(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 2 513 409 B1**

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention of the grant of the patent:
11.06.2014 Bulletin 2014/24

(21) Application number: **10798772.9**

(22) Date of filing: **17.12.2010**

(51) Int Cl.:
E21B 19/00 *(2006.01)* ***E21B 19/14*** *(2006.01)*

(86) International application number:
PCT/EP2010/070020

(87) International publication number:
WO 2011/083028 (14.07.2011 Gazette 2011/28)

(54) MOUSE HOLE DAMPENING SYSTEM

DÄMPFERSYSTEM FÜR EIN VORBOHRLOCH

SYSTÈME D'AMORTISSEMENT DE TROU DE SOURIS

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR

(30) Priority: **17.12.2009 NO 20093546**

(43) Date of publication of application:
24.10.2012 Bulletin 2012/43

(60) Divisional application:
14167290.7

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US-A- 3 689 060 **US-A- 4 160 060**
US-A- 5 468 121

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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.

[0003] Another example of a mouse hole is shown in NO 309537.

[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 offshore 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] US 4160060 describes a device for catching a falling object that comprises a large box-like structure to be placed under the deck. However, this structure must have a relatively large extent to be able to absorb the impact force. Hence it occupies a large valuable space. A space which could have been used for other types of necessary equipment.

[0010] Thus, there are no satisfactory 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.

[0011] The dependent claims describe advantageous embodiments of the invention.

[0012] 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.

[0013] 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 guide tube 5 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.

[0014] The guide tube 5 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.

[0015] Four tensions 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.

[0016] The main tube 1 is thereby suspended in the tension struts 8 from the deck 2.

[0017] 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.

[0018] 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 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.

[0019] 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.

[0020] 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.

[0021] 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.

[0022] Figure 4a shows a section through the device at the deck 2. Figure 4b shows a plane outline of the same. Here, two mouse hole devices according to the invention are shown placed next to each other.

[0023] 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.

[0024] 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.

[0025] The structure 11 forms a box-like structure that has an upper surface 18 that joins the surface of the deck 2. 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.

[0026] 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.

[0027] The operation of the dampening mechanism will now be explained in more detail.

[0028] 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.

[0029] 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.

[0030] 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 po-

sition occurs. If one of the tension struts has a fault, the other tensions struts will have sufficient capacity to absorb the energy from a maximum falling load.

[0031] 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.

[0032] 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.

[0033] 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.

[0034] 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.

[0035] 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.

[0036] Instead of tension struts in the form of rods, the tension struts can also have different forms, for example, tubes.

Claims

1. Device to dampen the impact when a pipe (25) or a pipe stand falls down in a mouse hole arrangement, said mouse hole arrangement comprises at least one pipe receiving tubular (1) with a bottom (26), which tubular (1) is adapted to receive a pipe (25) or a pipe stand, **characterised in that** the at least one tubular (1) is connected to a first end of at least one stretch element (8) which at a second end is connected to a deck (2), or a structure that is permanently connected to the deck (2),
   and that the at least one stretch element (8) is adapted to absorb the kinetic energy from the falling pipe (25) or pipe stand by going through a plastic deformation without breaking.

2. Device according to claim 1, **characterised in that** a guide tube (5) is arranged concentrically with the at least one tubular (1) and that the guide tube (5) is fastened to the deck (2) or a structure that is fastened to the deck (2).

3. Device according to claim 2, **characterised in that** the at least one tubular (1) is fitted with a flange (6) for fastening of the first end of the at least one stretch element (8).

4. Device according to claim 3, **characterised in that** the flange (6) is arranged on the at least one tubular (1) so that a considerable part of the tubular (1) is located between the flange (6) and the deck (2) and that the tubular (1) is fastened to the deck (2), or another structure which is fastened to the deck (2), solely via the at least one stretch element (8).

5. Device according to claim 4, **characterised in that** it comprises a number of stretch elements (8) that run on the outside of the guide tube (5) and are placed mutually spaced apart around the guide tube (5).

6. Device according to claim 5, **characterised in that** the guide tube (5) is fitted with a guide flange (7) about halfway between the flange (6) for fastening of the stretch elements (8) and the deck (2), through which guide flange (7) the stretch elements (8) extend with a very small clearance.

7. Device according to one of the preceding claims, **characterised in that** the stretch element (8) is a tension strut.

8. Device according to claim 7, **characterised in that** the tension strut has a larger diameter at its ends.

9. Device according to claims 7 or 8, **characterised in that** the tension strut is manufactured from a ductile, stainless steel.

Patentansprüche

1. Vorrichtung zum Dämpfen des Aufpralls, wenn eine Röhre (25) oder ein Röhrenständer in eine Vorbohrlochanordnung fällt, wobei die besagte Vorbohrlochanordnung zumindest ein Röhren aufnehmendes Rohrelement (1) mit einem Boden (26) umfasst, welches Rohrelement (1) angepasst ist, eine Röhre (25) oder einen Röhrenständer aufzunehmen, **dadurch gekennzeichnet, dass** das zumindest eine Rohrelement (1) mit einem ersten Ende von zumindest einem Dehnungselement (8) verbunden ist, welches an einem zweiten Ende mit einem Deck (2) oder einer Struktur verbunden ist, das bzw. die permanent mit dem Deck (2) verbunden ist und, dass

das zumindest eine Dehnungselement (8) angepasst ist, die kinetische Energie von der fallenden Röhre (25) oder dem Röhrenständer zu absorbieren, indem es eine plastische Verformung durchmacht, ohne zu brechen.

2. Vorrichtung nach Anspruch 1, **dadurch gekennzeichnet, dass** ein Führungsrohr (5) konzentrisch mit zumindest einem Rohrelement (1) angeordnet ist und, dass das Führungsrohr (5) an das Deck (2) oder eine Struktur befestigt ist, die am Deck (2) befestigt ist.

3. Vorrichtung nach Anspruch 2, **dadurch gekennzeichnet, dass** das zumindest eine Rohrelement (1) mit einem Flansch (6) zur Befestigung des ersten Endes des zumindest einen Dehnungselements (8) versehen ist.

4. Vorrichtung nach Anspruch 3, **dadurch gekennzeichnet, dass** der Flansch (6) am zumindest einem Rohrelement (1) derartig angeordnet ist, dass ein beträchtlicher Teil des Rohrelements (1) zwischen dem Flansch (6) und dem Deck (2) positioniert ist und, dass das Rohrelement (1) an das Deck (2) oder eine andere Struktur befestigt ist, die an das Deck (2) ausschließlich über das zumindest eine Dehnungselement (8) befestigt ist.

5. Vorrichtung nach Anspruch 4, **dadurch gekennzeichnet, dass** sie eine Reihe von Dehnungselementen (8) umfasst, die auf der Außenseite des Führungsrohrs (5) verlaufen und gegenseitig beabstandet um die Führungsrohr (5) herum platziert sind.

6. Vorrichtung nach Anspruch 5, **dadurch gekennzeichnet, dass** das Führungsrohr (5) mit einem Führungsflansch (7) auf halben Weg zwischen dem Flansch (6) zur Befestigung der Dehnungselemente (8) und dem Deck (2) versehen ist, durch welchen Führungsflansch (7) sich die Dehnungselemente (8) mit einem sehr kleinen Spiel erstrecken.

7. Vorrichtung nach einem beliebigen der vorangehenden Ansprüche, **dadurch gekennzeichnet, dass** das Dehnungselement (8) ein Zugstab ist.

8. Vorrichtung nach Anspruch 7, **dadurch gekennzeichnet, dass** der Zugstab einen größeren Durchmesser an seinen Enden hat.

9. Vorrichtung nach Ansprüchen 7 oder 8, **dadurch gekennzeichnet, dass** der Zugstab aus einem duktilen, rostfreien Stahl hergestellt ist.

Revendications

1. Dispositif permettant d'amortir l'impact quand une tige (25) ou une longueur de tige tombe dans un agencement de trou de souris, ledit agencement de trou de souris comportant au moins un matériel tubulaire de réception de tige (1) ayant un fond (26), matériel tubulaire (1) qui est adapté pour recevoir une tige (25) ou une longueur de tige, **caractérisé en ce que** ledit au moins un matériel tubulaire (1) est raccordé à une première extrémité d'au moins un élément d'extension (8) qui au niveau d'une seconde extrémité est raccordé à un pont (2), ou une structure qui est raccordée de manière permanente au pont (2), et **caractérisé en ce que** ledit au moins un élément d'extension (8) est adapté à des fins d'absorption de l'énergie cinétique de la tige (25) qui tombe ou de la longueur de tige qui tombe en passant par une déformation plastique sans casser.

2. Dispositif selon la revendication 1, **caractérisé en ce qu'**un tube de guidage (5) est agencé de manière concentrique avec ledit au moins un matériel tubulaire (1) et **caractérisé en ce que** le tube de guidage (5) est attaché au pont (2) ou à une structure qui est attachée au pont (2).

3. Dispositif selon la revendication 2, **caractérisé en ce que** ledit au moins un matériel tubulaire (1) comporte une bride (6) à des fins d'attache de la première extrémité dudit au moins un élément d'extension (8).

4. Dispositif selon la revendication 3, **caractérisé en ce que** la bride (6) est agencée sur ledit au moins un matériel tubulaire (1) de sorte qu'une partie considérable du matériel tubulaire (1) est située entre la bride (6) et le pont (2) et que le matériel tubulaire (1) est attaché au pont (2), ou une autre structure qui est attachée au pont (2) uniquement par le biais dudit au moins élément d'extension (8).

5. Dispositif selon la revendication 4, **caractérisé en ce qu'**il comporte un nombre d'éléments d'extension (8) qui s'acheminent sur l'extérieur du tube de guidage (5) et qui sont placés de manière mutuellement espacée les uns par rapport aux autres autour du tube de guidage (5).

6. Dispositif selon la revendication 5, **caractérisé en ce que** le tube de guidage (5) comporte une bride de guidage (7) environ à mi-chemin entre la bride (6) à des fins d'attache des éléments d'extension (8) et le pont (2), bride de guidage (7) au travers de laquelle les éléments d'extension (8) s'étendent avec un très petit jeu.

7. Dispositif selon l'une quelconque des revendications précédentes, **caractérisé en ce que** l'élément d'ex-

tension (8) est une jambe de force.

8. Dispositif selon la revendication 7, **caractérisé en ce que** la jambe de force a un diamètre plus large au niveau de ses extrémités.

9. Dispositif selon la revendication 7 ou la revendication 8, **caractérisé en ce que** la jambe de force est fabriquée à partir d'un acier inoxydable ductile.

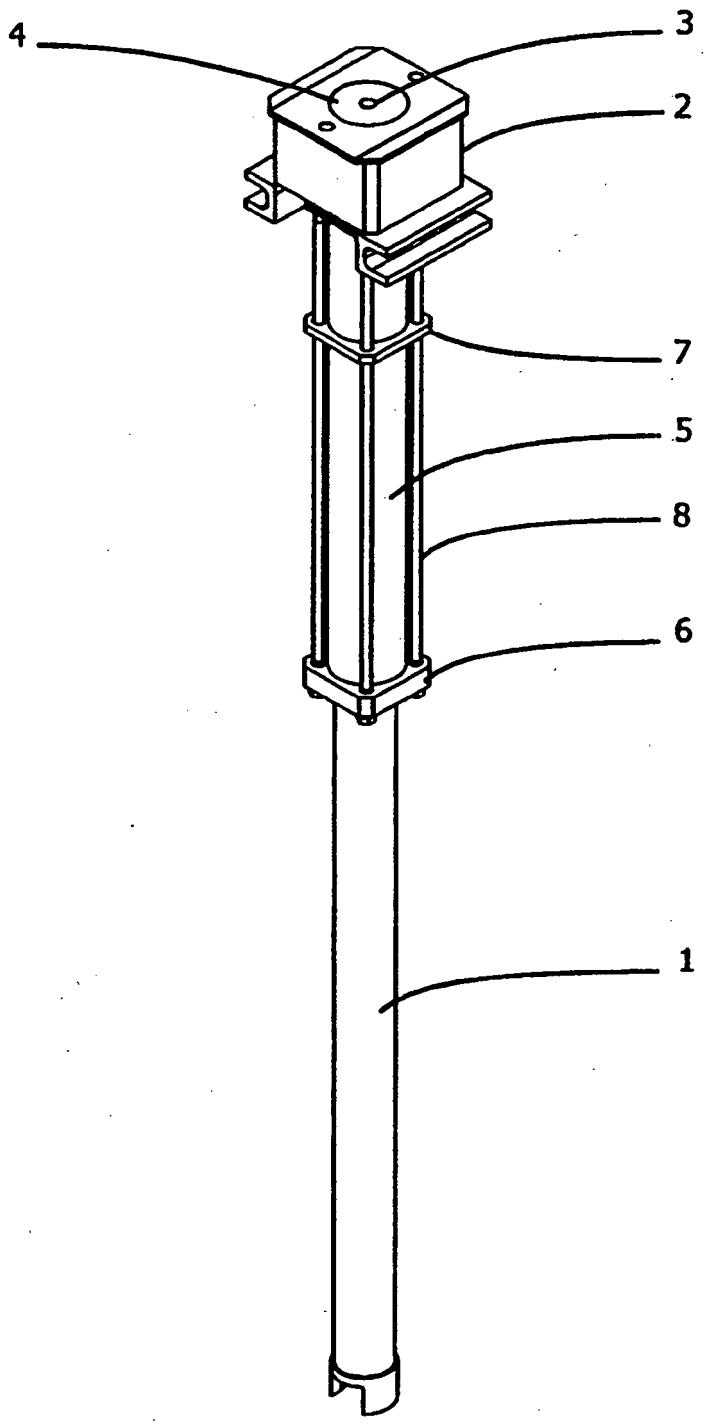


FIG 1

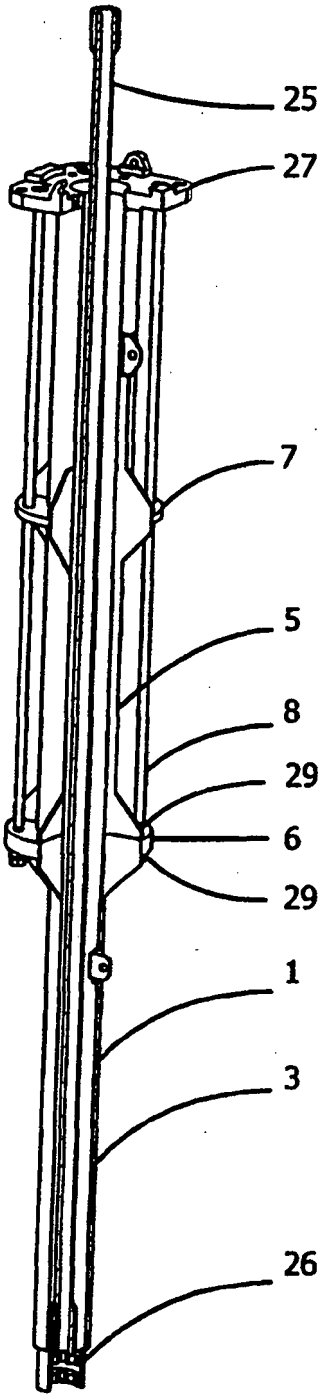


FIG 2a

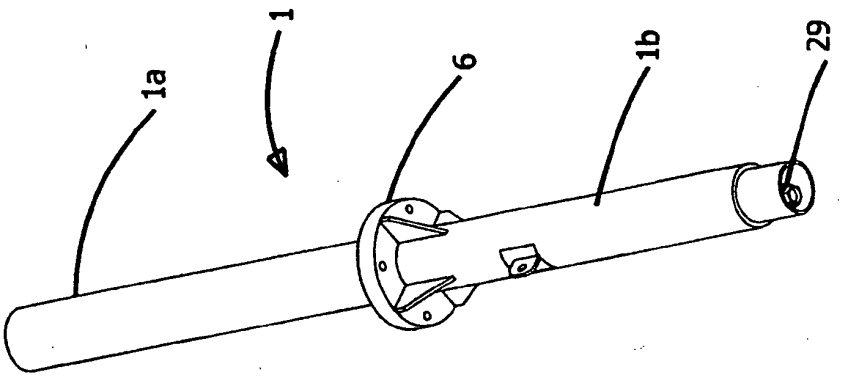


FIG 2c

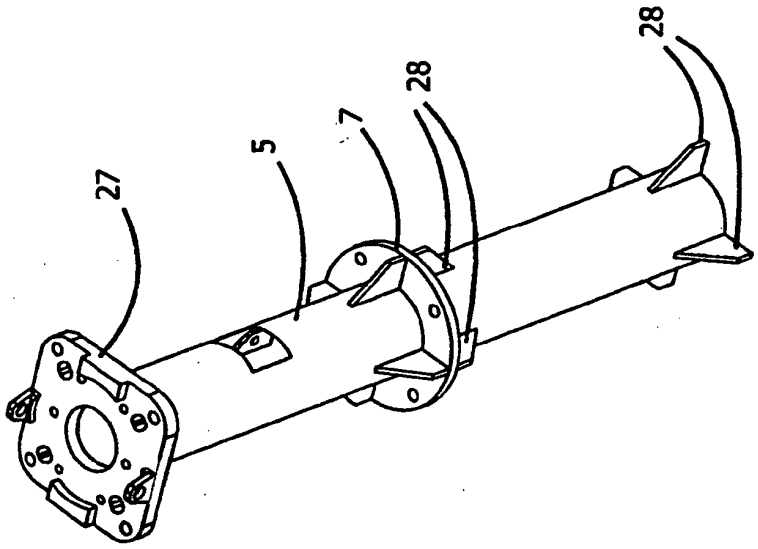


FIG 2b

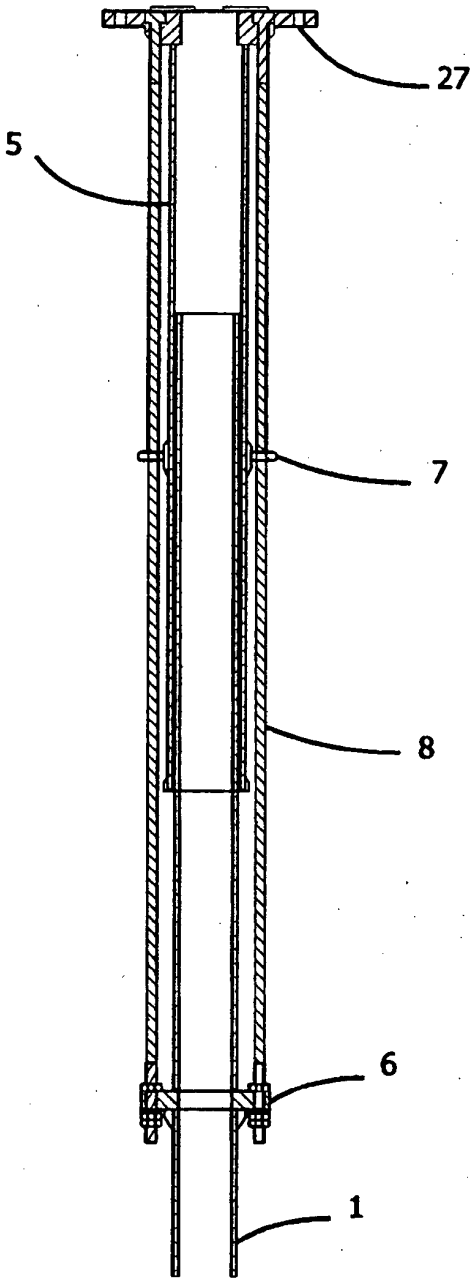


FIG 3b

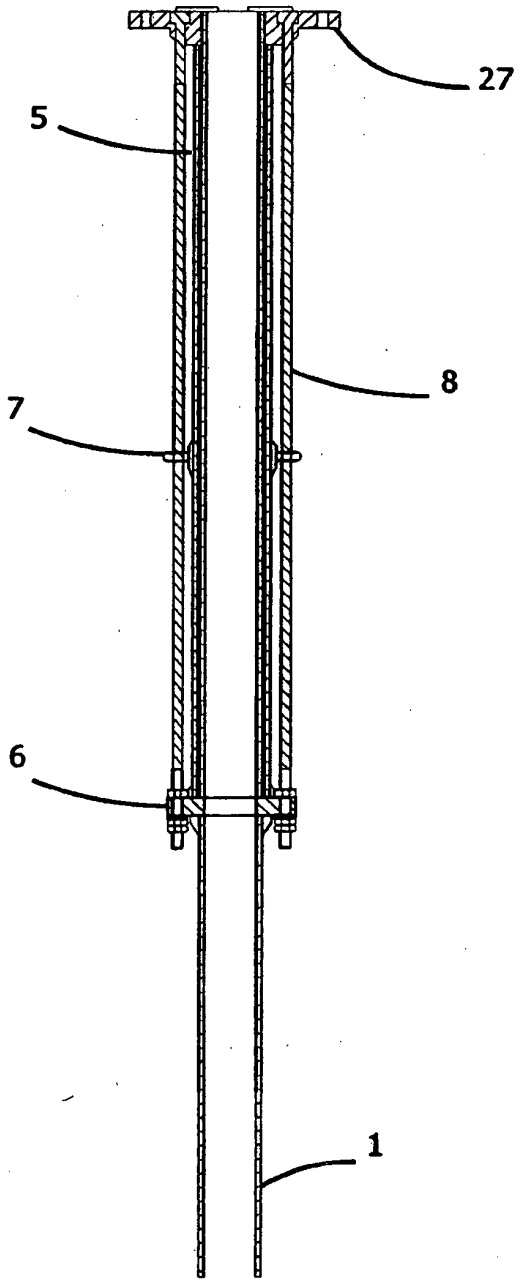


FIG 3a

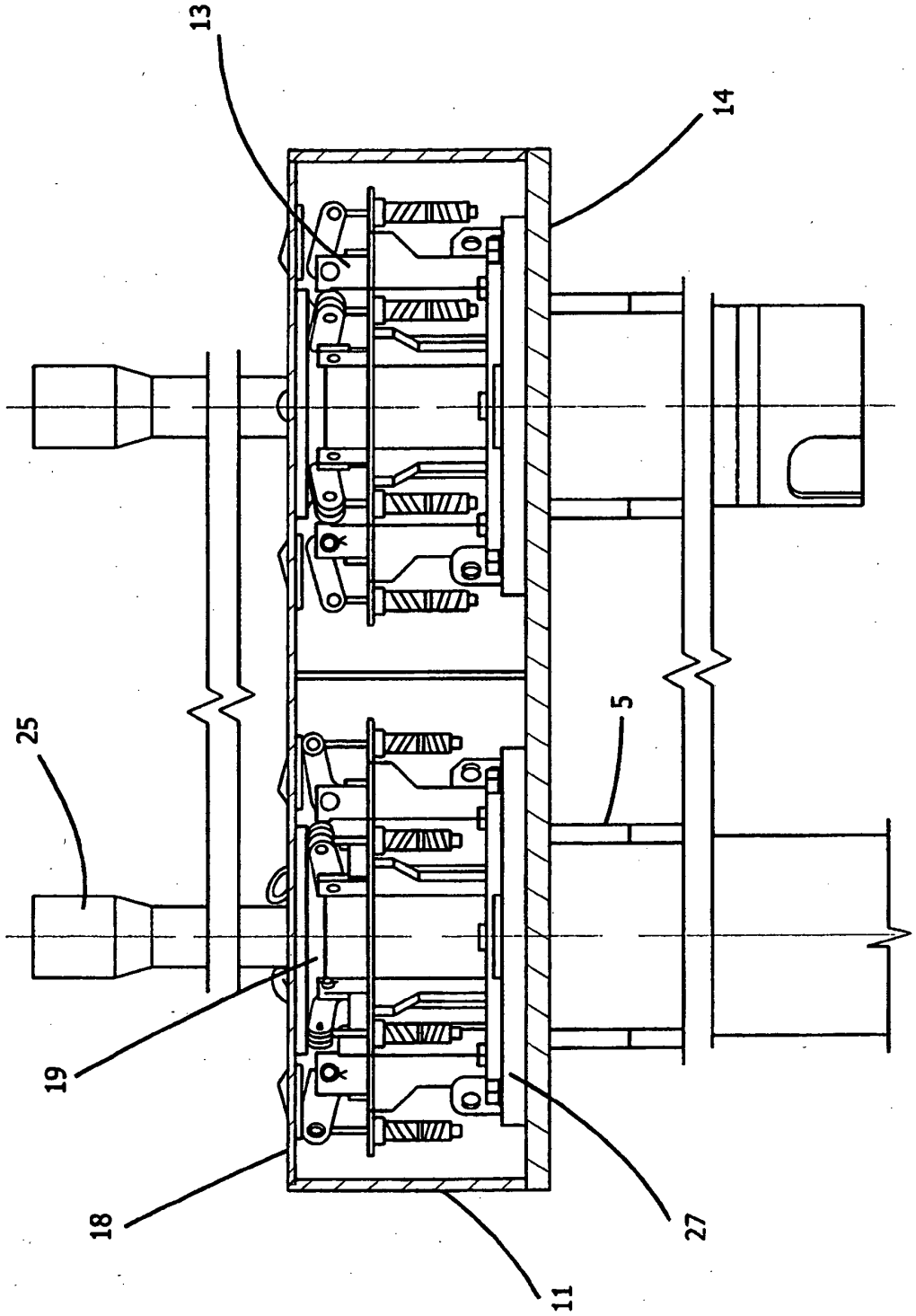


FIG 4a

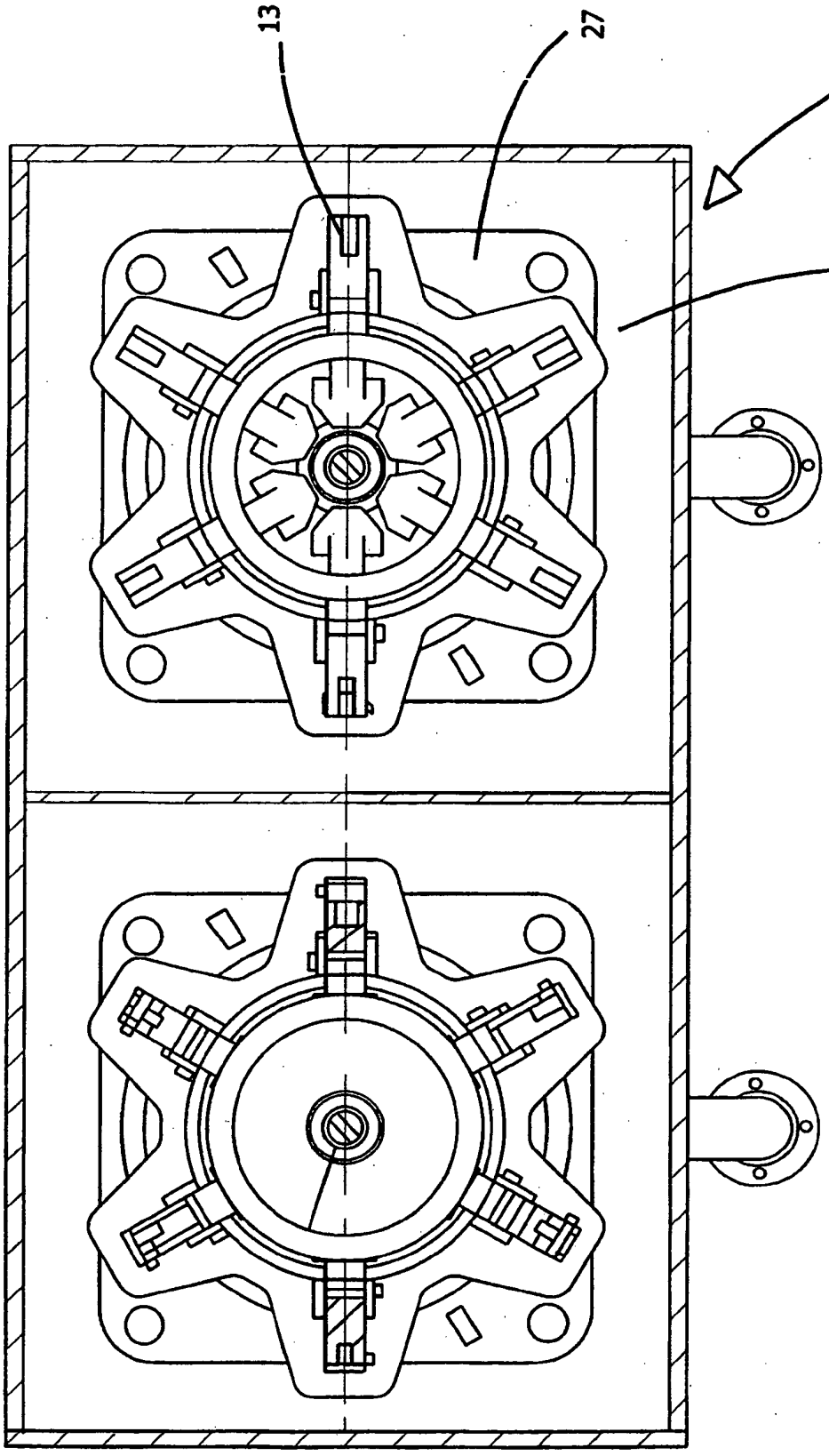


FIG 4b

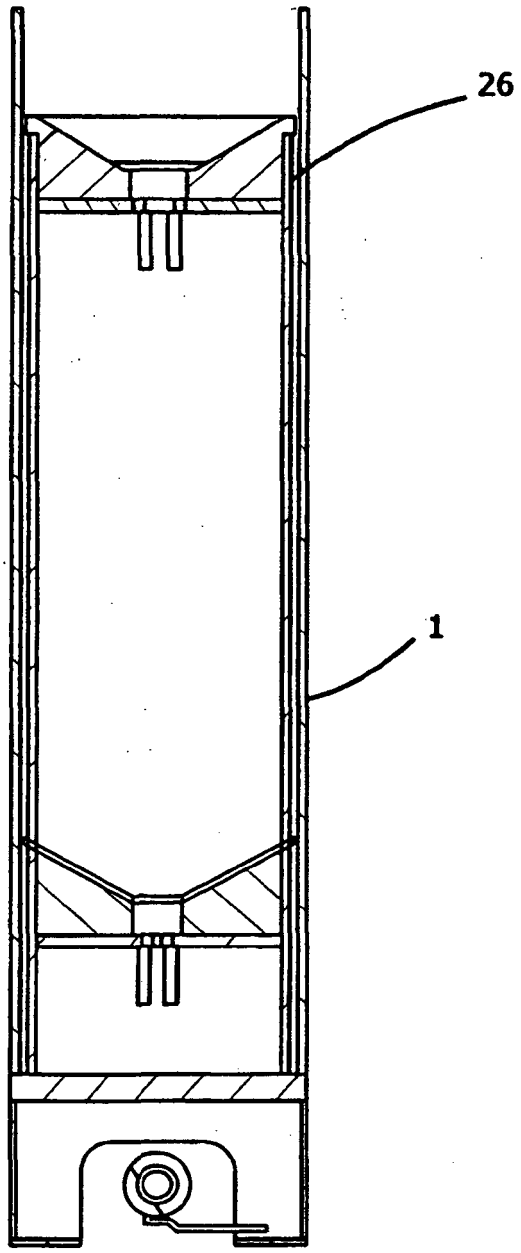


FIG 5

REFERENCES CITED IN THE DESCRIPTION

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- NO 309537 **[0003]**
- US 3689060 A **[0006] [0007]**
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