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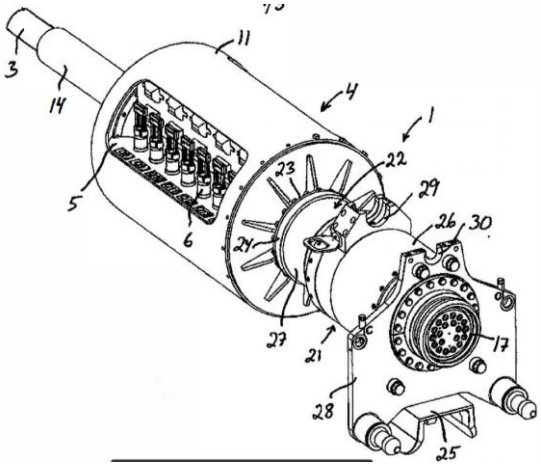
(54) Title **Subsea umbilical termination assembly**

(56) References Cited:

WO 2014206831 A1
US 20140046599 A1
US 8141909 B2
GB 2494180 A

(57) Abstract

A subsea umbilical termination assembly comprising: - an umbilical termination head (2) fixed to the end of a subsea umbilical (3); and - an electrical and/or optical distribution unit (4) comprising a base frame (5) and several connectors (6) mounted to the base frame (5), wherein each connector (6) is electrically connected to an electrical cable of the subsea umbilical (3) via the umbilical termination head (2) or optically connected to an optical cable of the subsea umbilical (3) via the umbilical termination head (2). The umbilical termination head (2) is mounted in a space (7) provided inside the base frame (5) of the distribution unit (4).



FIELD OF THE INVENTION AND PRIOR ART

The present invention relates to a subsea umbilical termination assembly according to the preamble of claim 1.

A subsea installation for processing and transport of oil and gas usually comprises subsea well equipment installed at the seabed and connected to a surface structure, for instance in the form of a surface vessel or platform, by means of a subsea umbilical. The subsea umbilical may be used to supply hydraulic fluid and/or electric power to the subsea well equipment and/or deliver different type» of production chemicals and service fluids to the subsea well equipment and/or transmit different types of electrical and/or optical signals between the surface structure and the subsea well equipment. The subsea umbilical may comprise several fluid lines, electrical cables and/or optical cables. The fluid lines and cables of the subsea umbilical are bundled together and enclosed within an outer protective sheathing. At the seabed, the subsea umbilical ends in an umbilical termination head, which is permanently fixed to the end of the subsea umbilical before the subsea umbilical is delivered for installation. During the installation, the subsea umbilical and the umbilical termination head are normally lowered into the sea from a surface vessel with the umbilical termination head connected to an electrical and/or optical distribution unit, which is normally located in line with the umbilical termination head.

SUMMARY OF THE INVENTION

The object of the present invention is to provide a subsea umbilical termination assembly of new and favorable design.

According to the invention, this object is achieved by a subsea umbilical termination assembly having the features defined in claim 1.

The subsea umbilical termination assembly of the present invention comprises: - an umbilical termination head fixed to the end of a subsea umbilical; and - an electrical and/or optical distribution unit comprising a base frame and several connectors mounted to the base frame, wherein each connector is electrically connected to an electrical cable of the subsea umbilical via the umbilical termination head or optically

connected to an optical cable of the subsea umbilical via the umbilical termination head.

According to the invention, the umbilical termination head is mounted in a space provided inside the base frame of the distribution unit. Hereby, the umbilical termination head and the distribution unit may be integrated with each other in a space-saving manner and the length of the subsea umbilical termination assembly may thereby be reduced.

Further advantages as well as advantageous features of the subsea umbilical termination assembly of the present Invention will appear from the following description and the dependent claims.

BRIEF DESCRIPTION OF THE DRAWINGS

With reference to the appended drawings, a specific description of preferred embodiments of the invention cited as examples follows below. In the drawings:

Fig 1 is a perspective view from a front end of a subsea umbilical termination assembly according to an embodiment of the present invention;

Fig 2 is a perspective view from a rear end of the subsea umbilical termination assembly of Fig 1;

Fig 3 is a lateral view of the subsea umbilical termination assembly of Fig 1;

Fig 4 is a planar view from above of the subsea umbilical termination assembly of Fig 1;

Fig 5 is a perspective view of the rear part of the subsea umbilical termination assembly of Fig 1; and

Fig 6 is an exploded view of the part shown in Fig 5, and Fig 7 is a partly cut top view of the part shown in Fig 5.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS OF THE INVENTION

A subsea umbilical termination assembly 1 according to an embodiment of the present invention is illustrated in Figs 1-7. The subsea umbilical termination assembly 1 comprises an umbilical termination head 2 which is fixed to an end of a subsea umbilical 3. The subsea umbilical 3 comprises several fluid lines (not shown) and electrical and/or optical cables (not shown) which are bundled together inside the umbilical. The bundle of fluid lines and cables is enclosed within an outer protective sheathing.

The fluid lines of the subsea umbilical 3 may be used for supplying hydraulic fluid or delivering different types of production Chemicals and service fluids to subsea well equipment. The electrical cables of the subsea umbilical 3 may be used for supplying electric power to subsea well equipment or transmitting electrical signals between a surface structure and subsea well equipment. The optical cables of the subsea umbilical 3 may be used for transmitting optical signals between a surface structure and subsea well equipment.

The subsea umbilical 3 terminates in the umbilical termination head 2, where the fluid lines and cables of the umbilical 3 are separated from each other in a conventional manner.

The subsea umbilical termination assembly 1 also comprises an electrical and/or optical distribution unit 4. The distribution unit 4 comprises a base frame 5 and several electrical and/or optical connectors 6 mounted to the base frame 5. Each electrical connector 6 of the distribution unit 4 is electrically connected to an electrical cable of the subsea umbilical 3 via the umbilical termination head 2 and each optical connector of the distribution unit 4 is optically connected to an optical cable of the subsea umbilical 3 via the umbilical termination head 2. The connectors 6 are in a conventional manner configured for engagement with electrical or optical flying leads (not shown), by means of which the distribution unit 4 is connected to the desired subsea well equipment.

The umbilical termination head 2 is mounted in a space 7 (see Fig 7) provided inside the base frame 5 of the distribution unit 4. The umbilical termination head 2 is

preferably centrally positioned inside the base frame 5. In the illustrated embodiment, the umbilical termination head 2 is circularly cylindrical and accommodated in a correspondingly shaped cavity 8 in the base frame 5, wherein the base frame 5 comprises an inner cylindrical wall 9 which delimits said cavity 8 in the radial direction and surrounds the umbilical termination head 2. In the example illustrated in Fig 7, the umbilical termination head 2 is bolted to an annular flange 10 of the base frame 5 provided at the inner end of the cavity 8. However, the umbilical termination head 2 may of course be fixed to the base frame 5 in any other suitable manner.

The base frame 5 of the distribution unit 4 is surrounded by a cylindrical outer casing 11, which preferably has a circular cross-sectional shape.

At least some of the connectors 6 are located in a space of the distribution unit 4 radially outwardly of the umbilical termination head 2. In the illustrated embodiment, the distribution unit 4 comprises several electrical terminations 12 (see Fig 6) mounted to the base frame 5, wherein each electrical termination 12 is electrically connected to an electrical cable of the subsea umbilical 3 via the umbilical termination head 2 and to one of said connectors 6. The electrical terminations 12 are with advantage located in a space of the distribution unit 4 radially outwardly of the umbilical termination head 2. For the sake of clarity, some of the electrical cables 13 between the umbilical termination head 2 and the electrical terminations 12 and between the electrical terminations 12 and the connectors 6 are omitted in Fig 6.

An end section of the subsea umbilical 3 may be surrounded by a bend restricting element 14 which extends along the end section and is fixed to a flange 15 (see Fig 7) at the rear end of the umbilical termination head 2, for instance by means of a clamping device 16. The bend restricting element 14 is configured to reduce the flexibility of the end section of the subsea umbilical 3.

The subsea umbilical termination assembly 1 comprises a multibore hub 17 and several fluid conduits 18 extending between the umbilical termination head 2 and the multibore hub 17, wherein each fluid conduit 18 is in fluid communication with a fluid line of the subsea umbilical 3. The fluid conduits 18 extend through an axial passage 19 (see Fig 7) in the base frame 5 of the distribution unit 4 and through an opening 20 at the front end of the base frame 5.

In the illustrated embodiment, the subsea umbilical termination assembly 1 also comprises a base structure 21 and a sliding unit 22 slidably mounted to the base structure 21. The base frame 5 of the distribution unit 4 is fixed to the sliding unit 22 at the rear end 22b thereof. In the illustrated example, the base frame 5 is provided with an annular mounting flange 23 at its front end, and this mounting flange 23 is bolted to a corresponding flange 24 at the rear end 22b of the sliding unit 22 to thereby secure the base frame 5 to the sliding unit 22. The above-mentioned fluid conduits 18 extend axially through the sliding unit 22.

The multibore hub17 is fixed to the sliding unit 22 at the front end 22a thereof so as to be axially moveable in relation to the base structure 21 together with the sliding unit 22. The multibore hub 17 is configured for engagement with a corresponding hub (not shown) of a subsea appliance.

The subsea umbilical termination assembly 1 also comprises an actuating unit (not shown), which is configured to act between the base structure 21 and the sliding unit 22 and by means of which the sliding unit 22 can be pushed axially forwards in relation to the base structure 21.

In the illustrated embodiment, the base structure 21 of the subsea umbilical termination assembly 1 comprises a lower base frame 23 and a support sleeve 26 mounted to the base frame25 , whereas the sliding unit 22 comprises a tubular body 27 and a vertical holding plate 28 rigidly mounted to the tubular body 27 at the front end thereof. The tubular body 27 is displaceably received in said support sleeve 26. The tubular body 27 extends through the support sleeve 26 and is axially displaceable in relation to the support sleeve 26 by means of the above-mentioned actuating unit.

The above-mentioned actuating unit may comprises a stroking device in the form of a hydraulic cylinder (not shown) configured to act between the support sleeve 26 and the tubular body 27 in the manner illustrated in US 2014/0103636 A1, the content of which being incorporated herein by reference. The hydraulic cylinder comprises a cylinder part, a piston displaceably received inside the cylinder part and a piston rod fixed to the piston. The base structure 21 comprises a first holder 29 to which the cylinder part is attachable, whereas the sliding unit 22 comprises a second holder 30

to which the piston rod is attachable. In the illustrated example, the first holder 29 is mounted to the support sleeve 26, whereas the second holder 30 forms part of the holding plate 28 provided at the front end of the tubular body 27.

The base structure 21 of the subsea umbilical termination assembly 1 is connectable to a landing platform (not shown) of a subsea support structure by being lowered downwards onto said landing platform so as to come to bear against it. The base structure 21 of the subsea umbilical termination assembly 1 is provided with guiding means configured to co-operate with corresponding guiding means on the subsea support structure so as to guide the base structure 21 into a correct position in relation to the landing platform of the subsea support structure when the subsea umbilical termination assembly 1 is lowered downwards into contact with the landing platform. These guiding means may for instance be of the types disclosed in closer detail in US 2014/0103636 A1. The subsea umbilical termination assembly 1 is intended to be lowered into the sea, e.g. from a surface vessel, barge or platform, while hanging in a crane hook of a hoisting device through lifting wires (not shown) attached to the subsea umbilical termination assembly 1.

The invention is of course not in any way restricted to the embodiments described above. On the contrary, many possibilities to modifications thereof will be apparent to a person with ordinary skill in the art without departing from the basic idea of the invention such as defined in the appended claims.

Claims

1. A subsea umbilical termination assembly (1) comprising: - an umbilical termination head (2) fixed to the end of a subsea umbilical (3); and - an electrical and/or optical distribution unit (4) comprising a base frame (5) and several connectors (6) mounted to the base frame (5), wherein each connector (6) is electrically connected to an electrical cable of the subsea umbilical (3) via the umbilical termination head (2) or optically connected to an optical cable of the subsea umbilical (3) via the umbilical termination head (2), c h a r a c t e r i z e d in that the umbilical termination head (2) is mounted in a space (7) provided inside the base frame (5) of the distribution unit (4).

2. A subsea umbilical termination assembly according to claim 1, c h a r a c t e r i z e d in that the distribution unit (4) comprises a cylindrical outer casing (11) which accommodates the base frame (5) of the distribution unit (4) and the umbilical termination head (2).

3. A subsea umbilical termination assembly according to claim 2, c h a r a c t e r i z e d in that said casing (11) has a circular cross-sectional shape.

4. A subsea umbilical termination assembly according to any of claims 1-3, c h a r a c t e r i z e d in that the umbilical termination head (2) is centrally positioned inside the base frame (5) of the distribution unit (4).

5. A subsea umbilical termination assembly according to any of claims 1-4, c h a r a c t e r i z e d in that one or more of the connectors (6) are located in a space of the distribution unit (4) radially outwardly of the umbilical termination head (2).

6. A subsea umbilical termination assembly according to any of claims 1-5, c h a r a c t e r i z e d in that the base frame (5) of the distribution unit (4) comprises an inner cylindrical wall (9) which surrounds the umbilical termination head (2).

7. A subsea umbilical termination assembly according to any of claims 1-6, c h a r a c t e r i z e d in that the distribution unit (4) comprises several electrical terminations (12) mounted to the base frame (5), wherein each electrical termination

(12) is electrically connected to an electrical cable of the subsea umbilical (3) via the umbilical termination head (2) and to one of said connectors (6).

8. A subsea umbilical termination assembly according to claim 7, c h a r a c t e r i z e d in that the electrical terminations (12) are located in a space of the distribution unit (4) radially outwardly of the umbilical termination head (2).

9. A subsea umbilical termination assembly according to any of claims 1-8, c h a r a c t e r i z e d in that the subsea umbilical termination assembly (1) comprises a multibore hub (17) and several fluid conduits (18) extending between the umbilical termination head (2) and the multibore hub (17), wherein each fluid conduit (18) is in fluid communication with a fluid line of the subsea umbilical (3).

10. A subsea umbilical termination assembly according to claim 9, c h a r a c t e r i z e d in that said fluid conduits (18) extend through an axial passage (19) in the base frame (5) of the distribution unit (4).

11. A subsea umbilical termination assembly according to claim 9 or 10 c h a r a c t e r i z e d in that the subsea umbilical termination assembly (1) comprises a base structure (21) and a sliding unit (22) slidably mounted to the base structure (21), the sliding unit (22) having a front end (22a) and an opposite rear end (22b); - that the base frame (5) of the distribution unit (4) is fixed to the sliding unit (22) at the rear end (22b) thereof and the multibore hub (17) is fixed to the sliding unit (22) at the front end (22a) thereof; and - that said fluid conduits (18) extend axially through the sliding unit (22).

Patentkrav

1. Undervanns navlestreng koblingssammenstilling (1) omfattende:
- et navlestreng-koblingshode (2) festet til enden av undervanns navlestreng (3); og
- en elektrisk og / eller optisk distribusjonsenhet (4) omfattende en fundamentramme (5) og flere koplinger (6) montert på fundamentrammen (5), hvor hver kopling (6) er elektrisk koblet til en elektrisk kabel i undervanns navlestreng (3) via navlestreng-koblingshodet (2) eller er optisk koblet til en optisk kabel i undervanns navlestreng (3) via navlestreng-koblingshodet (2),
karakterisert ved at:
navlestreng-koblingshodet (2) er montert i et rom (7) tilveiebrakt innvendig i distribusjonsenhetens (4) fundamentramme (5).

2. Undervanns navlestreng koblingssammenstilling ifølge krav 1, karakterisert ved at distribusjonsenheten (4) omfatter et sylindrisk, ytre hus (11) som opptar distribusjonsenhetens (4) fundamentramme (5) og navlestreng-koblingshodet (2).

3. Undervanns navlestreng koblingssammenstilling ifølge krav 2, karakterisert ved at nevnte hus (11) har et sirkulært tverrsnitt.

4. Undervanns navlestreng koblingssammenstilling ifølge et av kravene 1-3, karakterisert ved at navlestreng-koblingshodet (2) er sentralt plassert inne i distribusjonsenhetens (4) fundamentramme (5).

5. Undervanns navlestreng koblingssammenstilling ifølge et av kravene 1-4, karakterisert ved at en eller flere av koplingene (6) er plassert i et rom i distribusjonsenheten (4) radialt utover fra navlestreng-koblingshodet (2).

6. Undervanns navlestreng koblingssammenstilling ifølge et av kravene 1-5, karakterisert ved at distribusjonsenhetens (4) fundamentramme (5) omfatter en indre sylindrisk vegg (9) som omgir navlestreng-koblingshodet (2).

7. Undervanns navlestreng koblingssammenstilling ifølge et hvilket som helst av kravene 1-6, karakterisert ved at distribusjonsenheten (4) omfatter flere elektriske koblinger (12) montert på fundamentrammen (5), hvor hver elektrisk kobling (12) er elektrisk koblet til en elektrisk kabel i den undersjøiske navlestrengen (3) via navlestrenghodet (2) og til en av koplingene (6).

8. Undervanns navlestreng koblingssammenstilling ifølge krav 7, karakterisert ved at de elektriske koblingene (12) er lokalisert i et rom i distribusjonsenheten (4) radialt utover fra navlestreng-koblingshodet (2).

9. Undervanns navlestreng koblingssammenstilling ifølge et hvilket som helst av kravene 1-8, karakterisert ved at navlestreng koblingssammenstillingen (1) omfatter en flerboret koblingsflens (17) og flere fluidkanaler (18) som strekker seg mellom navlestreng-koblingshodet (2) og den flerborede koblingsflensen (17), hvor hver fluidkanal (18) er i fluidforbindelse med en fluidledning i den undersjøiske navlestrengen (3).

10. Undervanns navlestreng koblingssammenstilling ifølge krav 9, karakterisert ved at fluidkanalene (18) strekker seg gjennom en aksial passasje (19) i distribusjonsenhetens (4) fundamentramme (5).

11. Undervanns navlestreng koblingssammenstilling ifølge krav 9 eller 10, , karakterisert ved at:
-navlestreng koblingssammenstillingen (1) omfatter en fundamentstruktur (21) og en sleideenhet (22) glidbart montert på fundamentstrukturen (21), idet sleideenheten (22) har en fremre ende (22a) og en motstående bakre ende (22b);
- at distribusjonsenhetens (4) fundamentramme (5) er festet til sleideenheten (22) ved den bakre enden (22b) derav og den flerborede koblingsflensen (17) er festet til sleideenheten (22) ved den fremre enden (22a) derav; og
- at nevnte fluidkanaler (18) strekker seg aksialt gjennom sleideenheten (22).

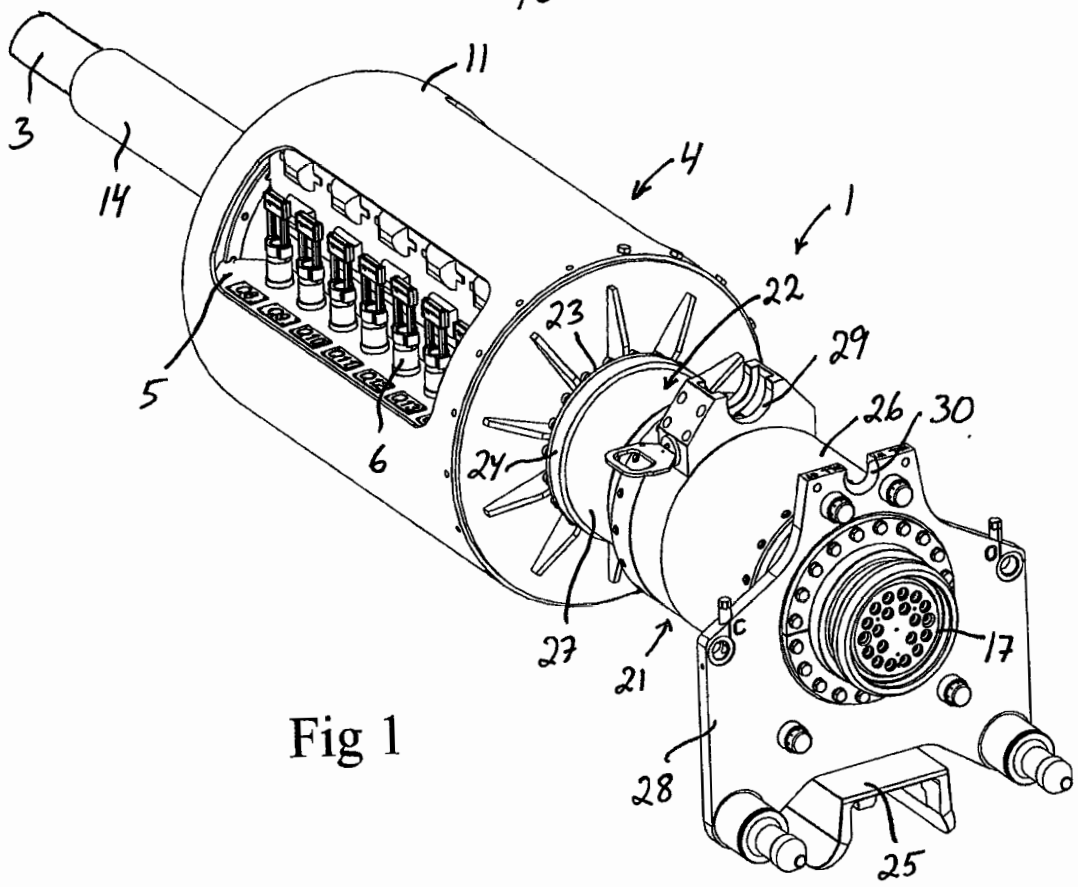

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Fig 1

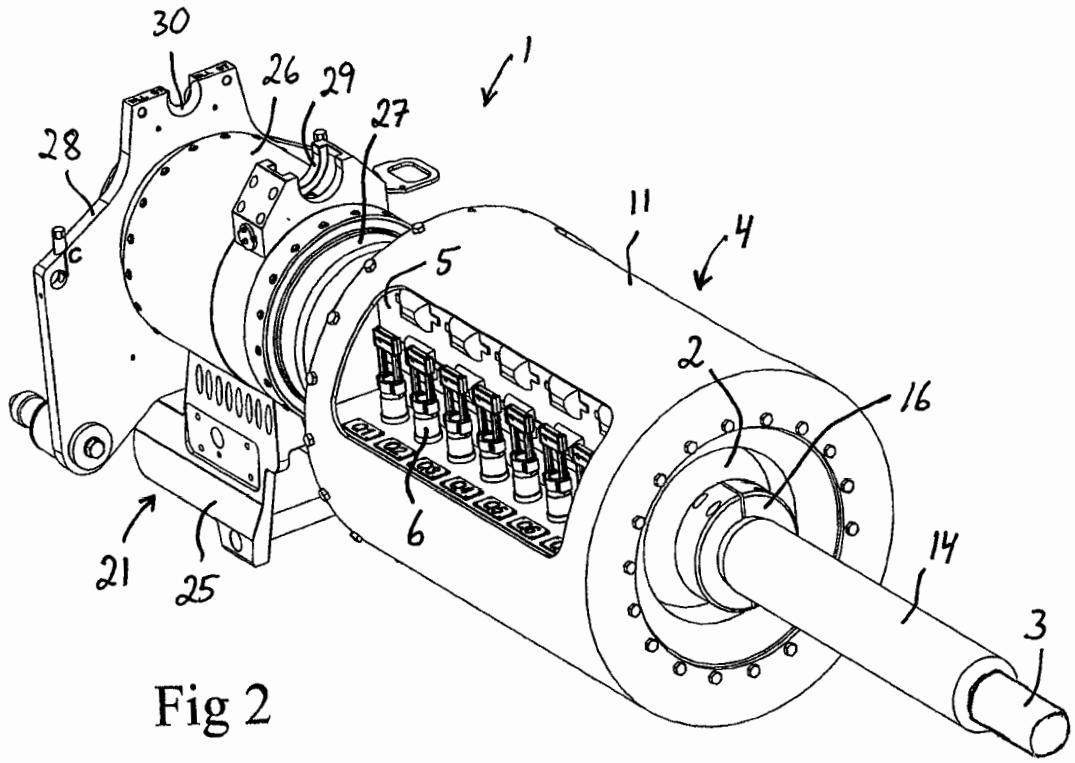
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Fig 2

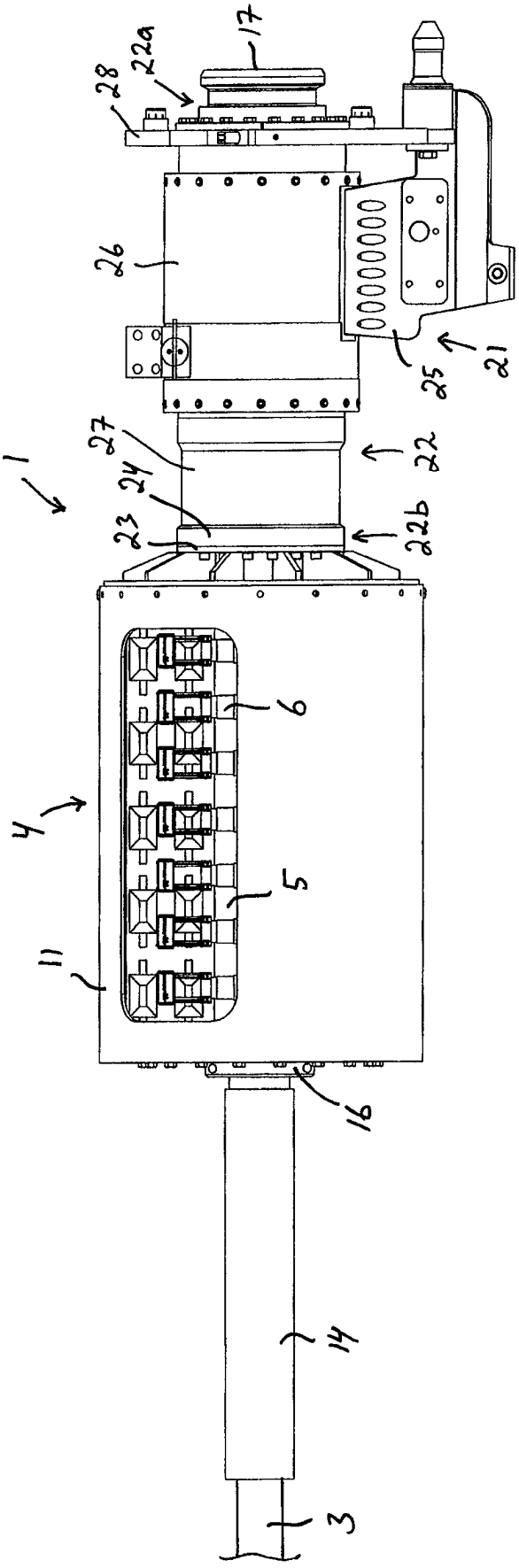
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Fig 3

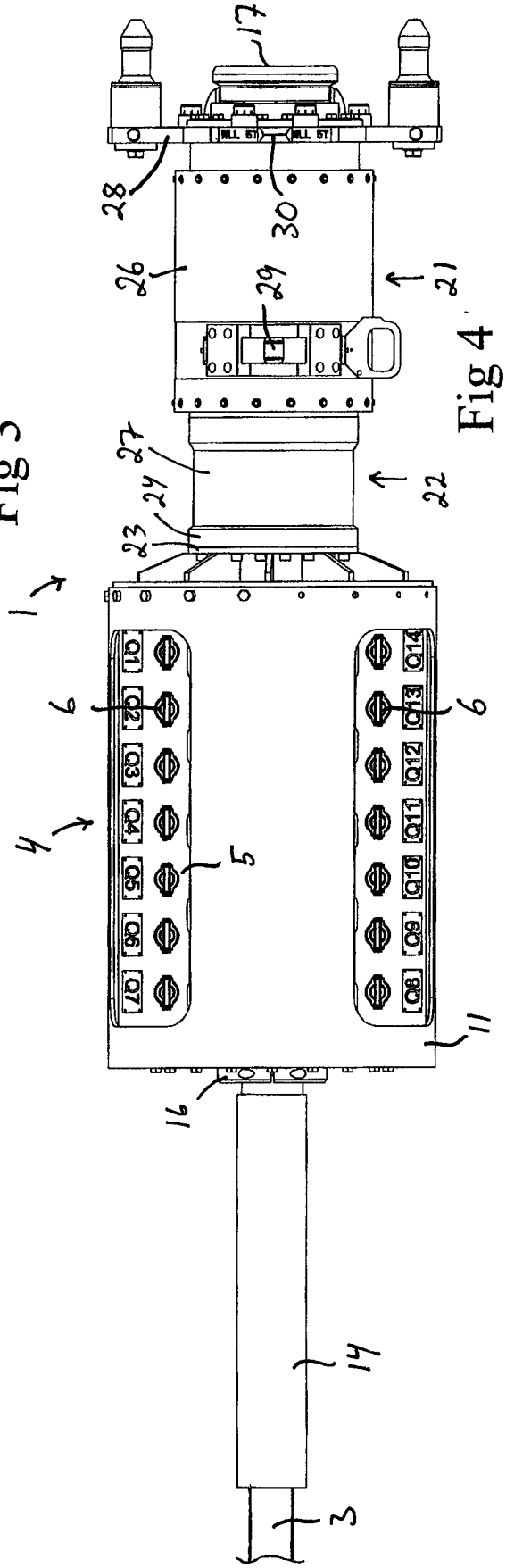
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Fig 4

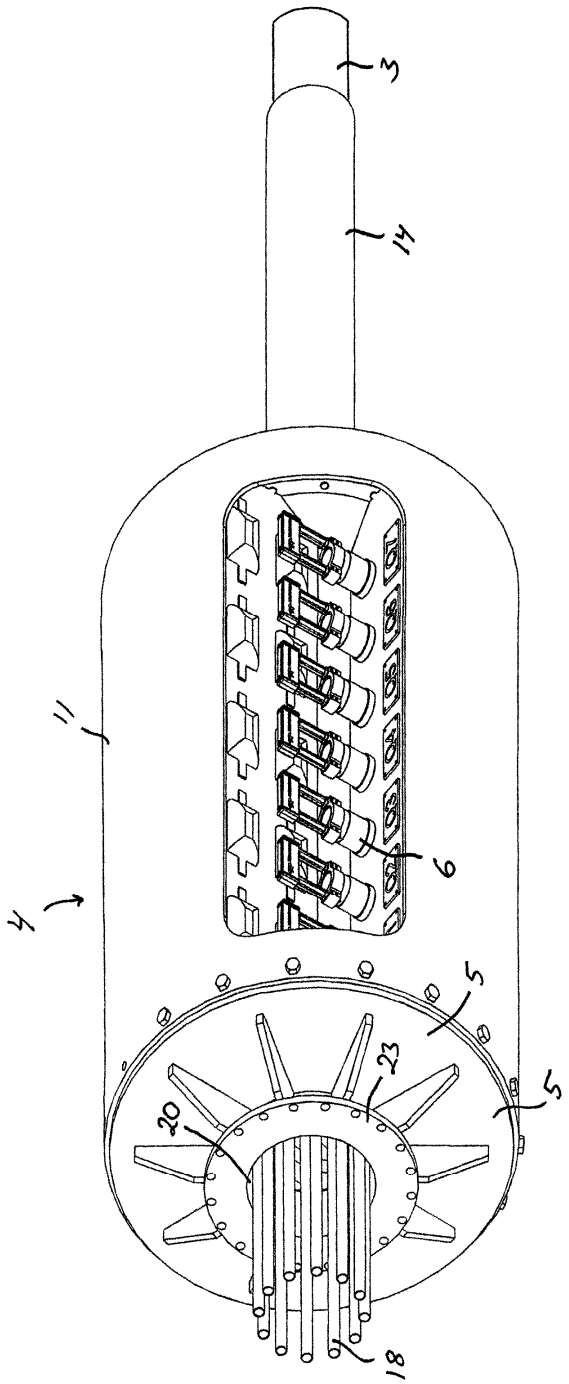

Fig 5

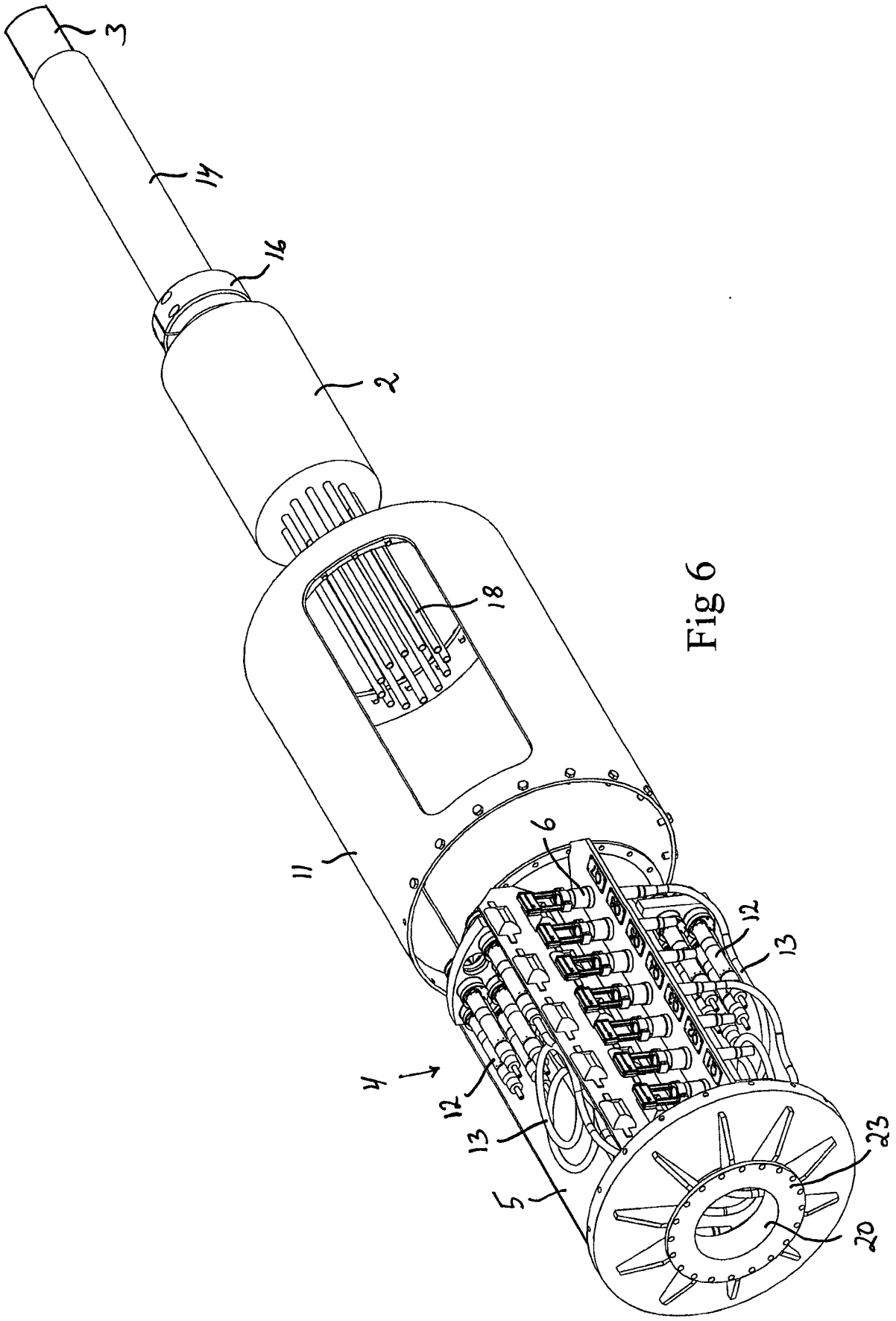

Fig 6

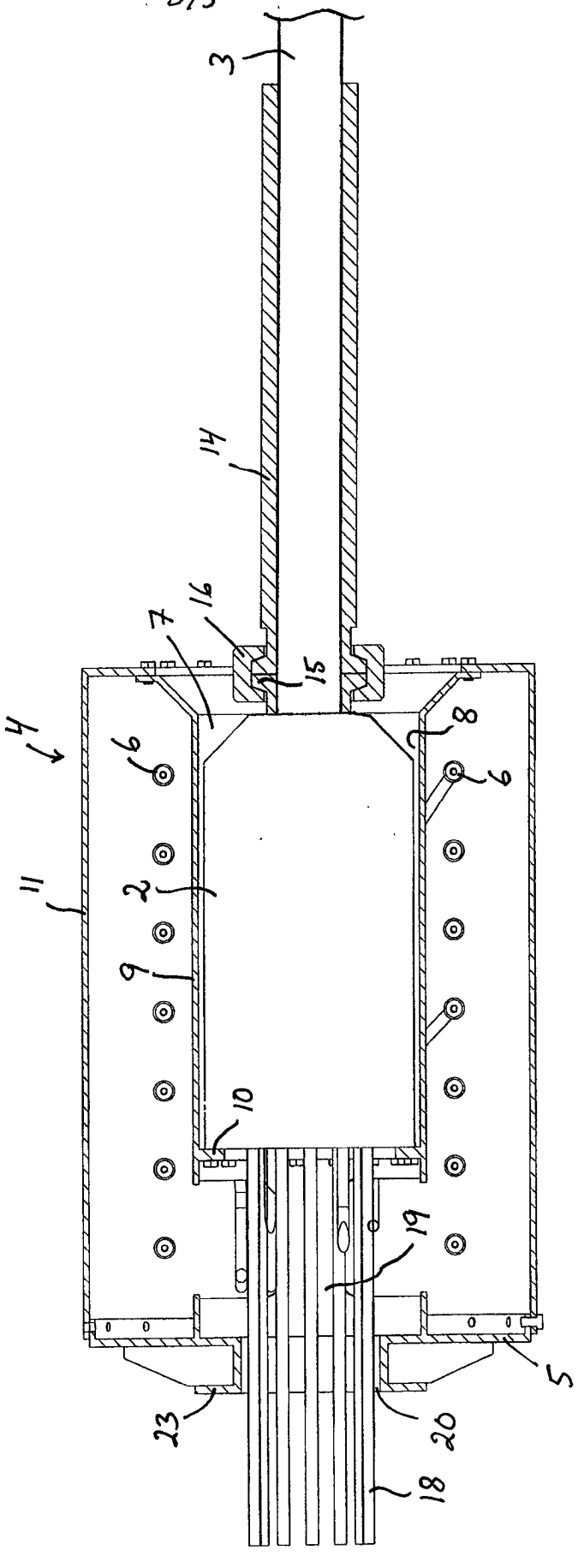

Fig 7