the guide pin 40.

In a lower end portion 44 opposite of the upper end portion 42, the guide pins 40 are provided with a recess 46.

There are at least two purposes of the guide pins 40.

A first purpose is to align the first connection means 10 with respect to the second connection means 20. In order to provide such an alignment prior to the male tubing 32 mating with the flow channel 12 of the first connection means 10, the guide pins 40 have a longer protrusion from the main flange 22 of the second connection means 20 than the protrusion of the male tubing 32, *i.e.* the guide pins 40 are configured to enter the recep-

tacles 16 of the first connection means 10 before the male tubing 32 enters the flow channel 12 of the first connection means 10.

A second purpose of the guide pins 40 is to allow an axial locking of the guide pins 40 with respect to the receptacles 16.

5 Figures 3a and 3b show a sequence of moving the first connection means 10 into engagement with the second connection means 20 using a lifting device 60 known *per se*. The lifting device comprises a pair of wires 62 connected via shackles to lifting lugs 64 forming part of the first connection means 10.

10 Fig. 4 shows the first connection means 10 when fully inserted into to the second connection means 20 and after an operator O has moved the locking means 50 from a passive position as shown in figures 2 - 3b (where handles 52 that form part of the locking means are pointing "outwards") to an active position (where the handles 52 are pointing "inwards"). In the active position, the locking means 50 are in engagement with the recesses 46 of the guide pins 40.

15 In fig. 5, the lifting device 60 has been removed from the first connection means 10. The operator O has moved to an adjacent connection means for repeating the connecting operation for another hose (not shown).

In an alternative embodiment of the lifting device 60, the end portion of the wires 62 connecting to the shackles may be provided with suitable lifting hooks (not shown) configured
20 for engaging the shackles or other suitable means known *per se* for receiving the lifting hooks. In such an embodiment, the shackles (or said other suitable means) may be permanently attached to the lifting lugs 64. An advantage of this alternative embodiment is that the lifting device 60 may be removed without having to disconnect the shackles from the lifting lugs 64. Thus, no tool is required and the risk of falling objects, such as said tool
25 or parts of the shackle when dismantled, is eliminated.

As an alternative to, or in addition to using a lifting device 60 as shown in figures 3a to 4, the first connection means 10 may be moved into engagement with the second connection means 20 using for example a manipulator arm (not shown) configured for gripping or
30 engaging a portion of the movable connection means in any other way. Such a manipulator arm may allow alignment of non-vertical connection means, *i.e.* connection means wherein the guide pins 40 and male tubing 32, and mating receptacles 16, and flow channel 12, respectively, are arranged in any angle other than vertical as shown in the figures.

Figures 6a – 6b and 7a – 7b show examples of two alternative locking means 50 suitable for use in the system according to the present invention.

In the embodiment shown in figs. 6a and 7a, the guide pins 40 and the bolts 26 are made in one piece. The guide pins 40 are provided with an enlarged diameter portion 42 (corresponding to the first end portion 42 mentioned above) for providing a shoulder configured to abut an underside of the main flange 22 when the nuts 28 are tightened.

In figs. 6a – 6b a locking means 50 is configured for engaging the recess 46 in the second end portion 44 of each of the guide pins 40. Figs. 6a – 6b show further and additional details of the first connection means 10 and the second connection means 20 shown in figs. 2a – 5. One such detail is that the main flange 22 comprises an annular element 23 and a pipe flange 34. The annular element 23 is arranged with close fit radially outwards of the pipe flange 34.

When tightening the nuts 28 of the bolts 26, the nuts 28 and the enlarged diameter portion 42 of the guide pins 40, urges the annular element 23 and the supporting flange 24 against a portion of the upper and lower surface of the studded block 5, and locks the guide pins 40 in position.

As can be seen for example in fig. 2, the end portion of the guide pins 40 have a “cradle-form” with two opposite, flat sides. The end portion of the guide pins 40 are configured for passing through an oblong opening 51 of the locking means 50. The oblong opening 51 is best seen in fig. 6c. The locking means 50 is pivotably connected to the first connection means 10 to form an extension of the receptacles 16. By means of pivot handle 52, the locking means 50 may be pivoted 90° from an inactive position to an active position after the guide pins 40 have been fully inserted into the recesses 16. In the active position the locking means 50 engages the recesses 46 of the guide pins 40 and prevents relative axial movement of the guide pins 40 with respect to the receptacles.

The locking means shown in figs. 7a – 7b is based on the same locking principle as shown in figs 6a – 6b. As described with regards to fig. 6a, the main flange 22 shown in fig. 7a comprises an annular element 23 and a pipe flange 34. However, the annular element 23 of the main flange 22 and the supporting flange 24 are secured against a portion of the upper and lower surface of the studded block 5 by means of connecting rods 27 (one shown in fig. 7a) and nuts 27' at each end portion thereof.

Contrary to the embodiment shown in figs. 6a – 6b, the locking means 50 in figs. 7a – 7b

form part of the guide pins 40. Each of the guide pins 40 passes through the supporting flange 24 and the annular element 23 of the main flange 22 via bushings 41. Bushings 41 are also provided in the receptacle 16 of the first connection means 10. The bushings 41 allow the pivoting of the guide pins 40 with respect to and around a longitudinal axis L thereof between an inactive position and an active position wherein the recess of the guide pin 40 in its active position engages a portion 16' of the receptacle 16. The portion 16' is provided with an oblong opening 51' similar to the oblong opening 51 shown in fig. 6c. Thus, by means of pivot handle 52 arranged in a top portion of the second connection means 20, the locking means 50 shown in fig. 7a may be pivoted 90° from an inactive position to an active position after the guide pins 40 have been fully inserted into the recesses 16 where in the active position relative axial movement of the guide pins 40 with respect to the receptacles 16 is prevented.

The embodiment shown in figures 7a- 7b has some advantages over the embodiment shown in figures 6a – 6c in that the handles 52 for operating the locking means 50 are arranged on the stationary, second connection means 20. The risk of damaging the handles 52 due to hitting any objects while connecting the connection means 10, 20 is therefore considerably reduced. Further, the handles 52 are better reachable for an operator O.

The present invention provides, in at least one embodiment, a system for connecting a flexible hose to a fluid line for providing fluid communication therebetween wherein the system is “self-aligning” while at the same time there is no need for separate or “loose” tools and connection means. The present invention therefore provides a faster and safer way of connecting a flexible hose to a fluid line than hitherto known.

It should be noted that the above-mentioned embodiments illustrate rather than limit the invention, and that those skilled in the art will be able to design many alternative embodiments without departing from the scope of the appended claims. In the claims, any reference signs placed between parentheses shall not be construed as limiting the claim. Use of the verb "comprise" and its conjugations does not exclude the presence of elements or steps other than those stated in a claim. The article "a" or "an" preceding an element does not exclude the presence of a plurality of such elements.

C l a i m s

1. A system (1) for facilitating connection of a first fluid line (3) to a second fluid line (5, 5') for providing fluid communication therebetween, the system (1) comprising:
5 a first connection means (10) provided with a flow channel (12) and configured for being secured to an end portion of the first fluid line (3);
a second connection means (20) provided with a flow channel and configured for being secured to an end portion of the second fluid line (5, 5'),
wherein the flow channel of one of the first and second connection means (10,
10 20) is provided with a male tubing portion (32) for mating with the flow channel (12) of the other one of the connection means, wherein one of the first connection means (10) and the second connection means (20) is provided with a guide pin (40) for mating with a receptacle (16) arranged in the other one of the connection means, c h a r a c t e r i s e d i n that the system (1) is provided
15 with a pivotable locking means (50) movable around a longitudinal axis (L) of the guide pin (40) from an inactive position to an active position to lock the guide pin (40) with respect to the receptacle (16) when fully inserted therein, and pivotably movable to release the guide pin (40) with respect to the receptacle (16).
2. The system (1) according to claim 1, wherein the locking means (50) is provided
20 in conjunction with the receptacle (16) and being movable from the inactive position to the active position wherein the locking means (50) in its active position engages a portion of the guide pin (40).
3. The system (1) according to claim 2, wherein the guide pin (40) is provided with a recess (46) for receiving the locking means (50) when in the active position.
- 25 4. The system (1) according to claim 1, wherein the locking means (50) forms part of the guide pin (40), the guide pin (40) being pivotable with respect to a longitudinal axis (L) of the guide pin (40) between the inactive position and the active position wherein a portion of the guide pin (40) in its active position is configured for engaging a portion (16') of the receptacle (16).
- 30 5. The system (1) according to any one of claims 1-4, wherein the guide pin (40) and the male tubing portion (32) form part of the second connection means (20).

6. The system (1) according to claim 5, wherein the second connection means (20) is provided with a clamping device (22, 24) configured for being secured to a junction (5') forming an end portion of the second fluid line (5).
- 5 7. The system (1) according to any of the preceding claims, wherein the first connection means (10) is configured for being secured to a clamp (103) forming part of the end portion of the first fluid line (3).
8. The system (1) according to any of the preceding claims, wherein the locking means (50) is configured for being moved to and from its active position by a manual operation by an operator.
- 10 9. The system (1) according to any of the preceding claims, wherein the locking means (50) is configured for being moved to and from its active position by an actuator.
- 15 10. A method for connecting a first fluid line (3) to a second fluid line (5, 5') for providing fluid communication therebetween, c h a r a c t e r i s e d i n that the method comprises the steps of:
connecting the first connection means (10) and the second connection means (20) according to claim 1 to the first fluid line (3) and second fluid line (5, 5'), respectively;
moving the connection means (10, 20) into engagement with each other; and
20 when the connection means (10, 20) are fully engaged, activating the locking means (50) to lock the guide pin (40) with respect to the receptacle (16).
- 25 11. The method according to claim 10, wherein the method comprises moving the first connection means (10) while the second connection means (20) is substantially stationary.

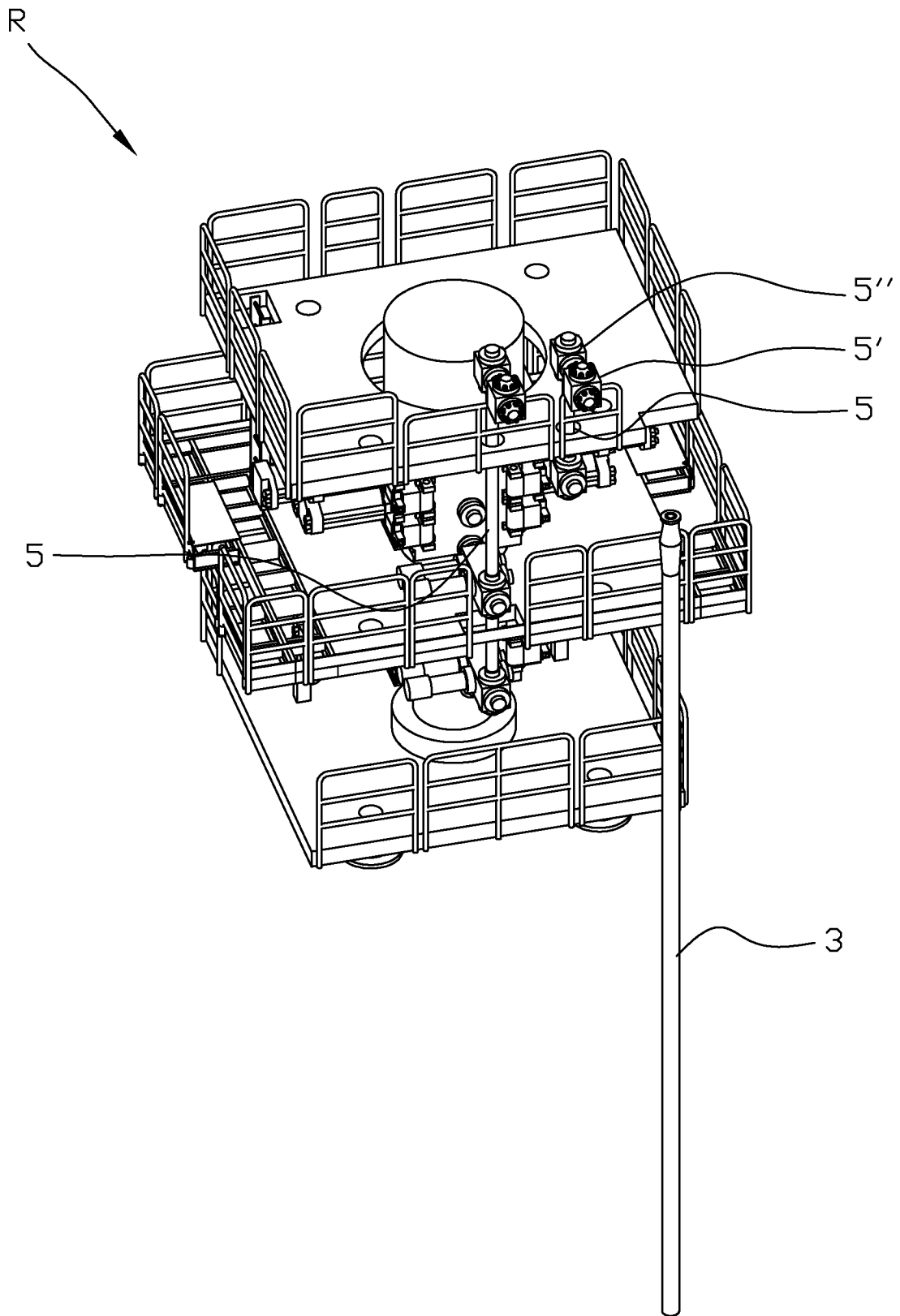


Fig. 1

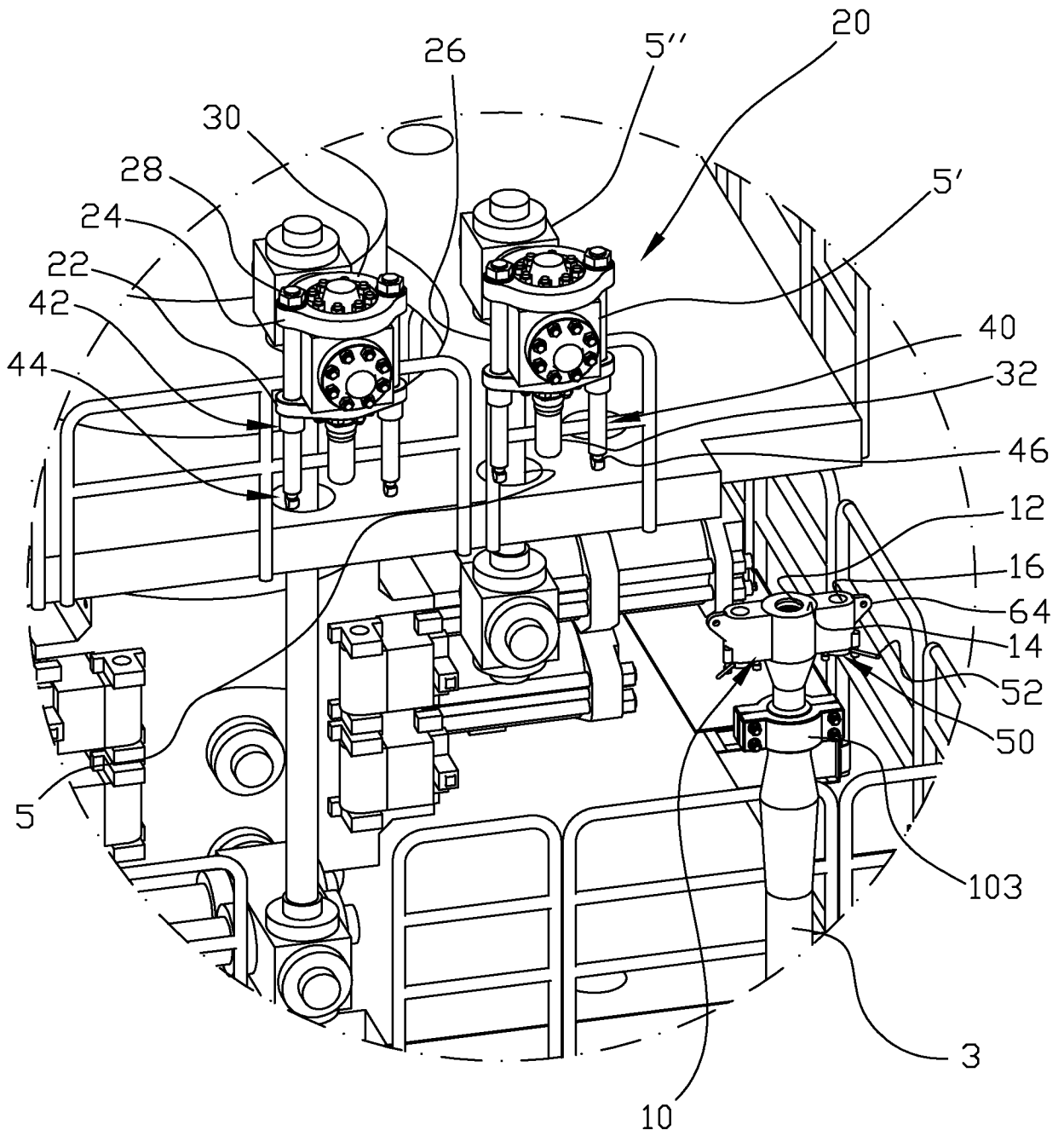


Fig. 2

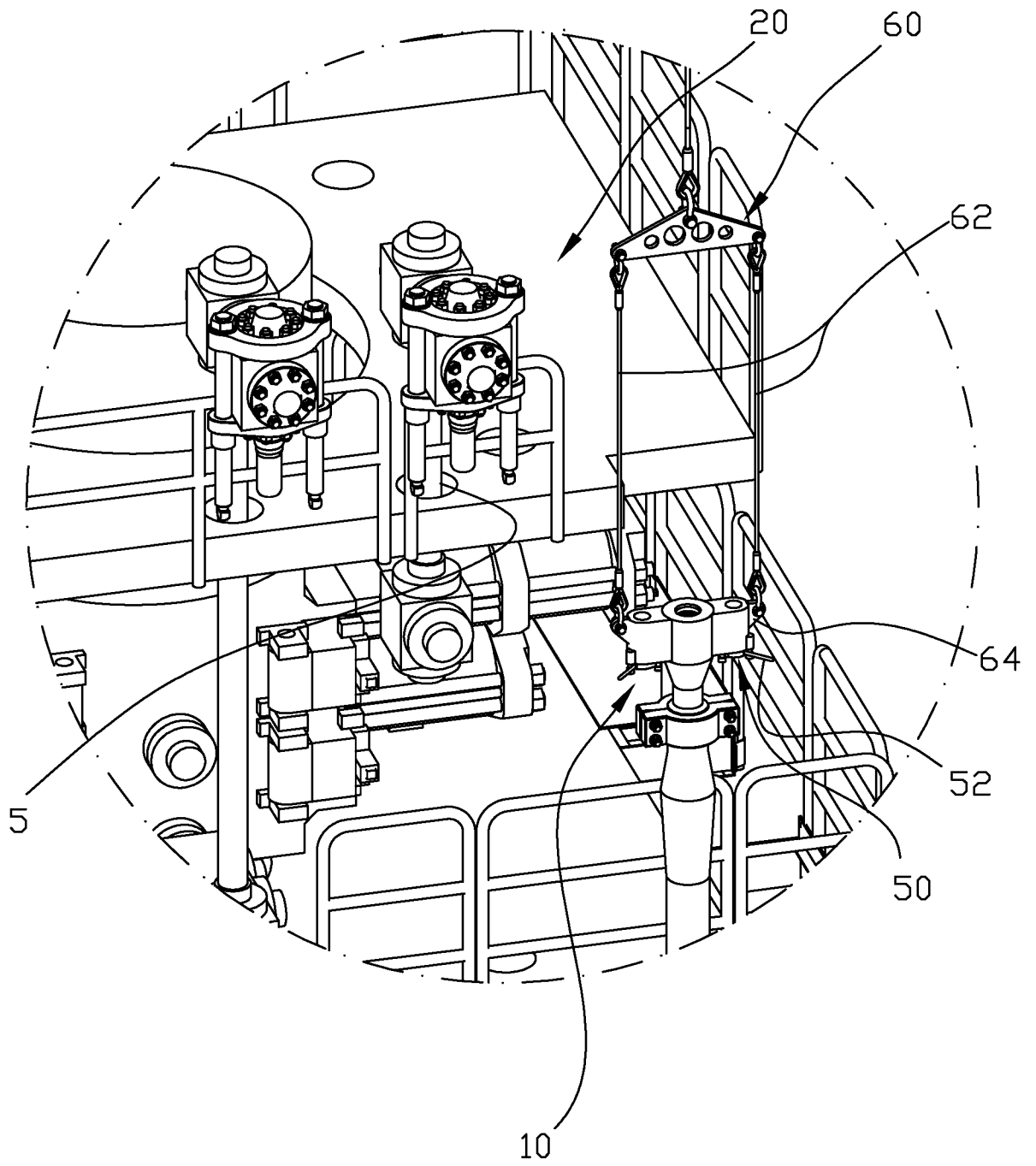


Fig. 3a

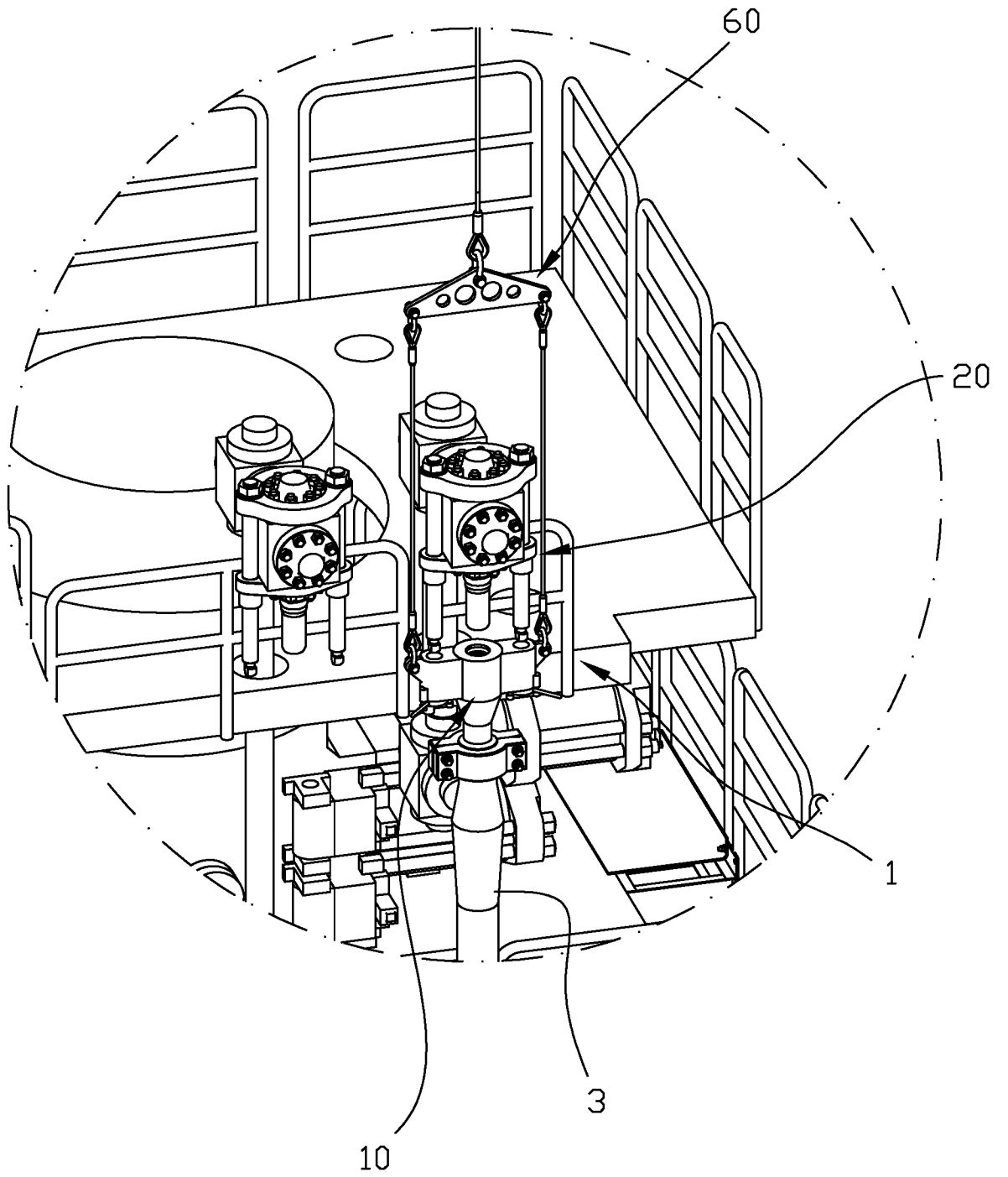


Fig. 3b

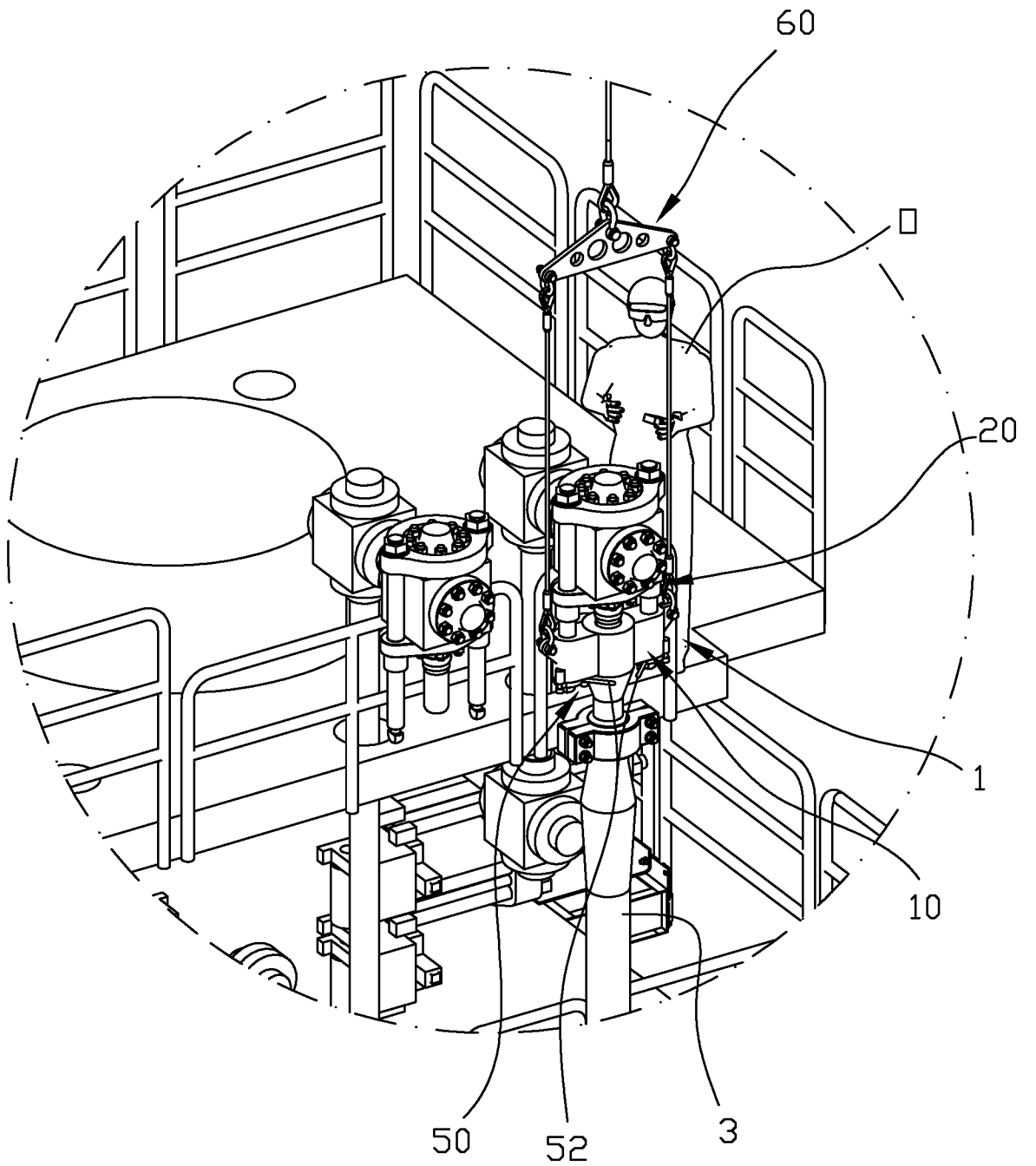


Fig. 4

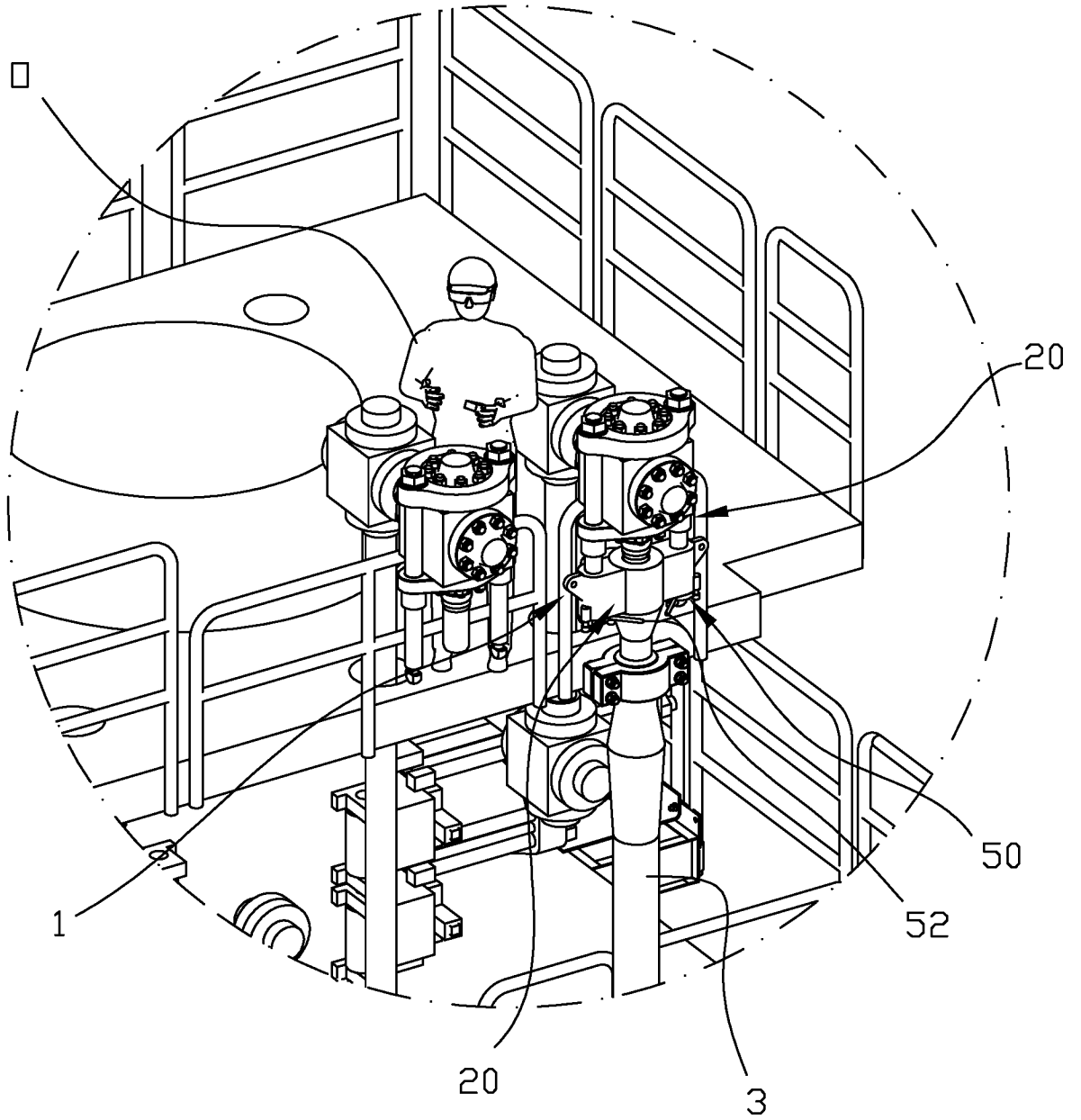
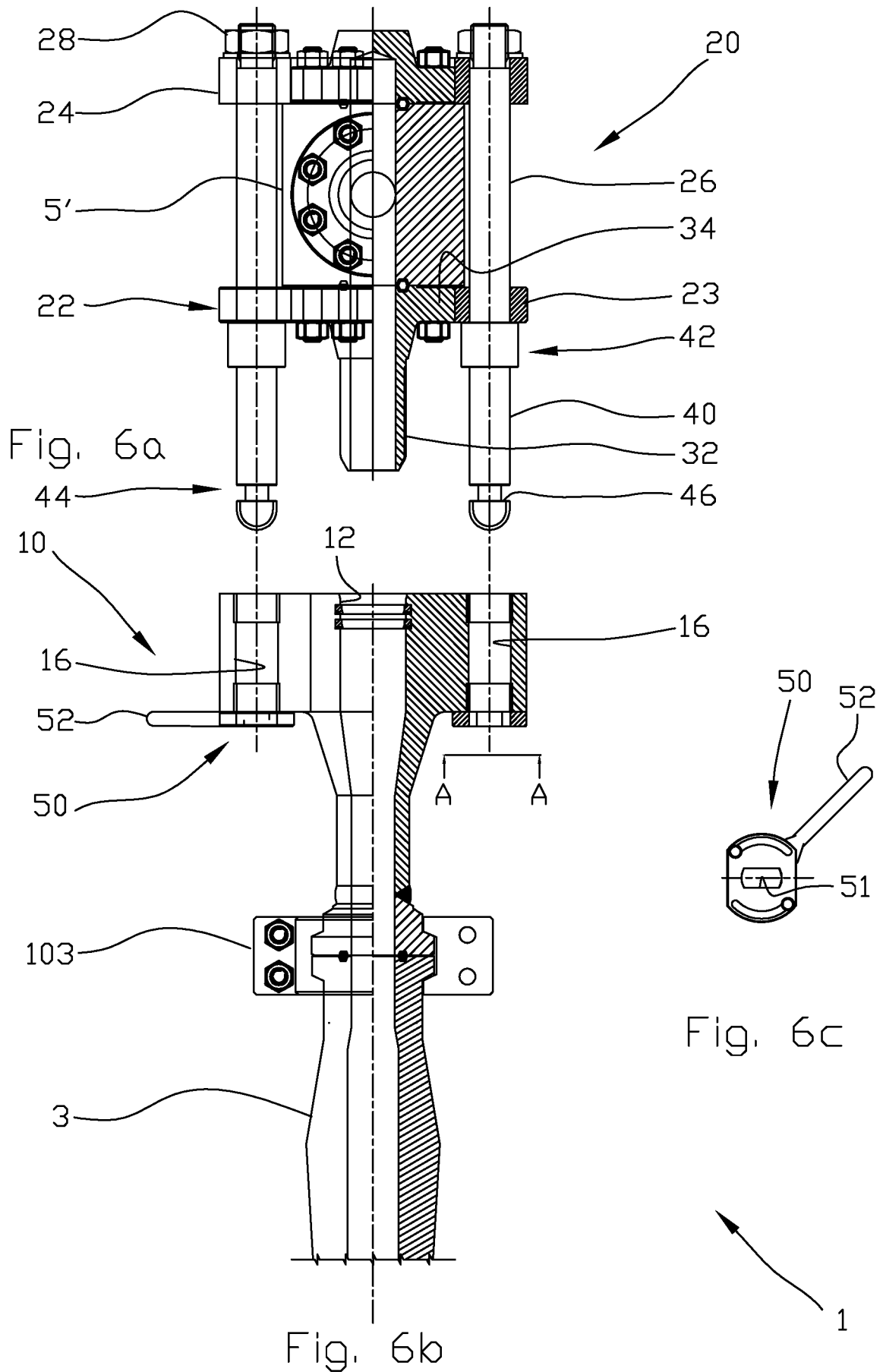
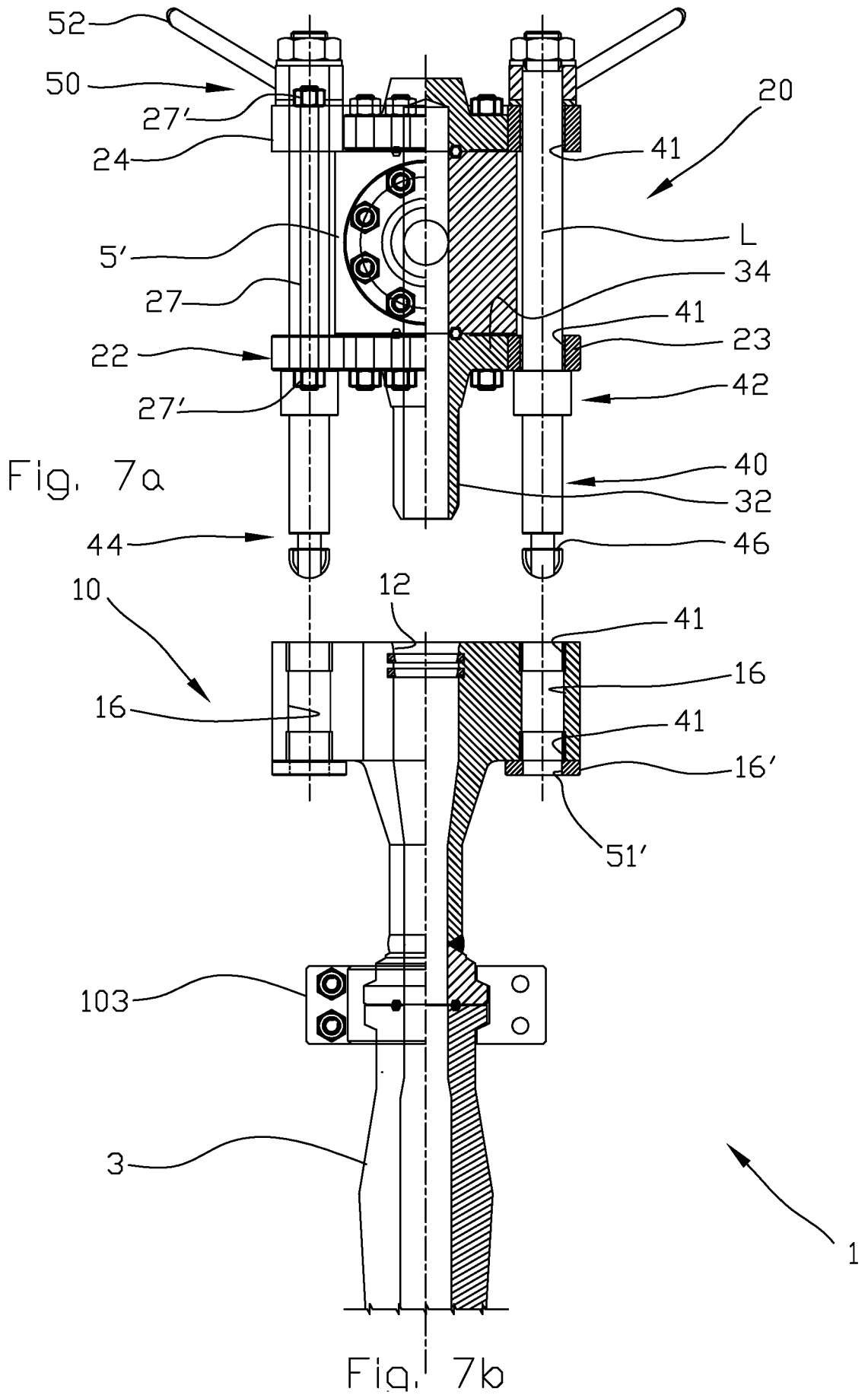


Fig. 5





INTERNATIONAL SEARCH REPORT

International application No.

PCT/NO2020/050086

| A. CLASSIFICATION OF SUBJECT MATTER | | |
|---|--|--|
| F16L 37/08 (2006.01), E21B 17/08 (2006.01), E21B 33/038 (2006.01), E21B 43/013 (2006.01), F16L 21/08 (2006.01) | | |
| According to International Patent Classification (IPC) or to both national classification and IPC | | |
| B. FIELDS SEARCHED | | |
| Minimum documentation searched (classification system followed by classification symbols) CPC- and IPC- classes combined with relevant search terms | | |
| Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched DK, NO, SE, FI: Classes as above. | | |
| Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) EPODOC, WPI | | |
| C. DOCUMENTS CONSIDERED TO BE RELEVANT | | |
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