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(54) **Device and method for closing a hole in the ground**

Vorrichtung zum Zuschliessen eines Loches auf dem Boden

Dispositif pour la fermeture d'un trou sur le sol

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(56) References cited:
DE-A1- 19 514 636
JP-A- 2006 144 263
US-A- 1 225 679
US-A1- 2007 274 779

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Description

[0001] The present invention relates to a device and method for closing a hole in the ground.

[0002] In the case of manhole covers in general it is desirable to keep the mass of the plate parts which close the hole in the ground as low as possible, this in order that placing of the plate part on and removal of the plate part from the hole involves minimal effort for the person carrying out this operation.

[0003] When covers of a large size are required, such as for instance at pumping stations where a manhole with a diameter of 80 cm or more is necessary to enable lifting of the pump of the pumping station out of the manhole, the mass of the plate part will be considerable.

[0004] This is particularly the case when, in accordance with the NEN EN 124 standard, the plate part must be able to withstand an imposed vehicular load. The D400 vehicle class (heavy vehicles) of this NEN EN 124 standard is the best known in Europe, since this class is mandatory for all manhole covers positioned in a roadway. A steel plate part with a diameter of 80 cm which meets the requirements of the D400 vehicle class generally has a mass of more than 100 kg, this requiring a considerable physical effort by the person carrying out the operation during placing of the plate part on, and removing of the plate part from, the hole in the ground.

[0005] Both DE-A1-195 14 636 and US-A1-2007/0274779 disclose a device for closing a hole in the ground, comprising a plate part for closing the hole in an edge thereof, and pressing means for at least partially compensating the mass of the plate part according to the preamble of claim 1.

[0006] An object of the present invention is to provide a device and method for closing a hole in the ground wherein the above stated drawbacks are obviated, and which is in particular less physically onerous for the person carrying out the work.

[0007] Said object is achieved with the device according to claim 1 and with a method according to claims 9 or 10.

[0008] Because the mass of the plate part is at least partially compensated by the pressing means, the physical load on the person carrying out the work is decreased.

[0009] There is arranged in the edge of the hole an inclining surface which is adapted to guide the plate part over the edge of the hole to a position at least partially adjacent to the hole. Owing to the inclining surface the plate part can be displaced with even less physical effort over the edge of the hole from its uppermost position.

[0010] In a preferred embodiment the force exerted by the pressing means on the plate part is to at least some extent smaller than the gravitational force resulting from the mass of the plate part. Only the difference between the force exerted by the pressing means on the plate part and the gravitational force resulting from the mass of the plate part then need be exerted by the person carrying out the work. The physical load is therefore reduced. "To at least some extent smaller" is therefore understood to mean a force which can be applied without too much physical effort, and as maximum value is for instance equivalent to the force required to lift a plate part weighing 20 kg, i.e. about 196 N.

[0011] In a preferred embodiment the force exerted by the pressing means on the plate part is at least 90% of the gravitational force resulting from the mass of the plate part. Only slightly more than 10% of the mass of the plate part then need be exerted by the person carrying out the work in order to raise the plate part further to a position from which the plate part is displaceable over the edge of the hole. In the case of a plate part with a mass of 100 kg, the physical effort is therefore reduced to lifting of a plate part which is perceived as weighing only 10 kg. This is because 90 kg is compensated by the pressing means.

[0012] It is noted that the force exerted on the plate part can vary, and is preferably at least 90% of the gravitational force resulting from the mass of the plate part, more preferably at least 95%. Although it is recommended to reduce the physical effort made by the person, lower percentages can of course also be applied, such as for instance 50%, 55%, 60%, 65%, 70%, 75%, 80%, 85%.

[0013] According to a preferred embodiment, the pressing means arranged under the plate part comprise a spring mechanism. This spring mechanism, which can be for instance a normal spring, gas spring, leaf spring or biased rod, pushes upward against the plate part.

[0014] In a preferred embodiment the device comprises locking means for locking the plate part in a lowermost position relative to the edge of the hole. The locking means prevent the possibility of the plate part, for instance as a result of traffic travelling thereover, becoming detached from the edge of the hole. In addition, removal of the plate part by unauthorized persons is prevented if the locking means can only be operated with a special tool.

[0015] In a further preferred embodiment the pressing means are adapted to lift the plate part in the unlocked position of the locking means from the lowermost position into an uppermost position in order to position the plate part for displacement over the edge of the hole. In the unlocked position the plate part is automatically raised by the pressing means from its lowermost position into its uppermost position. No physical effort of the person carrying out the work is required for this purpose. From it uppermost position the plate part can then be displaced with little physical effort over the edge of the hole. The person carrying out the work need after all only displace the plate part laterally over the edge of the hole. Less physical effort is required for this purpose than is the case with conventional manhole covers, where the plate part must be lifted by the person carrying out the work before it can be displaced over the edge. The self-lifting plate part according to the present invention therefore provides a closure for a hole in the ground which is less physically onerous.

[0016] When the locking means are in the unlocked position, according to this embodiment the plate part is moved upward by an upward force of the pressing means into the uppermost position, where the plate part is positioned such that it can be displaced over the edge of the hole.

[0017] According to a further preferred embodiment, the force exerted by the pressing means on the plate part is greater than the gravitational force resulting from the mass of the plate part, and smaller than the gravitational force resulting from the mass of the plate part on which a person is standing.

[0018] Because in this embodiment the pressing means exert a force on the plate part which is greater than the gravitational force resulting from the mass of the plate part, the pressing means are able, in the unlocked position of the locking means, to move the plate part upward into its uppermost position.

[0019] However, because the pressing means exert a force on the plate part which is smaller than the gravitational force resulting from the mass of the plate part on which a person is standing, it is possible for an operative to move the plate part from its uppermost position to its lowermost position with very little physical effort. For this purpose the person need only take up position on the plate part, after which the plate part sinks into its lowermost position. Once in this lowermost position, the person then need only move the locking means into the locked position so that the plate part does not move upward again when the person steps off the plate part.

[0020] When the pressing means are for instance adapted to be able to move the plate part upward with an additional mass of a maximum of for instance 60 kg, almost any adult person will be able to cause the plate part to move downward by standing thereon. The above stated additional mass of 60 kg is of course an example from which it is possible to vary, just as long as the mass of the operative person is greater than the additional mass.

[0021] According to a further preferred embodiment, the force exerted by the pressing means on the plate part is smaller than the gravitational force resulting from the mass of the plate part plus 40 kg, preferably about 25 kg. Limiting the force exerted by the pressing means on the plate part achieves that the plate part moves upward with relatively little force and in controlled manner when the person steps off the plate part.

[0022] According to a further preferred embodiment, the plate part is mounted on the edge of the hole for rotation round a rotation point. Rotatable mounting of the plate part guarantees that the plate part cannot be removed entirely from the hole, although the plate part can be displaced to a position at least for the greater part adjacent to the hole.

[0023] According to yet another preferred embodiment, the plate part comprises a substantially round form. A round form prevents the plate part being able to fall through the hole and is moreover favourable for the force transfer to the edge of the hole when the plate part is loaded. In addition, a round plate part has the advantage of being less susceptible to 'rattling', which occurs for instance in the case of rectangular covers which are almost never completely flat and can therefore begin to tilt around an axis of tilt.

[0024] According to yet another preferred embodiment, there is arranged on the plate part at least one guide roller which can be rolled over the inclined surface in the edge of the hole. By rolling the plate part over this guide roller the plate part can be displaced over the edge of the hole via the inclining surface with a very small physical effort. The guide roller is preferably arranged under the plate part because the guide roller then co-displaces with the plate part, if desired even into a position in which the plate part lies for the greater part adjacent to the hole in the ground.

[0025] According to yet another preferred embodiment, one or more guide rollers are arranged in the inclined surface. Only a small rolling resistance need hereby be overcome in order to move the plate part over the inclining surface.

[0026] According to yet another preferred embodiment, the pressing means comprise a spring mechanism of one or more biased rods, wherein a guide roller, which can be rolled over the inclined surface in the edge of the hole, is arranged close to the outer end on a biased rod. This construction has the advantage that due to the biasing of the rod the guide roller is pushed against the inclined surface. It is moreover a simple construction in which the number of components is reduced in that the pressing means and the guide roller are combined.

[0027] According to yet another preferred embodiment, the pressing means are adapted to raise the plate part at least 50 mm. Plate parts with standard inset depths are hereby raised sufficiently high to a position in which the plate part can be displaced relatively easily over the edge of the hole.

[0028] According to yet another preferred embodiment, the plate part has a diameter of at least 70 cm. Particularly for plate parts of such a size the mass is so high that it is desirable that they be embodied according to the present invention for displacement with less physical effort. The present invention does of course already provide significant advantages with plate parts of smaller dimensions, for instance with a diameter of 50 cm.

[0029] According to yet another preferred embodiment, a locking catch of the locking means which is arranged close to the rotation point bounds the rotation movement of the plate part in an extreme position in which the plate part is situated at least partially adjacent to the hole. This prevents the possibility of the plate part for instance being rotated all the way round which, if a guide roller were arranged non-fixedly under the plate part, could result in this roller falling into the hole.

[0030] According to yet another preferred embodiment, the pressing means comprise a shaft provided with screw thread arranged between the plate part and the

edge of the hole. The plate part can be pressed upward by unscrewing this shaft provided with screw thread, whereby the plate part is lifted to an uppermost position from which the plate part can be readily displaced to position adjacent to the edge of the hole with little physical effort. Conversely, by tightening the shaft provided with screw thread a downward force can be applied to the plate part which on the contrary pulls the plate part into the edge of the hole. A separate locking can hereby be dispensed with.

[0031] The present invention further relates to a method for removing/placing a plate in the ground by using a device according to claim 1, comprising the following steps of:

- a person placing a tool for operating the plate part in a recess arranged for this purpose in the plate part;
- the pressing means exerting a force on the plate part which is to at least some extent smaller than the gravitational force resulting from the mass of the plate part;
- the person exerting a force on the plate part with the tool which is to at least some extent greater than the difference between the force exerted on the plate part by the pressing means and the gravitational force resulting from the mass of the plate part;
- lifting the plate part through co-action of the pressing means and the force exerted by the person; and
- displacing the plate part over the edge of the hole into a position in which the plate part is situated at least partially adjacent to the hole; and
- wherein displacement of the plate part over the edge of the hole comprises the further step of guiding the plate part by sliding or rolling from a position in which the plate part substantially closes the hole, over an inclined surface arranged in the edge of the hole, to a position at least partially adjacent to the hole.

[0032] According to this embodiment the plate part is lifted by a combination of a force exerted by the pressing means on the plate part and a force exerted by the person on the plate part. Because the pressing means already compensate a part of the mass of the plate part, the physical load on the person carrying out the work is reduced.

[0033] The above stated steps describe removal of the plate part from the hole in the ground. The steps can of course be performed in reverse sequence in order to replace the plate part. By performing the steps vice versa a method is obtained for respectively removing and (re)placing a plate part in a hole in the ground.

[0034] The present invention further relates to a method for removing/placing a plate in the ground by using a device according to claim 1 comprising the following steps of:

- a person standing on the plate part situated in a lowermost position relative to the edge of the hole;
- unlocking locking means which lock the plate part in the lowermost position relative to the edge;
- the person who has taken up position on the plate part moving off the plate part;
- the pressing means lifting the plate part from the lowermost position into an uppermost position, in which uppermost position the plate part is positioned displaceably over the edge of the hole;
- displacing the plate part over the edge of the hole into a position in which the plate part is situated at least partially adjacent to the hole; and
- wherein displacement of the plate part over the edge of the hole comprises the further step of guiding the plate part by sliding or rolling from a position in which the plate part substantially closes the hole, over an inclined surface arranged in the edge of the hole, to a position at least partially adjacent to the hole.

[0035] The above stated steps describe the removal of the plate part out of the hole in the ground. The steps can of course be performed in reverse sequence in order to replace the plate part. By performing the steps vice versa a method is obtained for respectively removing and (re)placing a plate part in a hole in the ground.

[0036] According to a preferred embodiment of the method, displacement of the plate part over the edge of the hole is preceded by the step of placing a tool for operating plate part into a recess arranged for this purpose in the plate part.

[0037] According to yet another preferred embodiment of the method, the pressing means comprise a shaft provided with screw thread, also referred to as a threaded spindle, arranged between the plate part and the edge of the hole, and lifting of the plate part by the pressing means takes place by rotating this shaft provided with screw thread.

[0038] According to yet another preferred embodiment of the method, a device according to the present invention is applied.

[0039] Preferred embodiments of the present invention are further elucidated in the following description with reference to the drawing, in which:

Figure 1 is a perspective view of a manhole cover with a person standing thereon, wherein the cover is situated in a lowermost position;

Figure 2 is a sectional view of the locking means of the manhole cover shown in figure 1 according to a first embodiment;

Figure 3 is a bottom view of the locking means shown in figure 2;

Figure 4A is a sectional side view, wherein the manhole cover is situated in the lowermost position as shown in figure 1;

Figure 4B is a sectional side view, wherein the manhole cover is situated in the uppermost position as shown in figure 4;

Figure 5 is a perspective view of a manhole cover according to a first preferred embodiment, wherein

the cover is situated in an uppermost position;
Figure 6 is a perspective view wherein the person is moving the cover off the manhole;
Figure 7 is a cut-away perspective view of the situation shown in figure 6;
Figure 8 is a perspective view wherein the cover is situated in its position furthest removed from the manhole;
Figure 9 is a perspective view of a manhole cover according to a second preferred embodiment, wherein the cover is situated in an uppermost position;
Figure 10 is a cut-away perspective view of the situation shown in figure 9;
Figure 11 is a perspective view wherein the person is moving the cover off the manhole;
Figure 12 is a perspective view wherein the cover is situated in its position furthest removed from the manhole;
Figure 13 is a detail sectional view of the pressing means according to the second embodiment; and
Figure 14 is a detail sectional view of the pressing means according to a further embodiment.
Figure 1 shows a perspective view of a closing device 1 with a person P standing thereon, wherein cover 2 is situated in a lowermost position. In this lowermost position the cover 2 lies on the radially inward extending supporting edge 10 of the edge 8 of hole 4. The person P is standing on cover 2 and locking means 16 are in a locked position, i.e. they lock cover 2 relative to edge 8 of hole 4.

[0040] Locking means 16 comprise a through-hole 18 in cover 2 through which a bolt 20 is arranged. Bolt 20 has an external screw thread 24 over which can be moved a locking catch 26 with internal screw thread. The rotation freedom of locking catch 26 is bounded by lock housing 28. In the shown embodiment the maximum angle of rotation is about 90° (figure 3). When a tool is placed on the outer end 22 of bolt 20, in the first instance bolt 20 is rotated using the tool, and locking catch 26 will move to an extreme rotation position bounded by lock housing 28. Further rotation of the tool engaging on outer end 22 of bolt 20 results in the second instance in a displacement of locking catch 26 over screw thread 24 of bolt 20. Locking catch 26 is herein displaced in longitudinal direction over screw thread 24, and therefore in height direction relative to edge 8. By rotating outer end 22 with a tool fitting thereon the locking catch 26 can in this way be tightened such that it comes into contact with the radially inward extending supporting edge 10, and thus locks cover 2 tightly relative to edge 8 of the hole (figure 2). By rotating bolt 20 in the other direction the locking catch can once again be loosened, after which locking means 16 can be unlocked.

[0041] In figure 3, which is a bottom view of locking means 16 shown in figure 2, can also be seen a pin 12 around which cover 2 is rotatably arranged. Because pin 12 is arranged slidably in a through-hole, cover 2 can also undergo some displacement in height direction, this being necessary to enable displacement of cover 2 over edge 8 of hole 4 into a position in which cover 2 is situated for the greater part adjacent to hole 4.

[0042] Figure 4A, which is a sectional side view wherein cover 2 is situated in the lowermost position shown in figure 1, also shows the pressing means for lifting cover 2. These pressing means are formed by spring mechanism 30 which in the shown embodiment comprises two biased, elastically deformable rods 32. Arranged on the underside of cover 2 are two partitions 34 in which long slots 36 and short slots 38 are arranged. Slots 36 and 38 function as guide for the biased rods 32.

[0043] Biased rods 32 are deformed elastically to some extent due to their bias and are in a slightly curved position (figure 4A). The upward directed force exerted on the cover by biased rods 32 is greater than the gravitational force resulting from the mass of cover 2 and smaller than the gravitational force resulting from the mass of cover 2 on which person P is standing. As a result the cover 2 - as long as person P is standing on cover 2 - remains in the lowermost position as shown in figure 4A, so that person P can unlock locking means 16 when he/she is standing on cover 2. When person P then moves off cover 2, the gravitational force of cover 2 decreases to a value corresponding to the gravitational force resulting from the mass of cover 2 alone. Because biased rods 32 exert a greater force on the cover than the gravitational force resulting from the mass of cover 2 alone, in the unlocked position of locking means 16 the spring mechanism 30 will move cover 2 upward into its uppermost position. This uppermost position is shown in figures 4B and 5, which also show that pin 12 allows a height displacement of cover 2. This height displacement is preferably at least 50 mm, since cover 2 is then raised sufficiently high to enable, in the case of standard inset depths, relatively simple displacement over edge 8 of hole 4.

[0044] The force exerted by spring mechanism 30 on cover 2 is preferably such that spring mechanism 30 can on the one hand easily displace cover 2 upward to its uppermost position, but on the other hand does this in a controlled manner. In a suitable embodiment the spring mechanism exerts an upward directed force on cover 2 which corresponds to the gravitational force resulting from the mass of cover 2 with an additional mass of X kg, wherein X is for instance 5, 10, 15, 20, 25, 30, 35, 40 kg. A value of X = 25 kg has been found to be very suitable.

[0045] It is noted that according to an alternative embodiment of the invention X can also comprise a negative value such as X = -20, -15, -10 and -5. Spring mechanism 30 in that case only partially compensates the mass of cover 2. In the case of a cover 2 with a mass of 100 kg, and a value of X = -10 kg, spring mechanism 30 compensates a mass of 90 kg of cover 2. Only 10 kg, or 10%, need in that case be exerted by the person carrying out

the work. The physical load is therefore reduced by about 90%. An advantage of a negative value of X can be that cover 2 - even when locking means 16 are unlocked - will not displace wholly independently into an uppermost position. This provides additional safety in the case cover 2 is not locked, while a reduction in physical load for the person carrying out the work is still obtained.

[0046] It is noted for the sake of completeness that a value of X = 0 kg can also be applied within the scope of the invention. In that case cover 2 is not lifted automatically, although the physical load for the person carrying out the work is minimal.

[0047] As can be clearly seen in figures 4A and 4B, there is arranged in edge 8 of the hole an inclined surface 44 on which is situated a guide roller 46 arranged on the outer end of a rod 32. It is noted that the present invention can also be applied without such a guide roller 46, in which case the inclined surface 44 functions as sliding surface. The inclined surface 44 is in that case preferably embodied with a surface layer with a low coefficient of friction.

[0048] When cover 2 is displaced from the lowermost position shown in figure 4A to the uppermost position shown in figure 4B, it can then be displaced over edge 8 of hole 4 without too much physical effort by person P.

[0049] Figure 5 shows a perspective view in which cover 2 is situated in the uppermost position. In engaging recess 40 can be arranged a tool 42 with which a person P can displace cover 2 from the uppermost position shown in figure 5 to the position shown in figure 6, in which cover 2 is already situated partially over edge 8 of hole 4. During displacement of cover 2 from the position shown in figure 5 to the position shown in figure 6 the guide roller 46 rolls over inclined surface 44, whereby the physical effort required is small, and is at least considerably reduced relative to opening of conventional manhole covers.

[0050] Figure 7 is a cut-away perspective view of the situation shown in figure 6, wherein guide roller 46 has been displaced onto edge 8 of hole 4.

[0051] Arranged at the outer end of inclined surface 44 is a stop 48 which guarantees that guide roller 46 cannot run off inclined surface 44 when cover 2 is placed on the hole (situation of figure 5). It is desirable that guide roller 46 remains on inclined surface 44, since in that case inclined surface 44 can function as support surface against which the spring action can react via the curved rods.

[0052] When the plate part is rotated further outward, one of the locking means 16 will run up against the edge 8 of the hole, whereby cover 2 is bounded in its extreme rotation position (figure 8).

[0053] According to a further aspect of the present invention, the pressing means for at least partially compensating a mass of plate part 2 comprise a shaft provided with screw thread, also referred to as threaded spindle, which can be rotated by means of a tool 50 such that the screw thread ensures that cover 2 is displaced into an uppermost position (figure 9). Figure 10 is a cut-away detail view of the position of plate part 2 shown in figure 9, wherein pressing means 52, or lifting means, hold plate part 2 in the uppermost position. The precise operation will be further elucidated with reference to figures 13 and 14.

[0054] In engaging recess 40 can be arranged a tool 42 with which a person P can displace cover 2 from the uppermost position shown in figures 9 and 10 to the position shown in figure 11, in which cover 2 is already situated partially over edge 8 of hole 4. If desired, tools 42 and 50 can be given a combined form, wherein for instance the one outer end of the tool is suitable for engaging in engaging recess 40, while the other outer end of the tool is suitable for engaging on shaft 54 provided with screw thread which forms pressing means 52.

[0055] During displacement of cover 2 from the position shown in figure 11 to the position shown in figures 12 the guide roller 46 rolls over inclined surface 44, whereby the physical effort required is small, and is at least considerably reduced relative to opening of conventional manhole covers.

[0056] In the embodiment shown in figure 13 cover 2 is situated in a raised position relative to edge 8 of hole 4. Pressing means 52 comprise a shaft 54 which is provided with external screw thread and which engages in a recess 56, provided with internal screw thread, in edge 8 of the hole. It is noted that it is also possible to envisage the internal screw thread being situated in a nut block (not shown) arranged in the edge. When the shaft 54 provided with screw thread is rotated by means of tool 50, cover 52 can be displaced in height direction. Ball joint 58 of ball joint bearing 60 allows some freedom of movement, whereby plate part 2 will be oriented slightly sloping in the raised position. Another suitable bearing is for instance a rotatable axial bearing such as marketed for instance by the British company IGUS® Ltd. Once the cover has been pulled with tool 42 over inclined surface 44 in edge 8 of hole 4 via engaging recess 40 into the position in which cover 2 lies substantially adjacent to hole 4 (figure 12), cover 2 will once again be oriented substantially horizontally. A recess 64 is provided in cover 2 so that tool 50 can engage on outer end 66 of shaft 54 provided with screw thread. A cover ring 62 secures bearing 60 relative to cover 2.

[0057] According to a further preferred embodiment as shown in figure 14, the shaft 54 provided with external screw thread is suspended in a suspension 70 with a rubber suspension block 72, this likewise providing cover 2 with some freedom to tilt. In this embodiment screw thread 54 moves through the through-hole 68 provided with internal screw thread when tool 50 is placed into engagement with the hexagonal engagement 76 and rotated. A recess 74 is once again provided to allow tool 50 to engage with recess 76.

[0058] Although they show preferred embodiments of the invention, the above described embodiments are intended only to illustrate the present invention and not in

any way to limit the scope of the invention. It is particularly noted that the skilled person can combine measures from the different embodiments, so that for instance the somewhat flexible suspension of figure 14 and the bearing with some freedom to tilt of figure 13 can be interchanged or combined with each other. The scope of the invention is therefore defined solely by the following claims.

Claims

1. Device for closing a hole in the ground, comprising:

- an edge (8) around a hole (4)
- a plate part (2) for closing the hole (4) in said edge (8) of said device;
- pressing means for at least partially compensating the mass of the plate part (2);

characterized in that there is arranged in the edge (8) of the hole (4) of said device an inclined surface (44) which is adapted to guide the plate part (2) by sliding or rolling from a position in which the plate part (2) substantially closes the hole (4), over the edge (8) of the hole (4) to a position at least partially adjacent to the hole (4) for removal of said plate part (2) from the hole (4) in the ground.

2. Device as claimed in claim 1, wherein the pressing means comprise a spring mechanism (30) arranged under the plate part (2).

3. Device as claimed in claim 2, wherein the force exerted by the pressing means on the plate part (2) is to at least some extent smaller than the gravitational force resulting from the mass of the plate part.

4. Device as claimed in any of the foregoing claims, further comprising locking means (16) for locking the plate part in a lowermost position relative to the edge of the hole.

5. Device as claimed in any of claims 1-4, wherein there is arranged on the plate part (12) at least one guide roller (46) which can be rolled over the inclined surface (44) in the edge of the hole.

6. Device as claimed in any of claims 1-4, wherein one or more guide rollers are arranged in the inclined surface (44).

7. Device as claimed in any of claims 1-4, wherein the pressing means comprise a spring mechanism of one or more biased rods, wherein a guide roller, which can be rolled over the inclined surface (44) in the edge of the hole, is arranged close to the outer end on a biased rod.

8. Device as claimed in any of the foregoing claims, wherein the pressing means comprise a shaft provided with screw thread arranged between the plate part (2) and the edge of the hole.

9. Method for removing a plate from a hole (4) in the ground by using a device according to claim 1, comprising the following steps of:

- a person placing a tool (42) for operating a plate part (2) in a recess (40) arranged for this purpose in the plate part (2);
- the pressing means exerting a force on the plate part (2) which is to at least some extent smaller than the gravitational force resulting from the mass of the plate part (2);
- the person exerting a force on the plate part (2) with the tool (42) which is to at least some extent greater than the difference between the force exerted on the plate part (2) by the pressing means and the gravitational force resulting from the mass of the plate part (2);
- lifting the plate part (2) through co-action of the pressing means and the force exerted by the person; and
- displacing the plate part (2) over the edge (8) of the hole (4) into a position in which the plate part (2) is situated at least partially adjacent to the hole (4); and
- wherein displacement of the plate part (2) over the edge (8) of the hole (4) comprises the further step of guiding the plate part (2) by sliding or rolling from a position in which the plate part (2) substantially closes the hole (4), over an inclined surface (44) arranged in the edge (8) of the hole (4), to a position at least partially adjacent to the hole (4).

10. Method for removing a plate from a hole (4) in the ground by using a device according to claim 1, comprising the following steps of:

- a person standing on a plate part (2) situated in a lowermost position relative to an edge (8) of a hole (4);
- unlocking locking means (16) which lock the plate part (2) in the lowermost position relative to the edge (8);
- the person who has taken up position on the plate part (2) moving off the plate part (2);
- the pressing means lifting the plate part (2) from the lowermost position into an uppermost position, in which uppermost position the plate part (2) is positioned displaceably over the edge (8) of the hole (4);
- placing a tool (42) for operating the plate part (2) in a recess (40) arranged for this purpose in the plate part (2);

- displacing the plate part (2) over the edge (8) of the hole (4) into a position in which the plate part (2) is situated at least partially adjacent to the hole (4); and
- wherein displacement of the plate part (2) over the edge (8) of the hole (4) comprises the further step of guiding the plate part (2) by sliding or rolling from a position in which the plate part (2) substantially closes the hole (4), over an inclined surface (44) arranged in the edge (8) of the hole (4), to a position at least partially adjacent to the hole (4).

11. Method as claimed in either of the claims 9 or 10, wherein the plate part (2) is mounted on the edge of the hole for rotation round a rotation point, and wherein a locking catch of the locking means which is arranged close to the rotation point bounds the rotation movement of the plate part (2) in an extreme position in which the plate part is situated at least partially adjacent to the hole.

12. Method as claimed in any of claims 9-11, wherein guiding of the plate part over the inclining surface (44) comprises the step of rolling a guide roller (46) arranged on the plate part (2) over this inclined surface (44).

13. Method as claimed in any of the claims 9-12, wherein the pressing means comprise a shaft provided with screw thread arranged between the plate part (2) and the edge of the hole, and lifting of the plate part (2) by the pressing means takes place by rotating this shaft provided with screw thread.

Patentansprüche

1. Vorrichtung zum Verschließen eines Lochs in dem Boden, aufweisend:

eine Umrandung (8) um ein Loch (4);
ein Plattenteil (2) zum Verschließen des Lochs (4) in der Umrandung (8) der Vorrichtung;
Pressmittel, um die Masse des Plattenteils (2) zumindest teilweise zu kompensieren;
dadurch gekennzeichnet, dass eine schräge Fläche (44), die angepasst ist, für ein Entfernen des Plattenteils (2) von dem Loch (4) in dem Boden, das Plattenteil (2) aus einer Position, in der das Plattenteil (2) das Loch (4) im Wesentlichen verschließt, über die Umrandung (8) des Lochs (4) in eine Position, die zumindest teilweise angrenzend an das Loch (4) ist, durch Gleiten oder Rollen zu führen, in der Umrandung (8) des Lochs (4) der Vorrichtung angeordnet ist.

2. Vorrichtung, wie in Anspruch 1 beansprucht, wobei die Pressmittel einen Federmechanismus (30) aufweisen, der unter dem Plattenteil (2) angeordnet ist.

3. Vorrichtung, wie in Anspruch 2 beansprucht, wobei die durch die Pressmittel auf das Plattenteil (2) ausgeübte Kraft in zumindest einem gewissen Ausmaß kleiner als die Gravitationskraft ist, die sich aus der Masse des Plattenteils ergibt.

4. Vorrichtung, wie in einem der vorangehenden Ansprüche beansprucht, ferner ein Verriegelungsmittel (16) zum Verriegeln des Plattenteils in einer relativ zu der Umrandung des Lochs untersten Position aufweisend.

5. Vorrichtung, wie in einem der Ansprüche 1 - 4 beansprucht, wobei zumindest eine Führungsrolle (46), die über die schräge Fläche (44) in der Umrandung des Lochs gerollt werden kann, an dem Plattenteil (12) angeordnet ist.

6. Vorrichtung, wie in einem der Ansprüche 1 - 4 beansprucht, wobei eine oder mehrere Führungsrollen in der schrägen Fläche (44) angeordnet sind.

7. Vorrichtung, wie in einem der Ansprüche 1 - 4 beansprucht, wobei die Pressmittel einen Federmechanismus aus einem oder mehreren vorgespannten Stäben aufweisen, wobei eine Führungsrolle, die über die schräge Fläche (44) in der Umrandung des Lochs gerollt werden kann, auf einem vorgespannten Stab nahe dem äußeren Ende angeordnet ist.

8. Vorrichtung, wie in einem der vorangehenden Ansprüche beansprucht, wobei die Pressmittel einen Schaft, der mit einem zwischen dem Plattenteil (2) und der Umrandung des Lochs angeordneten Schraubengewinde versehen ist, aufweisen.

9. Verfahren zum Entfernen einer Platte von einem Loch (4) in dem Boden unter Verwendung einer Vorrichtung gemäß Anspruch 1, aufweisend die folgenden Schritte:

- eine Person platziert ein Werkzeug (42) zum Bedienen eines Plattenteils (2) in einer zu diesem Zweck in dem Plattenteil (2) angeordneten Vertiefung (40);
- die Pressmittel üben eine Kraft, die zumindest ein gewisses Ausmaß kleiner als die aus der Masse des Plattenteils (2) resultierenden Gravitationskraft ist, auf das Plattenteil (2) aus;
- die Person übt mit dem Werkzeug (42) eine Kraft, die zumindest ein gewisses Ausmaß größer als der Unterschied zwischen der durch die Pressmittel auf das Plattenteil (2) ausgeübten Kraft und der aus der Masse des Plattenteils (2) resultierenden Gravitationskraft ist, auf das Plat-

tenteil (2) aus;
- Anheben des Plattenteils (2) durch ein Zusammenwirken der Pressmittel und der durch die Person ausgeübten Kraft;
- Verschieben des Plattenteils (2) über die Umrandung (8) des Lochs (4) in eine Position, in der das Plattenteil (2) zumindest teilweise an das Loch (4) angrenzend gelegen ist; und
- wobei ein Verschieben des Plattenteils (2) über die Umrandung (8) des Lochs (4) den weiteren Schritt eines Führens des Plattenteils (2) durch Gleiten oder Rollen von einer Position, in der das Plattenteil (2) das Loch (4) im Wesentlichen verschließt, über eine in der Umrandung (8) des Lochs (4) angeordneten schrägen Fläche (44) in eine Position, die zumindest teilweise an dem Loch (4) angrenzend ist, aufweist.

10. Verfahren zum Entfernen einer Platte von einem Loch (4) in dem Boden unter Verwendung einer Vorrichtung gemäß Anspruch 1, aufweisend die folgenden Schritte:

- eine Person steht auf einem Plattenteil (2), das relativ zu einer Umrandung (8) eines Lochs (4) in einer untersten Position gelegen ist;
- Entriegeln von Verriegelungsmitteln (16), die das Plattenteil (2) relativ zu der Umrandung (8) in der untersten Position verriegeln;
- die Person, die eine Position auf dem Plattenteil (2) eingenommen hat, bewegt das Plattenteil (2) weg;
- die Pressmittel heben das Plattenteil (2) von der untersten Position in eine oberste Position, wobei das Plattenteil (2) in der obersten Position über der Umrandung (8) des Lochs (4) verschiebbar positioniert ist;
- Platzieren eines Werkzeugs (42) zum Bedienen des Plattenteils (2) in einer zu diesem Zweck in dem Plattenteil (2) angeordneten Vertiefung (40);
- Verschieben des Plattenteils (2) über die Umrandung (8) des Lochs (4) in eine Position, in der das Plattenteil (2) zumindest teilweise an dem Loch (4) angrenzend gelegen ist; und
- wobei ein Verschieben des Plattenteils (2) über die Umrandung (8) des Lochs (4) den weiteren Schritt eines Führens des Plattenteils (2) durch Gleiten oder Rollen von einer Position, in der das Plattenteil (2) das Loch (4) im Wesentlichen verschließt, über eine in der Umrandung (8) des Lochs (4) angeordnete schräge Fläche (44) in eine Position, die zumindest teilweise an das Loch (4) angrenzend ist, aufweist.

11. Verfahren, wie entweder in Anspruch 9 oder Anspruch 10 beansprucht, wobei das Plattenteil (2) auf der Umrandung des Lochs montiert ist, um sich um einen Drehpunkt zu drehen, und wobei eine Verriegelungssperre des Verrieglungsmittels, das nahe dem Drehpunkt angeordnet ist, die Drehbewegung des Plattenteils (2) in einer Extremposition, in der das Plattenteil zumindest teilweise angrenzend an das Loch gelegen ist, begrenzt.

12. Verfahren, wie in einem der Ansprüche 9 - 11 beansprucht, wobei ein Führen des Plattenteils über die schräge Fläche (44) den Schritt eines Rollens einer auf dem Plattenteil (2) angeordneten Führungsrolle (46) über diese geneigte Flüche (44) enthält.

13. Verfahren, wie in einem der Ansprüche 9 - 12 beansprucht, wobei die Pressmittel einen mit einem zwischen dem Plattenteil (2) und der Umrandung des Lochs angeordneten Schraubgewinde versehenen Schaft aufweist, und ein Anheben des Plattenteils (2) durch die Pressmittel durch Drehen dieses mit einem Schraubengewinde versehenen Schafts stattfindet.

Revendications

1. Dispositif d'obturation d'un trou dans le sol, comprenant :

un bord (8) autour d'un trou (4) ;
une partie formant plaque (2) destinée à obturer le trou (4) sur ledit bord (8) dudit dispositif ;
un moyen de pression destiné à compenser au moins partiellement la masse de la partie formant plaque (2) ;
caractérisé en ce que, sur le bord (8) du trou (4) dudit dispositif, est agencée une surface inclinée (44) qui est adaptée pour guider la partie formant plaque (2) par glissement ou roulement à partir d'une position dans laquelle la partie formant plaque (2) obture sensiblement le trou (4), sur le bord (8) du trou (4) à une position au moins partiellement adjacente au trou (4) afin de retirer ladite partie formant plaque (2) du trou (4) dans le sol.

2. Dispositif selon la revendication 1, dans lequel le moyen de pression comprend un mécanisme à ressort (30) agencé sous la partie formant plaque (2).

3. Dispositif selon la revendication 2, dans lequel la force exercée par le moyen de pression sur la partie formant plaque (2) est au moins, dans une certaine mesure, inférieure à la force de gravité résultant de la masse de la partie formant plaque.

4. Dispositif selon l'une quelconque des revendications précédentes, comprenant en outre un moyen de verrouillage (16) destiné à verrouiller la partie formant

plaque dans une position la plus basse par rapport au bord du trou.

5. Dispositif selon l'une quelconque des revendications 1 à 4, dans lequel il est agencé, sur la partie formant plaque (12), au moins un rouleau de guidage (46) qui peut rouler sur la surface inclinée (44) sur le bord du trou.

6. Dispositif selon l'une quelconque des revendications 1 à 4, dans lequel un ou plusieurs rouleaux de guidage sont agencés sur la surface inclinée (44).

7. Dispositif selon l'une quelconque des revendications 1 à 4, dans lequel le moyen de pression comprend un mécanisme élastique constitué d'une ou plusieurs tiges préchargées, dans lequel un rouleau de guidage, qui peut rouler sur la surface inclinée (44) sur le bord du trou, est agencé à proximité de l'extrémité externe sur une tige préchargée.

8. Dispositif selon l'une quelconque des revendications précédentes, dans lequel le moyen de pression comprend une partie d'arbre comportant un filet de vis agencé entre la partie formant plaque (2) et le bord du trou.

9. Procédé de retrait d'une plaque à partir d'un trou (4) dans le sol en utilisant un dispositif selon la revendication 1, comprenant les étapes suivantes de :

- mise en place, par un opérateur, d'un outil (42) destiné à agir sur une partie formant plaque (2) dans une cavité (40) agencée à cet usage sur la partie formant plaque (2) ;
- application d'une force par le moyen de pression sur la partie formant plaque (2) qui est au moins, dans une certaine mesure, inférieure à la force de gravité résultant de la masse de la partie formant plaque (2) ;
- avec l'outil (42), application d'une force par l'opérateur sur la partie formant plaque (2) qui est, au moins dans une certaine mesure, supérieure à la différence entre la force exercée sur la partie formant plaque (2) par le moyen de pression et la force de gravité résultant de la masse de la partie formant plaque (2) ;
- soulèvement de la partie formant plaque (2) par l'action simultanée du moyen de pression et de la force exercée par l'opérateur ; et
- déplacement de la partie formant plaque (2) sur le bord (8) du trou (4) dans une position dans laquelle la partie formant plaque (2) est située, au moins partiellement, de manière adjacente au trou (4) ; et
- dans lequel le déplacement de la partie formant plaque (2) sur le bord (8) du trou (4) comprend l'étape supplémentaire de guidage de la partie formant plaque (2) par glissement ou roulement à partir d'une position dans laquelle la partie formant plaque (2) obture sensiblement le trou (4), au-dessus d'une surface inclinée (44) agencée sur le bord (8) du trou (4), vers une position au moins partiellement adjacente au trou (4).

10. Procédé de retrait d'une plaque à partir d'un trou (4) dans le sol en utilisant un dispositif selon la revendication 1, comprenant les étapes suivantes de :

- mise en place d'un opérateur debout sur une partie formant plaque (2) situé dans une position la plus basse par rapport à un bord (8) d'un trou (4) ;
- déverrouillage d'un moyen de verrouillage (16) qui verrouille la partie formant plaque (2) dans la position la plus basse par rapport au bord (8) ;
- déplacement de l'opérateur qui avait pris une position debout sur la partie formant plaque (2) hors de la partie formant plaque (2) ;
- soulèvement par le moyen de pression de la partie formant plaque (2) depuis la position la plus basse vers une position la plus haute, position la plus haute dans laquelle la partie formant plaque (2) est positionnée de manière à pouvoir se déplacer au-dessus du bord (8) du trou (4) ;
- mise en place d'un outil (42) destiné à agir sur la partie formant plaque (2) dans une cavité (40) agencée dans ce but sur la partie formant plaque (2) ;
- déplacement de la partie formant plaque (2) au-dessus du bord (8) du trou (4) dans une position dans laquelle la partie formant plaque (2) est située, au moins partiellement, de manière adjacente au trou (4) ; et
- dans lequel le déplacement de la partie formant plaque (2) au-dessus du bord (8) du trou (4) comprend l'étape supplémentaire de guidage de la partie formant plaque (2) par glissement ou roulement à partir d'une position dans laquelle la partie formant plaque (2) obture sensiblement le trou (4), sur une surface inclinée (44) agencée sur le bord (8) du trou (4), vers une position au moins partiellement adjacente au trou (4).

11. Procédé selon la revendication 9 ou 10, dans lequel la partie formant plaque (2) est montée sur le bord du trou afin de pouvoir tourner autour d'un point de rotation, et dans lequel un élément de saisie de verrouillage du moyen de verrouillage qui est agencé à proximité du point de rotation limite le mouvement de rotation de la partie formant plaque (2) dans une position extrême dans laquelle la partie formant plaque est située, au moins partiellement, de manière adjacente au trou.

12. Procédé selon l'une quelconque des revendications 9 à 11, dans lequel le guidage de la partie formant plaque au-dessus de la surface inclinée (44) comprend l'étape de roulement d'un rouleau de guidage (46) agencé sur la partie formant plaque (2) au-dessus de cette surface inclinée (44).

13. Procédé selon l'une quelconque des revendications 9 à 12, dans lequel le moyen de pression comprend un arbre comportant un filet de vis agencé entre la partie formant plaque (2) et le bord du trou, et le soulèvement de la partie formant plaque (2) par le moyen de pression est assuré en faisant tourner cet arbre comportant un filet de vis.

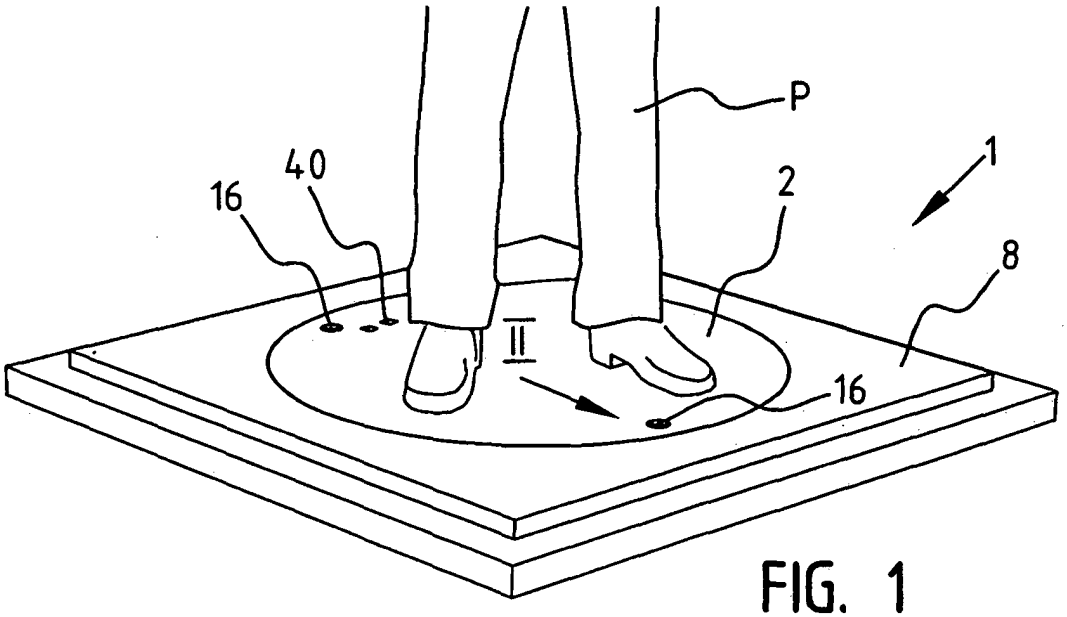


FIG. 1

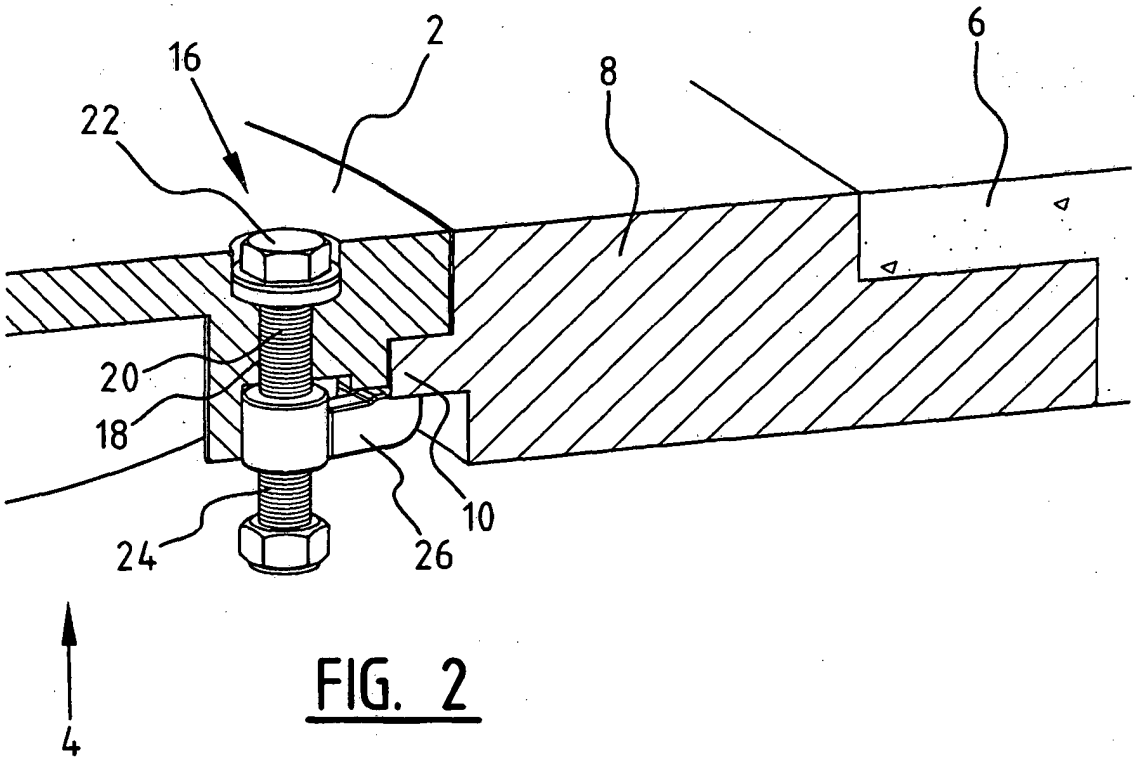


FIG. 2

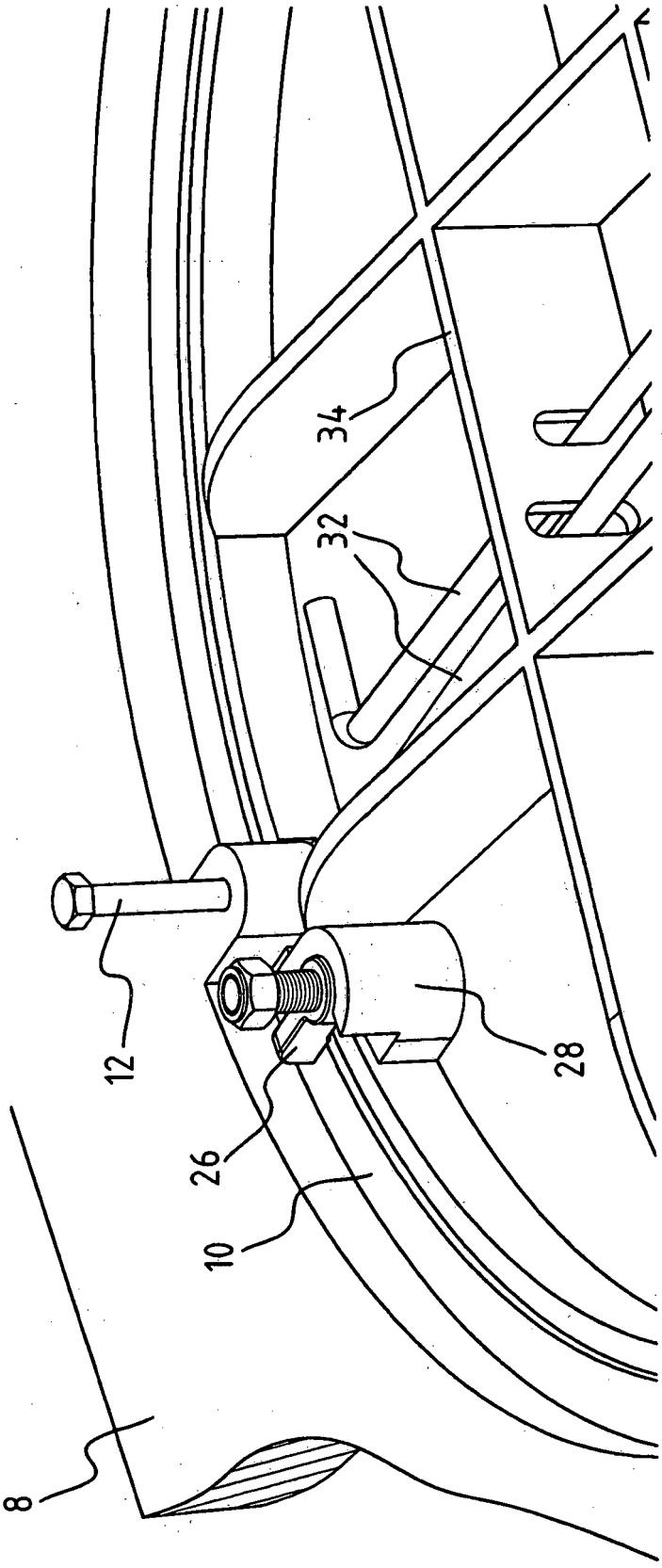


FIG. 3

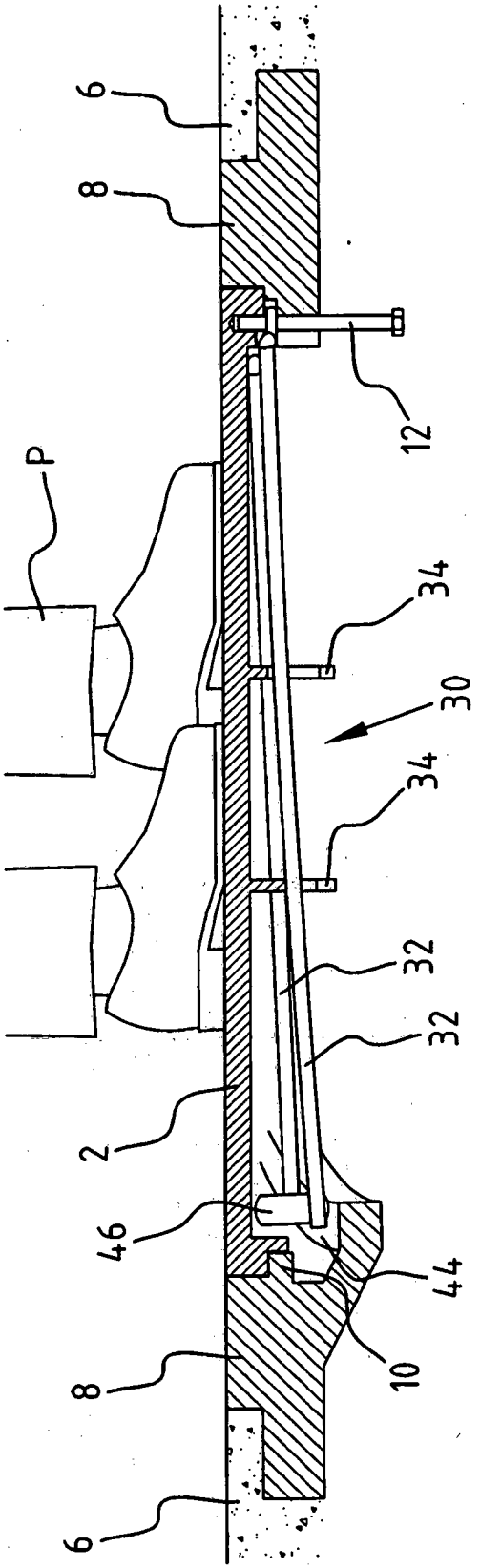


FIG. 4A

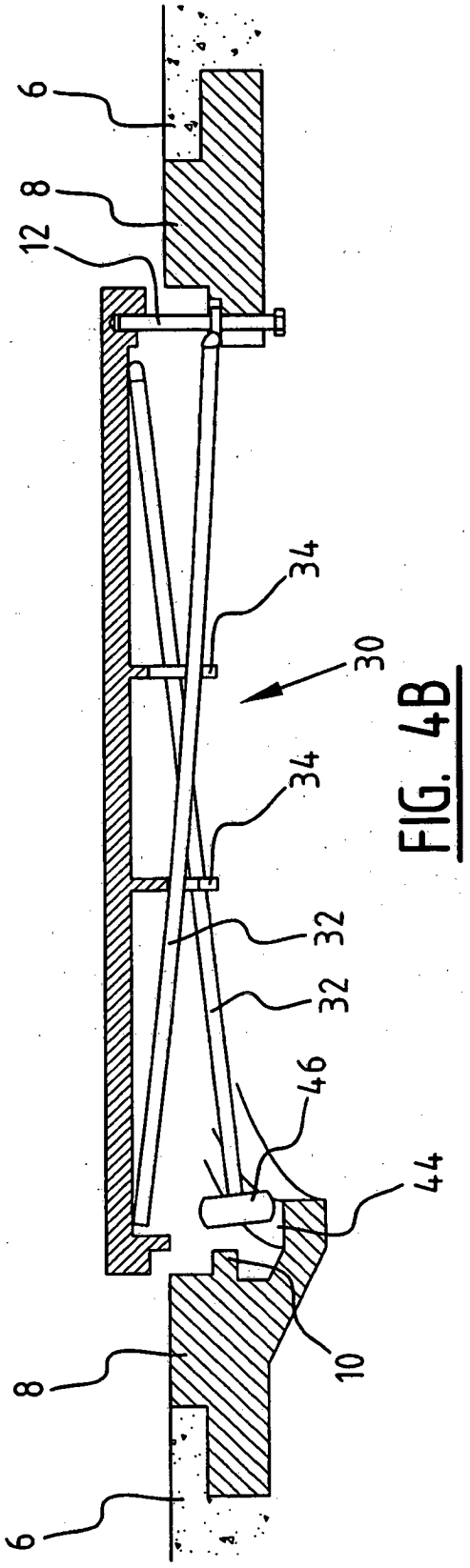


FIG. 4B

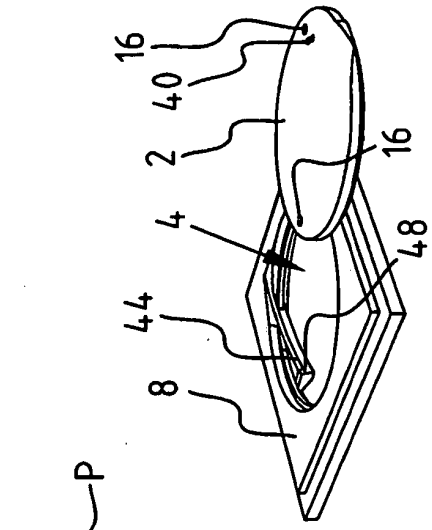


FIG. 8

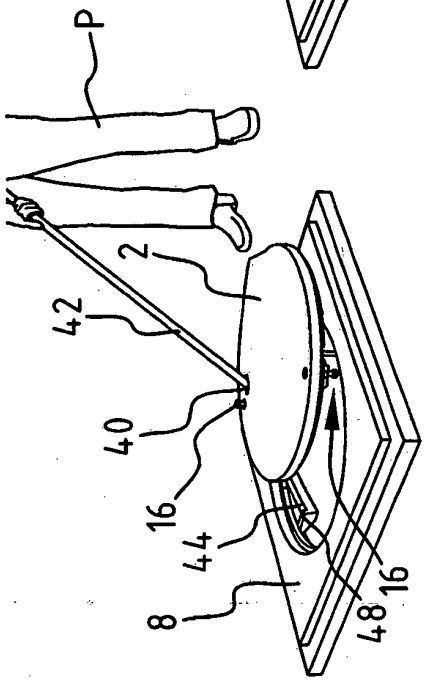


FIG. 6

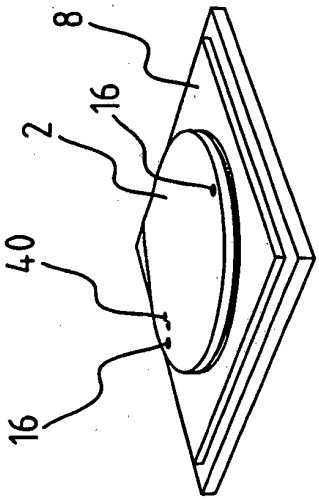


FIG. 5

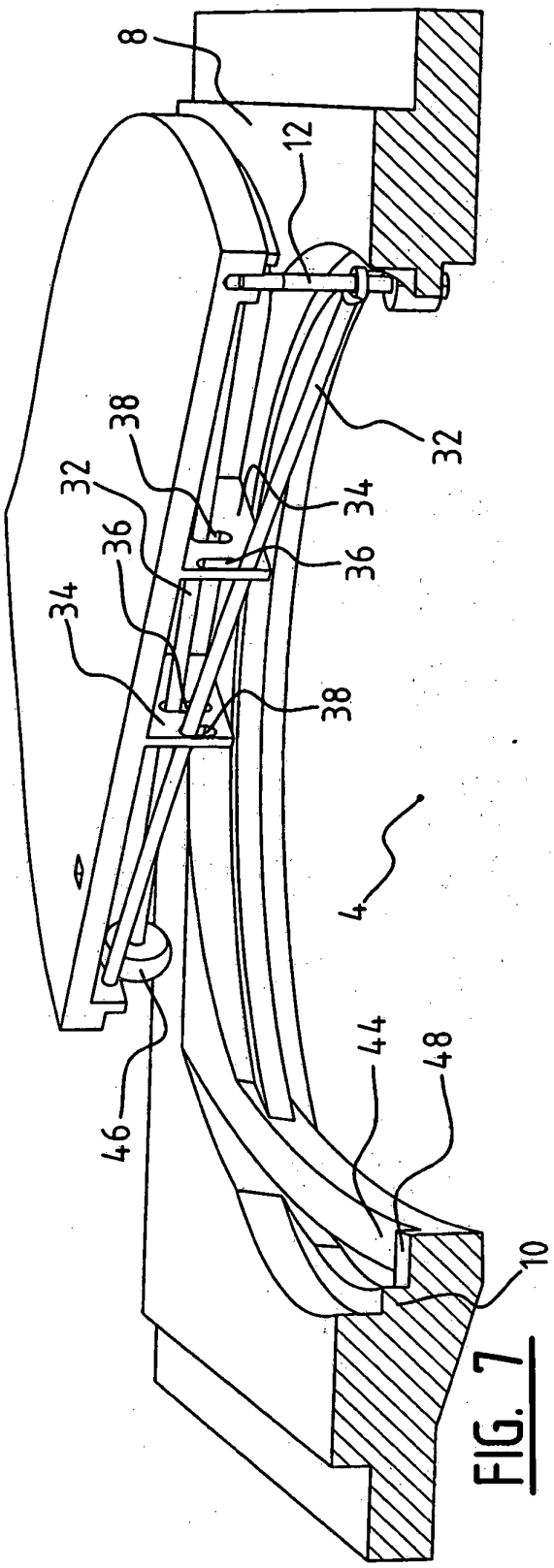


FIG. 7

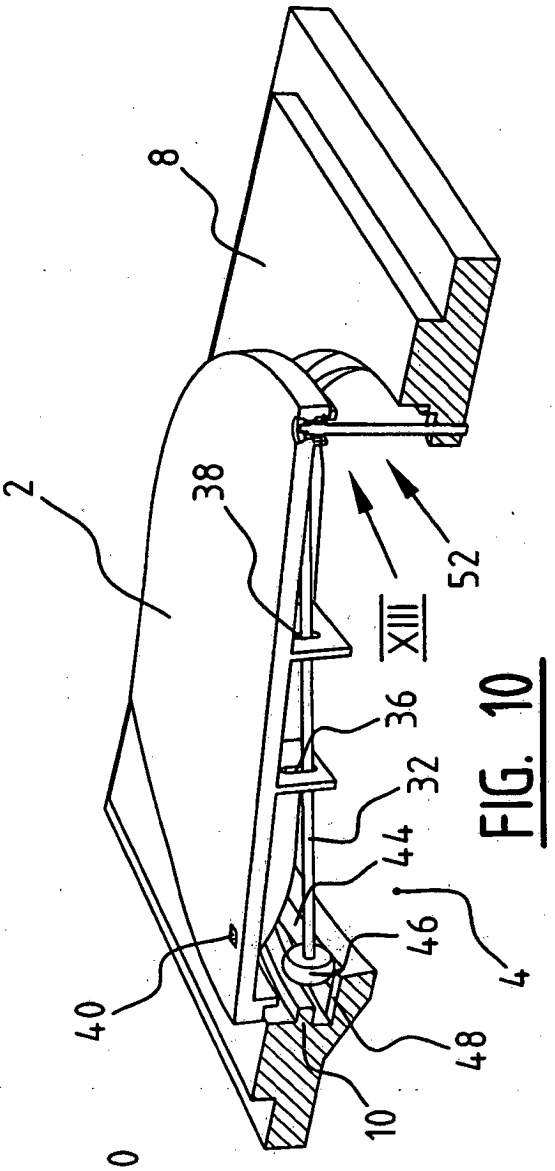


FIG. 10

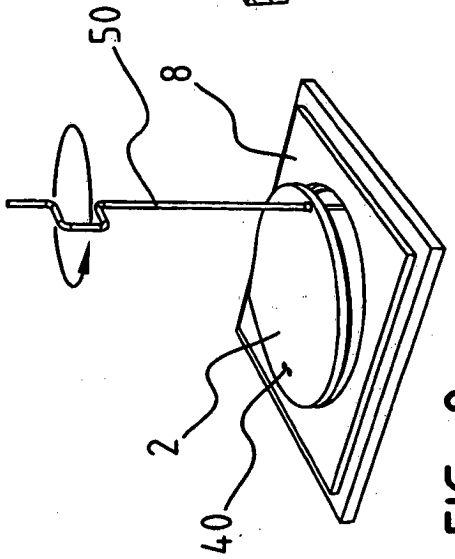


FIG. 9

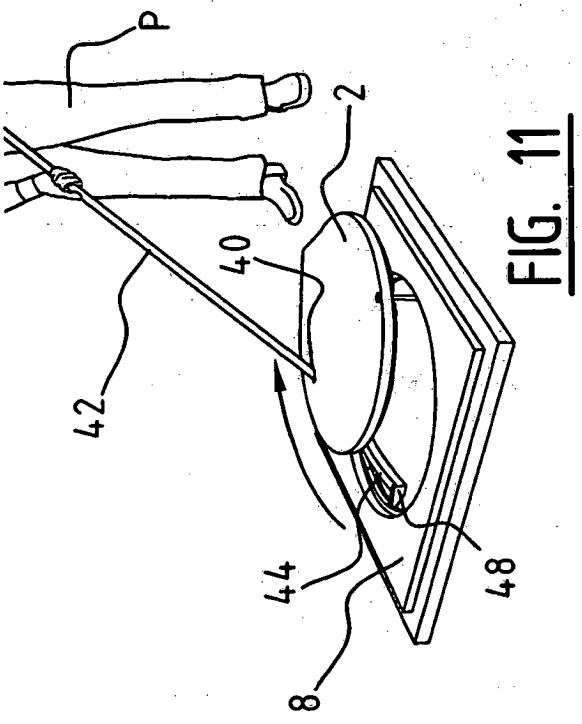


FIG. 11

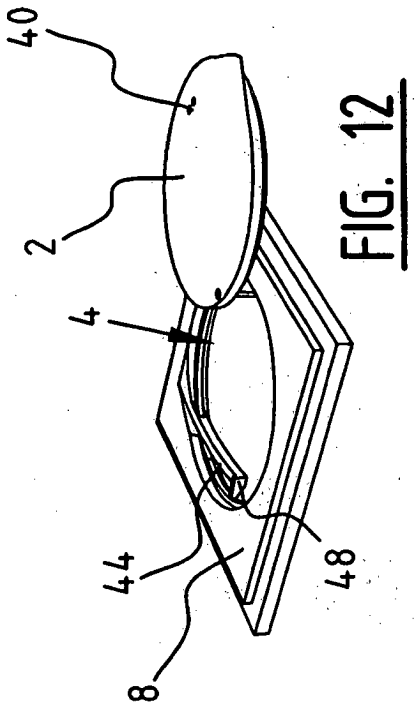


FIG. 12

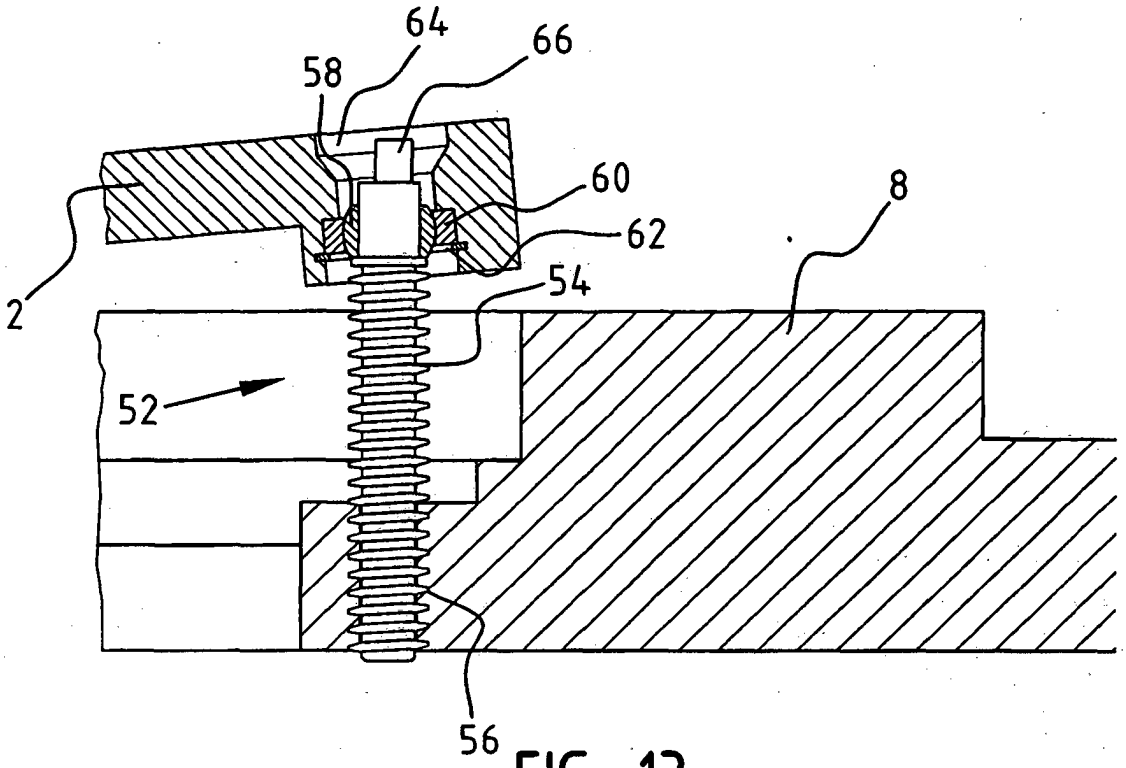


FIG. 13

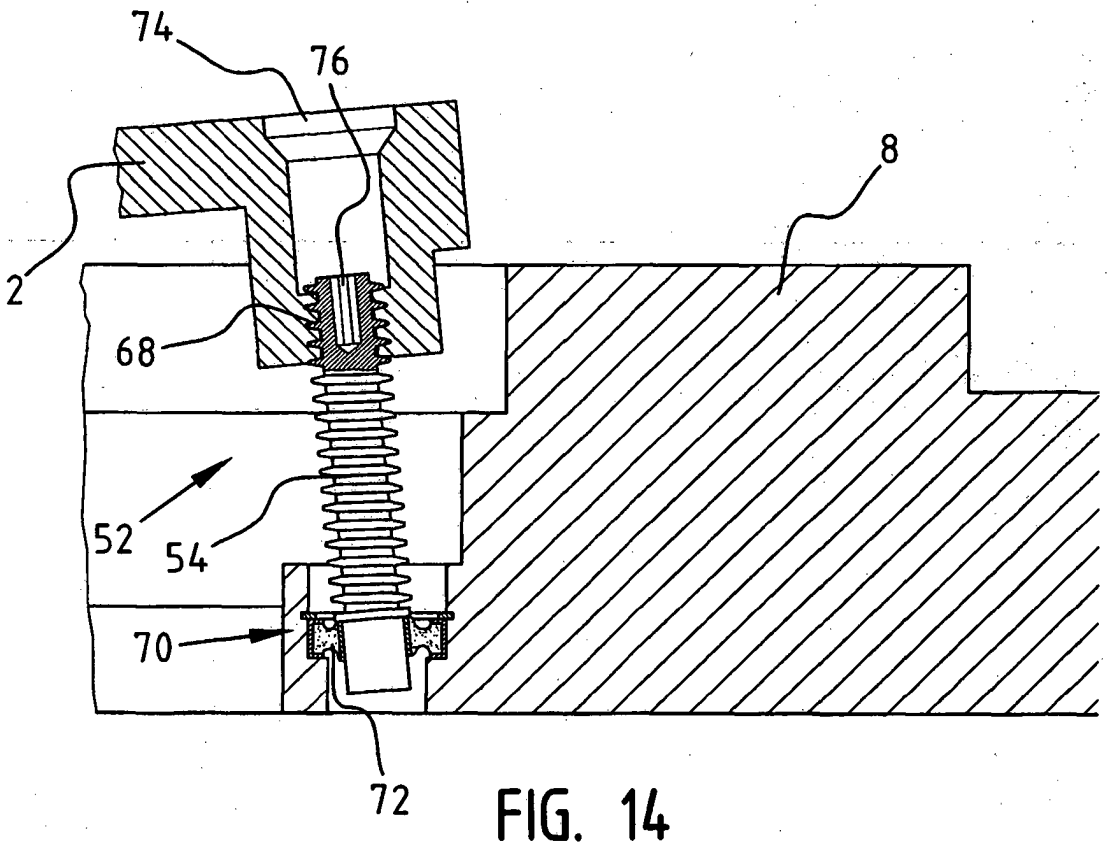


FIG. 14

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- DE 19514636 A1 **[0005]**
- US 20070274779 A1 **[0005]**