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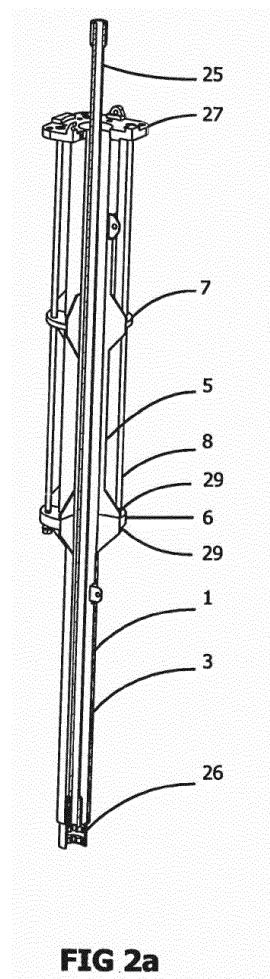
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(54) **Mouse hole dampening system**

(57) An apparatus having a hollow tube (1) for re-  
ceiving a pipe (25), characterised in that the hollow tube  
is coupled to a deck (2) or other structure (11) via at least  
one stretch element (8) adapted to absorb kinetic energy  
from the pipe by going through a plastic deformation.



**FIG 2a**

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## Description

**[0001]** The present invention relates to a device to dampen impacts when a pipe or a pipe stand falls down into a so-called mouse hole.

**[0002]** A mouse hole is used to temporarily place pipes in connection with drilling operations and is also used to build up pipe stands. This is described in detail in NO 322116 which belongs to the applicant. That publication is hereby incorporated in the present application by reference.

**[0003]** Another example of a mouse hole is shown in NO 309537. This also belongs to the applicant and is hereby incorporated by reference.

**[0004]** Mouse holes have developed from one single hole in the ground on land-based rigs to sophisticated solutions, such as the above mentioned, placed on off-shore installations. A problem that has existed almost from the start is that pipes that shall be placed in the mouse hole are sometimes dropped down into the hole, either because the operator is careless or because an accident happens. If this occurs the pipe will go straight through the mouse hole, and also what may be underneath, and could cause serious damages to, for example, a floating installation, or even to the wellhead on the ocean bed. This can again lead to release of well fluid and consequent serious discharge damages.

**[0005]** Therefore, there are several types of dampening devices which shall dampen the impact from a pipe that falls, or is dropped, down into the mouse hole. Examples of this are:

**[0006]** US 3,689,060, which describes a mouse hole that is fitted with a piston-like carrier at the bottom of the mouse hole. The carrier is spring loaded such that the carrier moves downwards against the spring force when it is hit by the pipe.

**[0007]** This dampening mechanism may function satisfactorily if the pipe is not too solid or is not dropped from too great a height. However, long pipe lengths (stands) are often used these days, encompassing three or four individual pipes. This means that the pipe body has a considerable mass in total. In some cases, the pipe body is also fitted with a weight pipe or other components that increase the mass considerably. A dampening mechanism as in the above mentioned US 3,689,060 will then be too weak.

**[0008]** US 5,468,121 shows another example of a dampening device. Here, an air-filled bellows is used to dampen the impact. With today's massive pipe bodies, the bellows would not be able to withstand the large forces exerted by the pipe body either.

**[0009]** Thus, there are no dampening devices today that will be able to catch the large forces from a falling pipe. One thing is that the pipe will be damaged or the dampening device can be damaged. Another, and more serious thing, is that the pipe can break through the mouse hole and damage equipment that may be underneath the mouse hole. It is also possible that a pipe falls

all the way down in the water and damages equipment below the rig. The problem which the present invention aims to solve is to ensure that falling pipes are held in the mouse hole and cause the least possible damage. It is also an aim that any damages which may occur are to components that can easily be replaced. These and other problems are solved by the characteristic features in the subsequent claim 1.

**[0010]** The dependent claims describe advantageous embodiments of the invention.

**[0011]** The invention shall now be explained in more detail with reference to the enclosed drawings, where:

Figure 1 shows a mouse hole device according to a first embodiment of the invention,

Figure 2a shows a section through the device according to figure 1,

Figure 2b shows the guide pipe separated from the other components according to the invention,

Figure 2c shows the main pipe separated from the other components according to the invention,

Figure 3a shows the device according to the invention before it has been subjected to falling pipes,

Figure 3b shows the device according to the invention after it has caught a falling pipe,

Figure 4a shows a detailed section of the device with the fastening against the deck,

Figure 4b shows a plane outline of the device in figure 4a, and

Figure 5 shows a detailed section of the bottom end of the device.

**[0012]** Figure 1 shows a mouse hole device, denoted only as a mouse hole in the following for the sake of simplicity, according to a first embodiment of the invention. It comprises a main tube 1 that stretches from the bottom part of the device up to the underside of a deck 2. The upper end of the main tube 1 lies against the underside of the deck 2, but is not fastened to it. An opening 3 is made in the deck 2, which in figure 1 is closed by a cover 4. A guide tube 5 is placed outside the main tube 1. A lower flange 6 is placed just below the main tube 1 and is, for example, welded to the main tube 1, but not to the guide tube 5. The guide tube 5 is fastened, for example, welded at its upper end to the underside of the deck 2.

**[0013]** The guide tube 2 is also fitted with an intermediate support flange 7 which serves as a guide for the tension struts 8, as these pass through the flange 7 with a narrow clearance.

**[0014]** Four tension struts 8 are placed outside the guide tube 5. The number of tension struts 8 is not critical, but four tension struts give a good balance and distribution of the forces. The tension struts 8 are fastened to the lower flange 6 in that the tension struts are fitted with threads at the bottom onto which nuts are screwed. At their upper ends, the tension struts 8 are fastened to the deck 2 in a corresponding way.

**[0015]** The main tube 1 is thereby suspended in the tension struts 8 from the deck 2.

**[0016]** Figure 2a shows a section through the device in figure 1 with a pipe length 25 placed in the device. A dampening mechanism 26 is placed at the bottom of the main tube 1 to dampen small knocks from the pipe 25.

**[0017]** Figure 2b shows the guide tube 5 separately. As one can see the guide tube 5 in this embodiment is fitted with an upper flange 27 that can be screwed securely to the deck 2 via a recess in the deck as will be explained in more detail in connection with figure 4. The tension struts (see figure 2a) are screwed securely to the upper flange 27. The intermediate flange 7 is preferably secured by welding. At this and at the bottom end of the guide tube 5 three triangular ribs 28 are secured by welding, which are set up to lie against the lower flange 6 (see figure 2a) on the main tube 1, so that a good contact surface is made and to prevent that the mouse hole gets stuck when hoisted up or lowered down through the hole 3 in the deck 2.

**[0018]** Figure 2c shows the main tube 1 separately. It has an upper part 1a, above the flange 6, which is set up to be led into the guide tube 5 and a lower part 1b, below the flange 6, which is set up to be located below the guide tube 5. At its bottom end a bottom assembly 29 is arranged, which contains the dampening mechanism 26.

**[0019]** As one can see in figure 2a the tension struts are fitted with nuts 9. These nuts 9 are set up to fasten the tension struts 8 to the flange 6.

**[0020]** The tension struts 8 have preferably a somewhat larger diameter at their upper and lower ends than in the middle section. This ensures that the extension occurs in the middle section and that the tension struts do not break at the fastening points.

**[0021]** Figure 4a shows a section through the device at the deck 2. Figure 4b shows a plane outline of the same. Here, two mouse hold devices according to the invention are shown placed next to each other.

**[0022]** The guide tube 5 and the tension struts 8 are not directly fastened to the deck, but via a structure 11. This structure comprises in general a recess in the deck 2 that carries the upper flange 27 from which the tension struts 8 are suspended and to which the guide tube 5 is securely welded. The main tube 1 is received inside the guide tube 5 but not fastened to this. The upper flange 27 also carries a centring device 13, which is not part of this invention and shall therefore not be explained in more detail.

**[0023]** In the embodiment according to the figures 4a and 4b the upper flange 27 is carried by a deck section

or collar 14. This rests on its side on two beams (not shown) that form a part of the carrying construction of the deck 2.

**[0024]** The structure 11 forms a box-like structure that has an upper surface 18 that joins the surface of the deck 3. Here, an opening is formed for pipe 25. A funnel 19 is arranged on the underside of the opening and contributes to guiding the pipe 25 down into the mouse hole.

**[0025]** Figure 5 shows the lower part of the mouse hole. A dampening mechanism 26 is arranged here, which is capable of absorbing smaller knocks as a consequence of the normal setting down of pipes. This is formed to prevent damage to the threads of the pipe if it is put down too hard in the mouse hole. At the same time the pipe is centred and it is formed to drain any sludge or oil residues. The dampening mechanism 26 comprises a thick rubber body that shall dampen the impact from knocks. The rubber body is covered with a soft stainless steel plate onto which the pipes are placed. If a heavy pipe should fall down in the mouse hole, this dampening mechanism will only absorb a very small part of the kinetic energy. If this is exceeded the dampening device according to the invention will take over the absorption of the impact.

**[0026]** The operation of the dampening mechanism will now be explained in more detail.

**[0027]** When a pipe falls down in the mouse hole it will hit, via the dampening mechanism 26, the bottom of the main tube 1 that is suspended in the tension struts 8. Because of this, the main tube 1 will be pulled downwards and the forces will be absorbed by the tension struts 8. The tension struts 8 are made from a ductile material that withstands a considerable plastic extension before breaking. The tension struts will therefore have a plastic extension. As the tension struts 8 have a larger diameter at their ends, the plastic extension will occur over the middle part of the tension struts where the surface is smooth and without substantial notches. At the fastening points, the tension struts have necessarily several notches and the movements are therefore small here and, in the main, elastic. Figure 3a shows the state before the tension struts 8 have been extended and figure 3b shows the state after the extension.

**[0028]** The diameter and ductility of the tension struts are adjusted so that they are capable of absorbing the largest expected kinetic energy from the falling pipe without breaking and with a good safety margin. As these extensions absorb the forces from the pipe it will be only these forces that are led further out in the system. Thus, it is easy to dimension the struts so that the forces from these will not lead to appreciable, incidental damage to the mouse hole construction.

**[0029]** The guide tube 5 and the intermediate flange 7 are set up to guide the main tube 1 and ensure that the tension struts are stretched evenly and no lopsided position occurs. If one of the tension struts has a fault, the other tension struts will have sufficient capacity to absorb the energy from a maximum falling load.

**[0030]** After the tension struts 8 have been extended

plastically, the main tube will have been displaced a distance downwards, as shown in figure 3. The top of the main tube 1 will then lie a distance from the upper flange 27 and the lower flange 6 will lie a corresponding distance from the lower end of the guide tube 5. This distance can be detected so that one can get a clear indication that the tension struts 8 have gone through a plastic deformation.

[0031] If a plastic deformation of the tension struts 8 has happened, the tension struts must be replaced. This can be simply carried out by unscrewing the nuts at each end of the tension struts and replacing the tension struts 8 with new struts.

[0032] Strong impacts can be absorbed in this way with minimal damage to the components. The tension struts are relatively cheap components that are made from a cheap material. They are preferably manufactured from a soft stainless steel, such as, for example, 316L.

[0033] Although it is dampening of impacts in a mouse hole with a given length which is described above, the dampening device is also used in mouse holes of a variable length, for example, a telescopic mouse hole. The tension struts will then preferably be connected to the uppermost of the telescopic tubes, which are secured to the deck.

[0034] The number of tension struts can be varied. It is an advantage if the number can be chosen so that there is redundancy in the system i.e. that even if one or more of the tension struts should accidentally break, the others will have sufficient capacity to be able to absorb the forces.

[0035] Instead of tension struts in the form of rods, the tension struts can also have different forms, for example, tubes.

[0036] Further exemplary embodiments of the present disclosure are set out in the following numbered clauses:

[0037] Numbered Clause 1: Device to dampen the impact when a pipe or a pipe stand falls down in a mouse hole arrangement, said mouse hole arrangement comprises at least one pipe with a bottom, that is adapted to receive a pipe or a pipe stand, characterised in that the at least one tube is connected to a first end of at least one stretch element which at its other end is connected to a deck, or a structure that is permanently connected to the deck, and that the at least one stretch element is adapted to absorb the kinetic energy from the falling pipe or pipe stand by going through a plastic deformation without breaking.

[0038] Numbered Clause 2: Device according to clause 1, characterised in that a guide tube is arranged concentrically with the at least one tube and that the guide tube is fastened to the deck or a structure that is fastened to the deck.

[0039] Numbered Clause 3: Device according to clauses 1 or 2, characterised in that the at least one tube is fitted with a flange for fastening of the at least first end of the stretch element.

[0040] Numbered Clause 4: Device according to

clause 3, characterised in that the flange is arranged on the at least one tube so that a considerable part of the tube is located between the flange and the deck and that the tube is only fastened to the deck, or another structure which is fastened to the deck, via the stretch elements.

[0041] Numbered Clause 5: Device according to clause 4, characterised in that it comprises a number of stretch elements that run on the outside of the guide tube and are placed mutually spaced apart around the guide tube.

[0042] Numbered Clause 6: Device according to clause 5, characterised in that the guide tube is fitted with a guide flange about halfway between the flange for fastening of the stretch elements and the deck, through which guide flange the stretch elements extend with a very small clearance.

[0043] Numbered Clause 7: Device according to one of the preceding clauses, characterised in that the stretch element is a tension strut.

[0044] Numbered Clause 8: Device according to clause 7, characterised in that the tension strut has a larger diameter at its ends.

[0045] Numbered Clause 9: Device according to clauses 7 and 8, characterised in that the tension strut is manufactured from a ductile, stainless steel.

## Claims

1. An apparatus having a hollow tube (1) for receiving a pipe (25), **characterised in that** the hollow tube is coupled to a deck (2) or other structure (11) via at least one stretch element (8) adapted to absorb kinetic energy from the pipe by going through a plastic deformation.
2. The apparatus of claim 1, **characterised by** a guide tube (5) coupled to the deck or the other structure.
3. The apparatus of claim 2, **characterised in that** the hollow tube (1) is received in the guide tube (5), which is positioned to guide the hollow tube (1) during the plastic deformation of the at least one stretch element (8).
4. The apparatus of claim 2, **characterised in that** the guide tube (5) includes a plurality of ribs (28) coupled to an end of the guide tube (5).
5. The apparatus of claim 4, **characterised in that** the hollow tube (1) includes a flange (6) that abuts the plurality of ribs (28) coupled to the end of the guide tube (5).
6. The apparatus of claim 1, **characterised by** a dampening mechanism (26) disposed within the hollow tube (1).

7. The apparatus of claim 6, **characterised in that** the dampening mechanism (26) includes a rubber body.
  
8. The apparatus of claim 6, **characterised in that** the dampening mechanism (26) is adapted to absorb at least some of the kinetic energy from the pipe (25) and the at least one stretch element (8) is adapted to absorb kinetic energy that is not absorbed by the dampening mechanism (26).
 

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9. The apparatus of claim 1, **characterised in that** the at least one stretch element (8) includes a tension rod or a tension tube.
  
10. A method comprising providing a mouse hole device at a drilling rig, **characterised in that** providing the mouse hole device at the drilling rig includes coupling at least one tension strut (8) to a hollow tube (1) of the mouse hole device and coupling the at least one tension strut (8) to a deck (2) or other structure (11) of the drilling rig such that the hollow tube (1) is suspended from the deck (2) or other structure (11) by the at least one tension strut (8), the deck (2) or other structure (11) having an opening (3) to enable receipt of a pipe (25) in the hollow tube.
 

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11. The method of claim 10, **characterised by** coupling a guide tube (5) to the deck (2) or other structure (11) and positioning the hollow tube (1) in the guide tube (5).
 

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12. The method of claim 11, **characterised in that** coupling the guide tube (5) to the deck (2) or other structure (11) includes coupling an upper flange (27) of the guide tube (5) to the deck (2) or other structure (11).
 

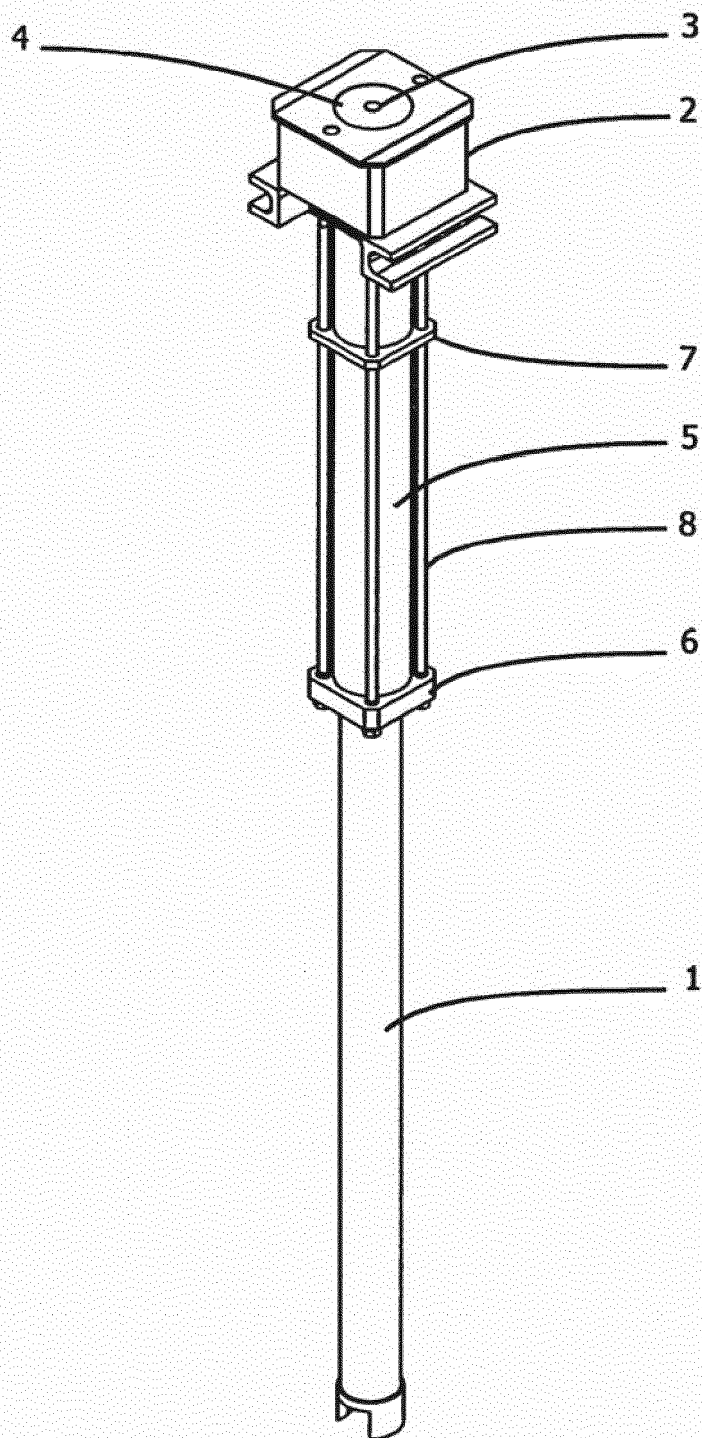
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13. The method of claim 12, **characterised in that** coupling the at least one tension strut (8) to the deck (2) or other structure (11) includes coupling the at least one tension strut (8) to the upper flange (27) of the guide tube (5).
 

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14. The method of claim 11, **characterised by** passing the at least one tension strut (8) through a flange (7) of the guide tube (5).
 

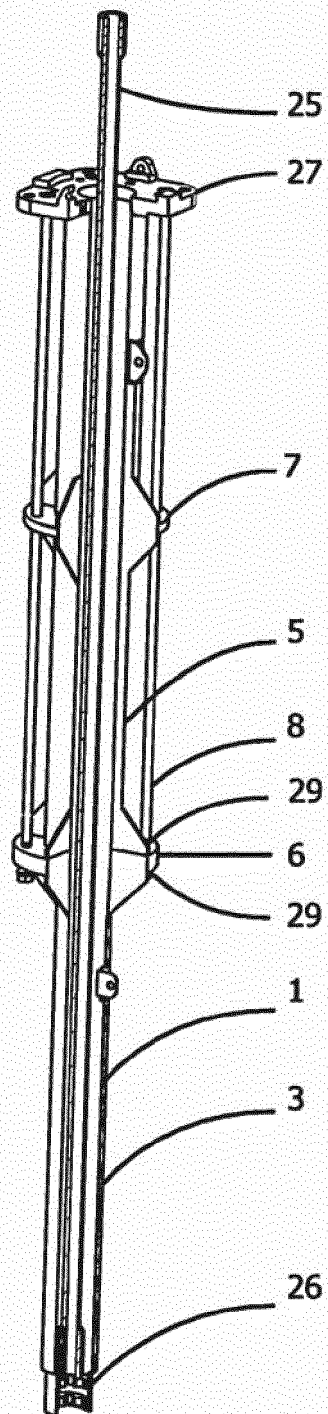
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15. The method of claim 10, **characterised by** plastically deforming the at least one tension strut (8) upon receiving the pipe (25) to absorb kinetic energy of the pipe (25).
 

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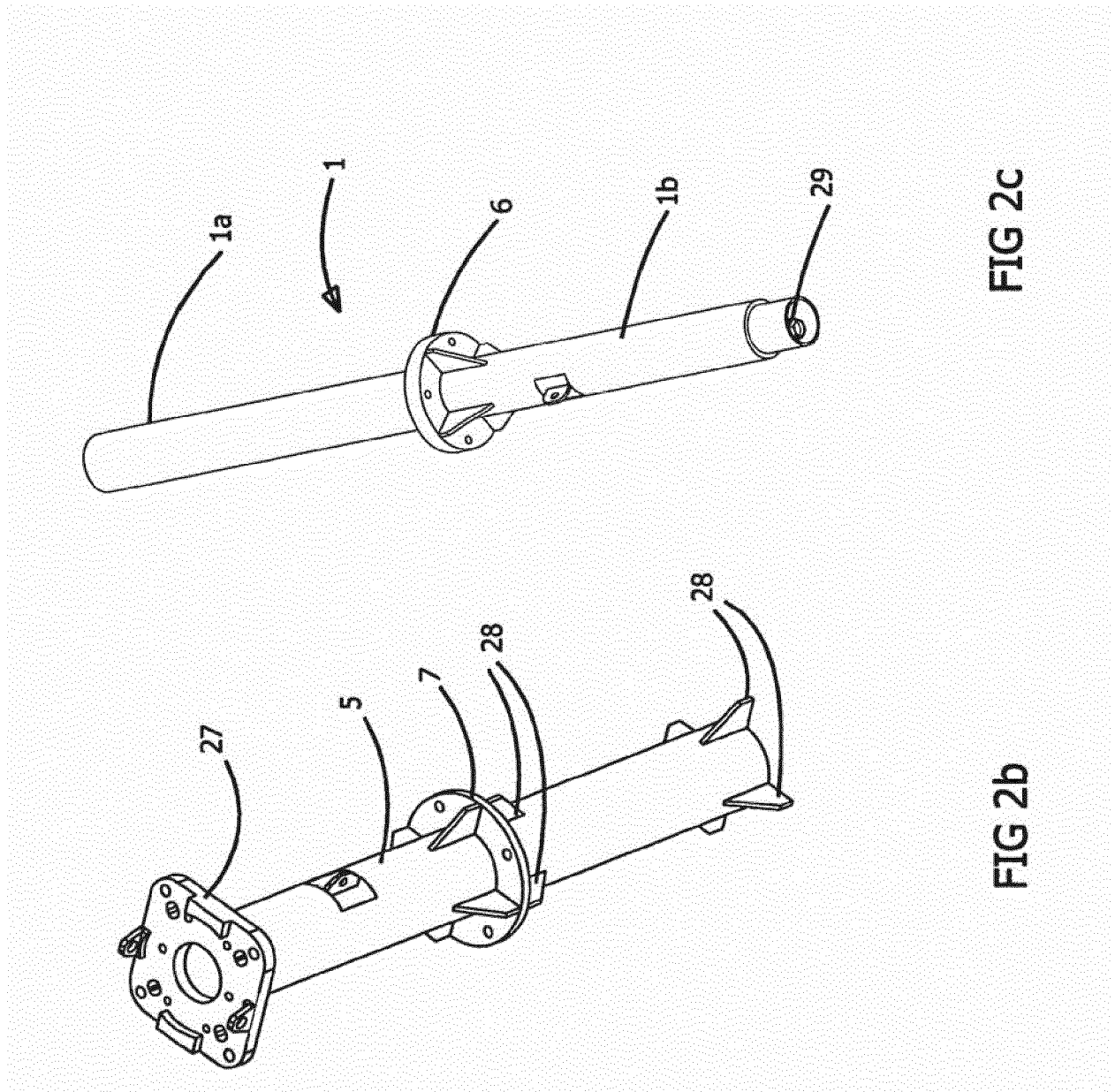
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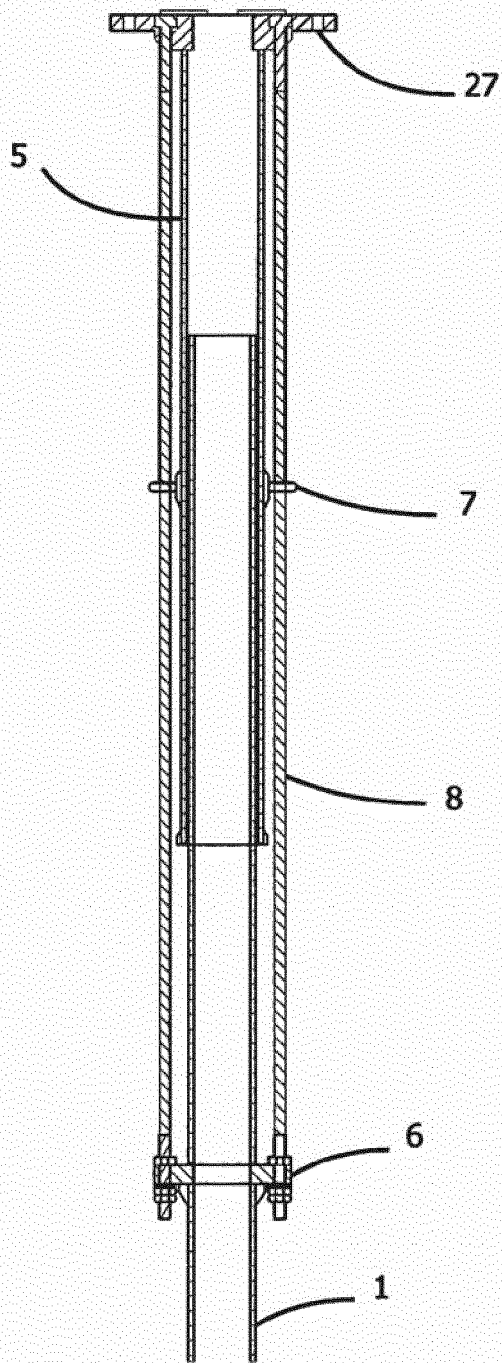
**FIG 1**



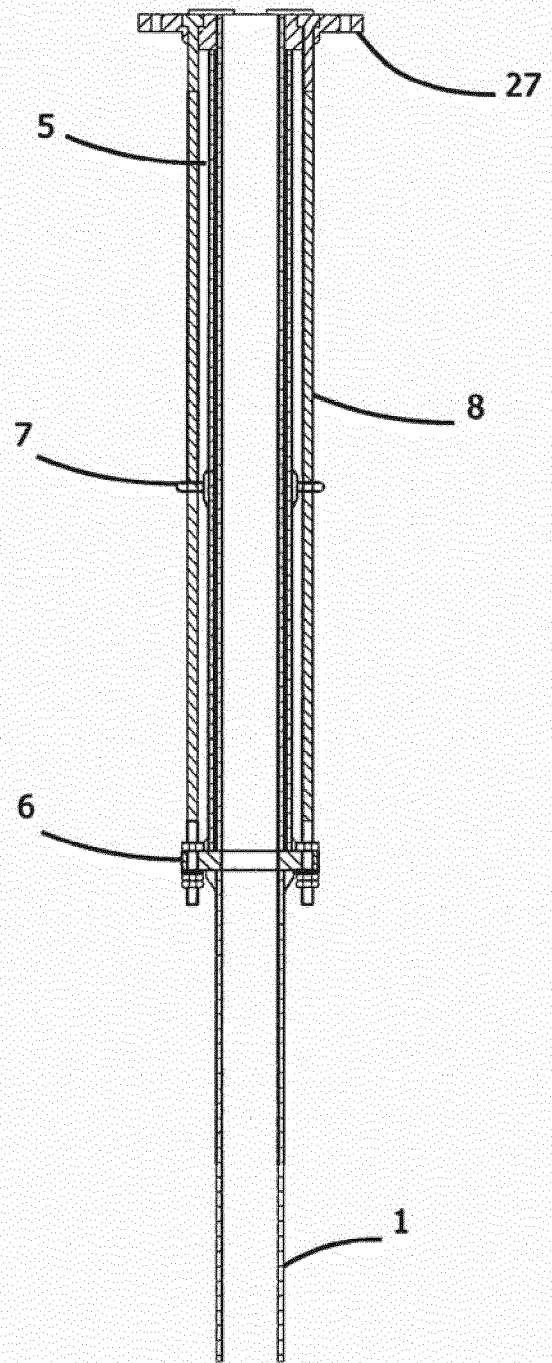
**FIG 2a**







**FIG 3b**



**FIG 3a**

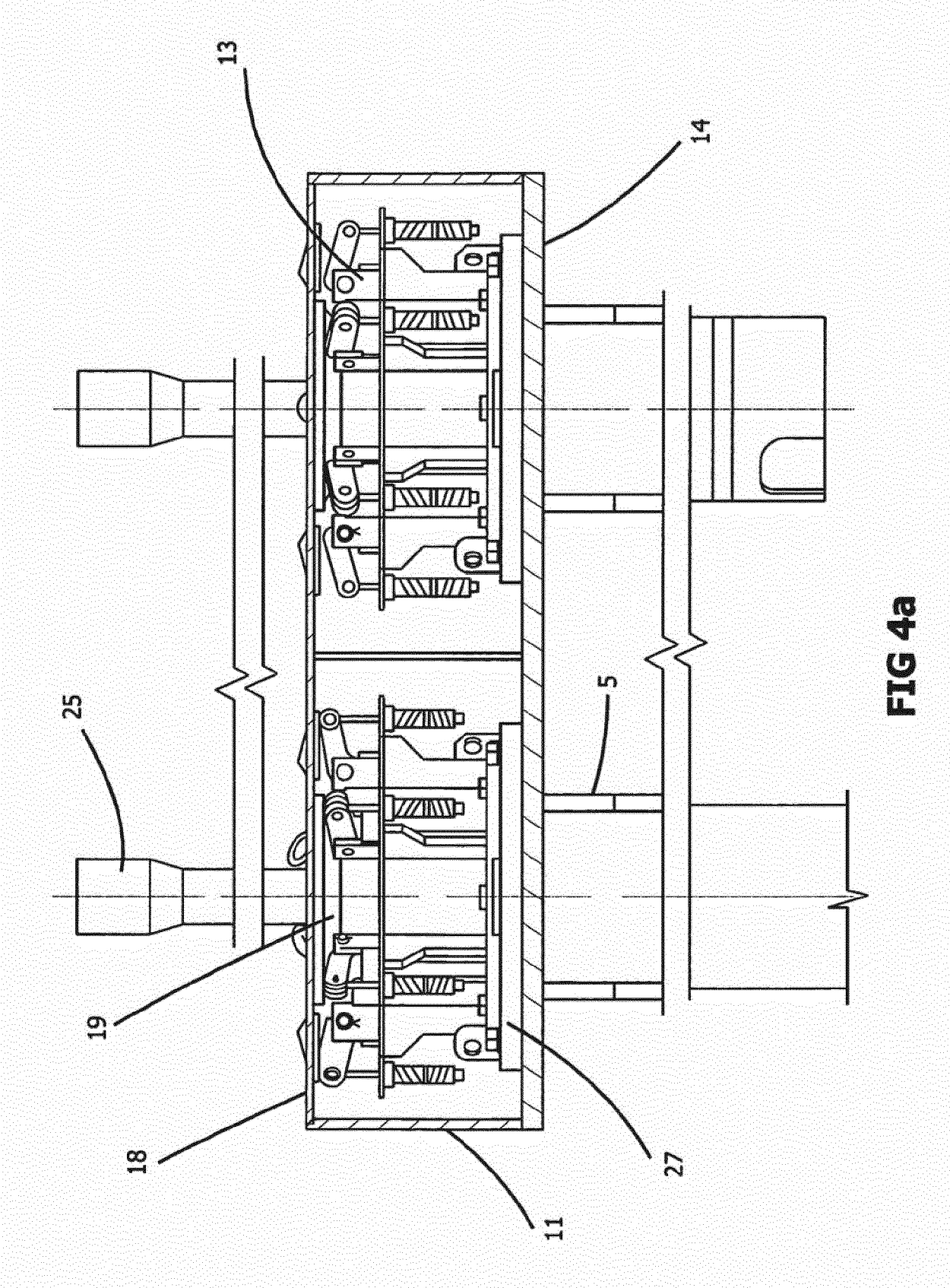


FIG 4a

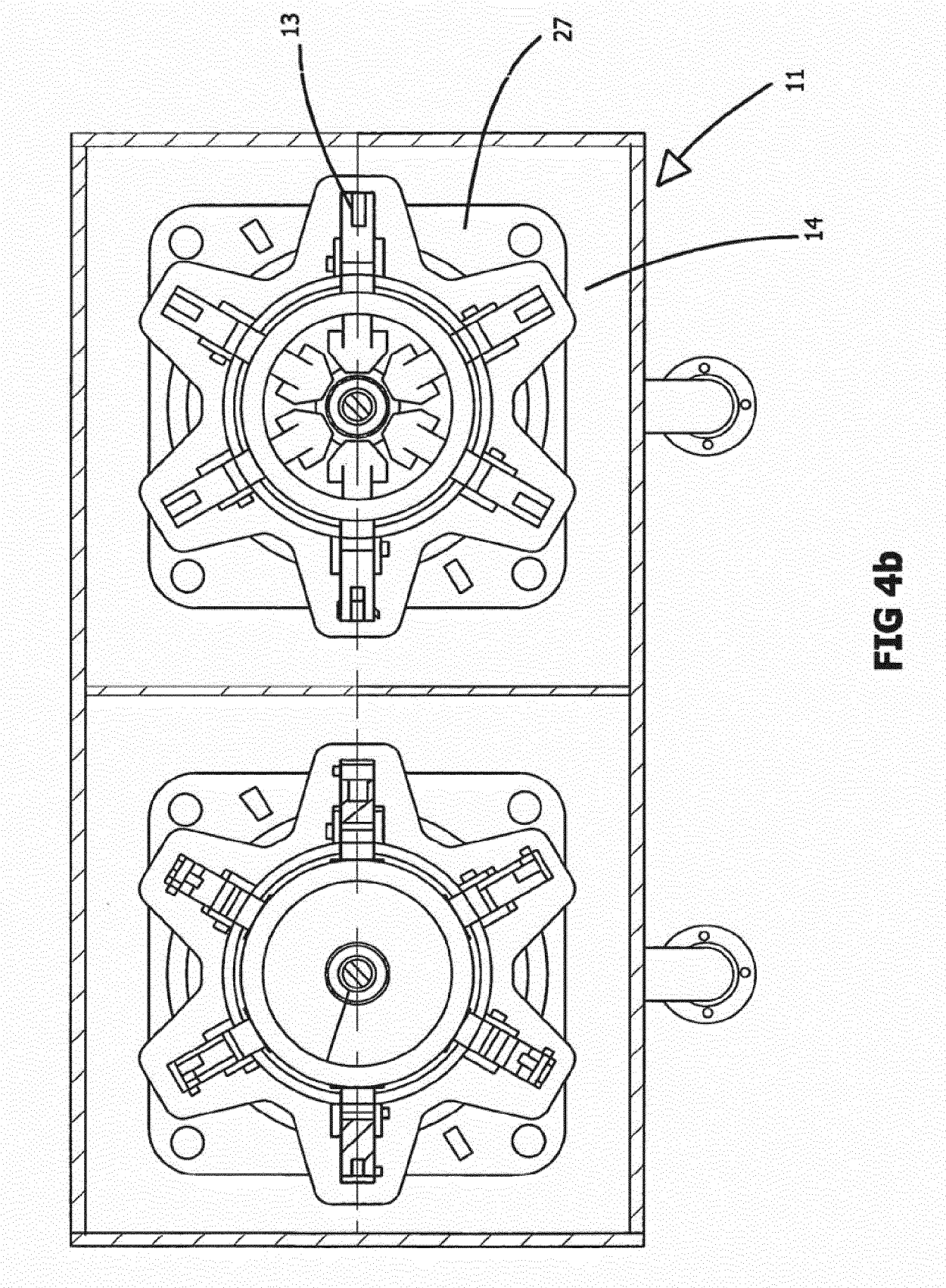


FIG 4b

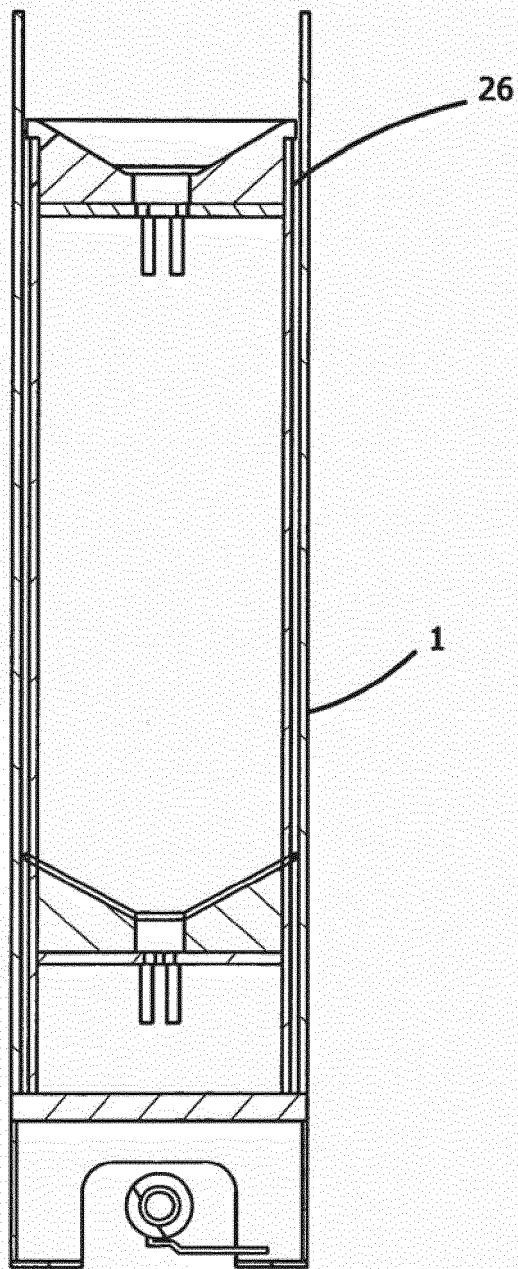


FIG 5



## EUROPEAN SEARCH REPORT

Application Number  
EP 14 16 7290

| DOCUMENTS CONSIDERED TO BE RELEVANT                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                        |                                                       |                                         |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------|-----------------------------------------|
| Category                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Citation of document with indication, where appropriate, of relevant passages                                                          | Relevant to claim                                     | CLASSIFICATION OF THE APPLICATION (IPC) |
| X                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | US 5 468 121 A (STOGNER HUEY [US])<br>21 November 1995 (1995-11-21)<br>* column 3, line 58 - column 4, line 30;<br>figures 1-3 *       | 1-15                                                  | INV.<br>E21B19/00<br>E21B19/14          |
| A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | -----<br>US 4 160 060 A (BYNUM JR DOUGLAS)<br>3 July 1979 (1979-07-03)<br>* column 3, line 41 - column 5, line 33;<br>figures 1-5 *    | 1-15                                                  |                                         |
| A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | -----<br>US 3 689 060 A (HENSLEY WILLIAM BURTON JR)<br>5 September 1972 (1972-09-05)<br>* column 3, line 7 - line 24; figures 2,4<br>* | 1-15                                                  |                                         |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                        |                                                       | TECHNICAL FIELDS SEARCHED (IPC)         |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                        |                                                       | E21B                                    |
| The present search report has been drawn up for all claims                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                        |                                                       |                                         |
| Place of search<br>Munich                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                        | Date of completion of the search<br>10 September 2014 | Examiner<br>Strømme, Henrik             |
| <p>CATEGORY OF CITED DOCUMENTS</p> <p>X : particularly relevant if taken alone<br/>Y : particularly relevant if combined with another document of the same category<br/>A : technological background<br/>O : non-written disclosure<br/>P : intermediate document</p> <p>T : theory or principle underlying the invention<br/>E : earlier patent document, but published on, or after the filing date<br/>D : document cited in the application<br/>L : document cited for other reasons<br/>&amp; : member of the same patent family, corresponding document</p> |                                                                                                                                        |                                                       |                                         |

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ON EUROPEAN PATENT APPLICATION NO.**

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

**REFERENCES CITED IN THE DESCRIPTION**

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- NO 309537 [0003]
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