



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
16.04.2008 Bulletin 2008/16

(51) Int Cl.:
E02D 29/14^(2006.01) E05B 35/00^(2006.01)

(21) Application number: **07075870.1**

(22) Date of filing: **08.10.2007**

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HU IE IS IT LI LT LU LV MC MT NL PL PT RO SE SI SK TR
Designated Extension States:
AL BA HR MK RS

(30) Priority: **10.10.2006 NL 1032660**
18.06.2007 NL 1034000

(71) Applicant: **TBS Soest b.v.**
NL-3762 EC Soest (NL)

(72) Inventor: **Ent, Wouter**
4171 CB Herwijnen (NL)

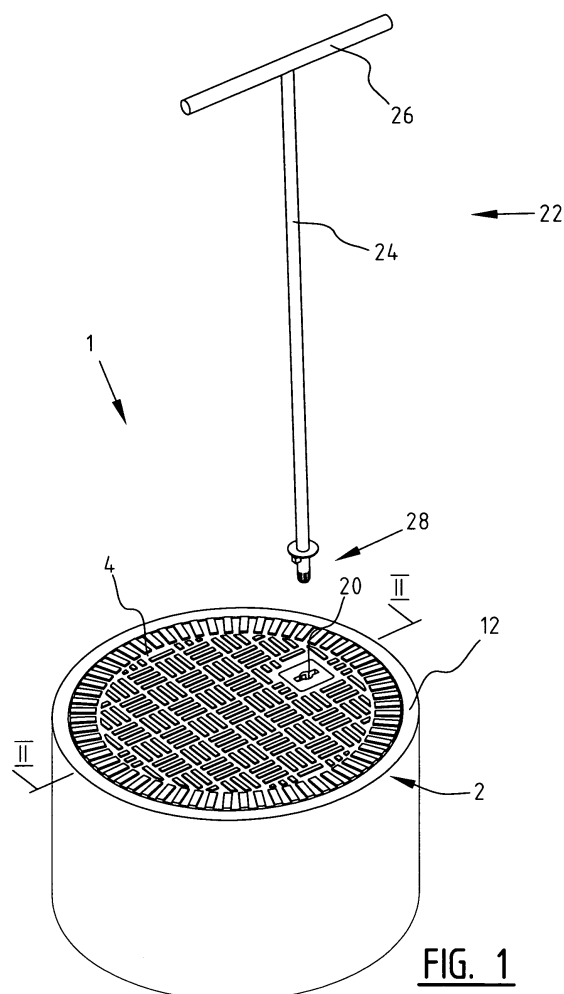
(74) Representative: **Land, Addick Adrianus Gosling et al**
Arnold & Siedsma
Sweelinckplein 1
2517 GK Den Haag (NL)

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

(57) The present invention relates to a closing device (1) for closing a hole (2) in the ground, comprising:
- a lightweight plate part (4) for closing the hole in an edge (12) thereof; and
- locking means for locking and unlocking the plate part relative to the edge, wherein the locking means comprise a mechanism which can be operated via an opening (20) in the plate part.

The invention also relates to a closing system and a method for respectively unlocking and locking a lightweight plate part relative to a hole in the ground, comprising the steps of:

- inserting a tool (22) in a first insertion position into an opening (20) of a plate part (4) arranged for this purpose, wherein the plate part comprises locking means for locking the plate part relative to an edge (12) of the hole (2);
- moving the tool from the first insertion position into a second handling position, wherein in the first insertion position the tool can be respectively inserted into and removed from the plate part; and
- moving the tool from the second handling position to the first insertion position, wherein the tool operates the locking means from an unlocked position to a locked position.



Description

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

[0002] The present invention relates particularly to a manhole cover. When a manhole cover is applied in areas where traffic will drive over the manhole cover, it is important that the manhole cover does not spring upward or become otherwise detached as a result of the traffic travelling thereover. Conventional manhole covers, which are normally manufactured from cast iron, have a sufficiently high mass that they are not prone to springing upward when traffic drives thereover. A drawback of these conventional cast-iron covers is that, due to their high mass, they are not easy to handle. In order to increase ease of handling of manhole covers lightweight variants have been developed. A drawback of these lightweight covers is that they are indeed prone to springing upward, and can moreover even be lifted up by a rising (ground)water level.

[0003] Specific requirements have been laid down for lightweight closing devices in order to guarantee the safety of such lightweight closing devices. The standard valid for the Netherlands in 2006, NEN-EN 124:2004, which relates to gratings and covers for manholes and drains in areas subjected to vehicular traffic, states that all manhole covers must be able to withstand a determined pressure load and that non-locked manhole covers in the Netherlands must weigh a minimum of 200 kg/m². The regulations differ per country. In 2006 a minimum weight applied in Germany for instance of 300 kg/m². According to this standard, a lightweight closing device must be locked at all times when applied in areas subjected to vehicular traffic.

[0004] Existing lightweight covers are usually provided with locks arranged in the frame/concrete supporting the cover. With this type of existing lock arranged in the edge of the hole enclosing the cover, a pin is moved out of the edge into the cover by means of a lever mechanism to be operated via a socket screw key. The drawback of these existing locks is that they can be forgotten, whereby a manhole cover can be left unlocked. When such an unlocked manhole cover springs up and comes to lie on for instance a roadway or leaves a hole unclosed, hazardous situations can thereby occur. It is furthermore possible for such lightweight manhole covers to be lifted up in the case of a high groundwater level, and to possibly even float away. This is also undesirable since this too can result in hazardous situations.

[0005] There is therefore a need for a closing device for closing a hole in the ground which can be locked in a reliable manner in order to prevent springing upward or detaching in other manner.

[0006] An object of the present invention is to provide a closing device for closing a hole in a ground, wherein the above stated problems are obviated and in particular a reliable locking mechanism is provided.

[0007] Said object is achieved with the closing device

for closing a hole in the ground, comprising a lightweight plate part for closing the hole in an edge thereof, and locking means for locking and unlocking the plate part relative to the edge, wherein the locking means comprise a mechanism which can be operated via an opening in the plate part.

[0008] A closing device with a reliable locking mechanism is provided by arranging the locking means for locking and unlocking the plate part relative to the edge in the plate part where these locking means can be operated via an opening.

[0009] In a preferred embodiment of the invention the locking means can be operated with a tool which can be inserted in the opening in the plate part. By making use of a single tool a person can operate the locking means situated internally in the lightweight plate part, while the same tool is also suitable for placing the plate part on and/or removing it from the hole in the ground in ergonomically responsible manner. The closing device according to the present invention in this way integrates the locking mechanism into the generally known lifting mechanism.

[0010] In a preferred embodiment the opening in the plate part comprises a non-round form, and the tool which can be inserted into the non-round opening in the plate part is rotatable between a first insertion position, in which the tool can be inserted and taken out, and a second handling position in which the tool urges the locking means into an unlocked position, and removal of the tool through the non-round opening is prevented. In the first insertion position, the locking means are in a locked position. The non-round form is for instance a slot-like recess in the plate part behind which the tool hooks in its handling position, whereby the tool can only be taken out of the plate part in a locked position of the locking means.

[0011] In a further preferred embodiment of the present invention the locking means can be operated such that the locking means are situated in a locked position of the plate part relative to the edge when the tool is situated in an insertion position where it is removable from the opening. This guarantees that, when the tool is removed from the opening of the plate part, the locking means are situated at all times in a locked position in which the plate part is locked relative to the edge. Since the tool cannot be taken out without leaving the closing device in locking position, a very reliable closing device is provided for closing a hole in the ground.

[0012] In a further preferred embodiment of the invention the locking means can be operated such that the locking means are situated in an unlocked position of the plate part relative to the edge when the tool is situated in a handling position for handling the plate part in the opening of the plate part. When the tool is moved in the plate part to the handling position for the purpose of removing the plate part from the hole in the ground, the locking means will be automatically unlocked. In this way a closing device is provided for closing a hole in the ground which unlocks automatically at moments when

the plate part must be removed, while at other moments locking of the closing device is guaranteed.

[0013] In a further preferred embodiment of the present invention the locking means comprise a locking pin which can be engaged with the tool such that the locking pin is moved from a locked position to an unlocked position when the tool is operated for the purpose of taking the plate part out of the hole. The locking means in this preferred embodiment comprise a locking pin which is moved in and out of the plate part when the locking means are brought into the locked position.

[0014] In a further preferred embodiment of the present invention a hole for receiving the locking pin is arranged in the edge of the hole. The hole arranged in the edge receives the locking pin when it is situated in the locked position, thereby locking the plate part relative to the edge.

[0015] In yet another preferred embodiment of the invention a channel arranged in the peripheral direction of the edge of the hole is arranged in the edge of the hole for the purpose of receiving the locking pin. Although it is possible according to the above described preferred embodiment for the locking pin to be received in a hole, this has the drawback that the plate part must be arranged in the edge such that the locking pin falls into the locked position in the hole of the edge. By arranging in the edge of the hole a channel arranged in peripheral direction the plate part can be locked to the edge in all positions. In this way a closing device is therefore provided wherein the plate part can be arranged flexibly in the edge of the hole.

[0016] In yet another preferred embodiment of the present invention the opening for receiving the tool in the plate part comprises a borehole. Although it is possible for the locking mechanism arranged in the plate part to be situated in a closed housing which has an opening only on the top side for the purpose of receiving a tool, it is recommended that the locking means are placed in a housing which is open on both the top and bottom side. This prevents the possibility of dirt accumulating in the housing of the locking means.

[0017] In yet another preferred embodiment of the present invention at least a part of the locking pin comprises a toothing. By providing the part of the locking pin which engages with the tool with a toothing, such as for instance a gear rack form, it is possible to convert a rotation movement of the tool into a translation movement for the purpose of moving the locking pin between an unlocked and locked position. It is possible to envisage the tool not engaging directly onto the locking pin, but this taking place via a bush arranged rotatably in the plate part, wherein the bush comprises on its outer periphery a toothing which can engage with the toothing of the locking pin.

[0018] In a further preferred embodiment the closing device comprises a bush arranged rotatably in the plate part, wherein the bush comprises on its outer periphery a protrusion which can engage with a recess arranged

in the locking means. By performing an angular rotation of the bush via the tool, the locking means are displaced by the protrusion situated on the outer periphery of the bush from a locked position of the plate part relative to the edge to an unlocked position of the plate part relative to the edge, and vice versa. The bush comprises an opening in which the tool can be received in an engaging manner in order to effect an engaging contact between the tool and the bush.

[0019] In a further preferred embodiment the locking means comprise a locking pin, and the recess arranged in the locking pin comprises an inclining surface at least on its outward facing side, i.e. on its side directed toward the edge of the hole in the ground. This inclining surface, at least in the position where the plate part is locked relative to the edge, lies substantially perpendicularly of the front side of the protrusion arranged on the outer periphery of the bush. The protrusion hereby acquires a locking property which prevents the possibility of the locking pin being pushed inward from the outer edge to an unlocked position, which is indeed possible for instance in the case of the gear rack. The substantially right-angled contact between the front side of the protrusion and the inclining surface provides in simple manner a locking function which further precludes undesired removal of the plate part. Only by using the correct tool can the bush be rotated, whereby the locking means can be operated via the protrusion.

[0020] In order to provide a substantially perpendicular contact surface between the front side of the protrusion and the inclining surface, in a further preferred embodiment the inclining surface is arranged substantially at an angle of 45° to the longitudinal axis of the locking pin.

[0021] In an alternative embodiment the locking pin comprises an inclining contact surface. When the tool engages with this inclining contact surface and, using the tool, a pushing force is exerted on this contact surface, this contact surface and thereby also the locking pin are displaced in a direction transversely of the pushing direction of the tool. The translation movement of the tool is converted via the inclining contact surface into a translation movement of the locking pin substantially transversely of the translation movement of the tool. The locking pin can in this way be moved between an unlocked and locked position.

[0022] In a further embodiment the contact surface makes an angle greater than 45° with the longitudinal axis of the locking pin, this guaranteeing a good conversion of the translation movement of the tool into the translation movement of the locking pin.

[0023] In a further preferred embodiment of the present invention the plate part is manufactured from plastic, composite or lightweight metal, whereby a lightweight plate part is provided for a closing device for closing the hole in the ground. Such a lightweight plate part, whereby the mass of the plate part can be reduced per square metre by a factor of eight, increases ease of handling relative to the conventional metal, normally cast-iron

plate parts.

[0024] In a still further preferred embodiment of the present invention the hole in the ground comprises a drain of a sewer system. Drains of a sewer system in particular are generally placed such that they are readily and freely accessible. As a result such drains will often be situated in areas subjected to vehicular traffic, where the compulsory locking requirement for lightweight covers referred to in the introduction is applicable.

[0025] The present invention also relates to a closing system comprising a closing device as described above, and a tool which can be inserted into the opening of the plate part, wherein the tool operates the locking means such that the locking means are situated in a locked position of the plate part relative to the edge when the tool is situated in an insertion position where it is removable from the opening, and the locking means are situated in an unlocked position of the plate part relative to the edge when the tool is situated in a handling position for handling the plate part in the opening of the plate part.

[0026] The present invention further relates to a method for respectively unlocking and locking a lightweight plate part relative to a hole in the ground, comprising the steps of:

- inserting a tool in a first insertion position into an opening of a plate part arranged for this purpose, wherein the plate part comprises locking means for locking the plate part relative to an edge of the hole;
- moving the tool from the first insertion position into a second handling position, wherein in the first insertion position the tool can be respectively inserted into and removed from the plate part;
- moving the tool from the second handling position to the first insertion position, wherein the tool operates the locking means from an unlocked position to a locked position.

[0027] The tool engages with the locking means such that, during rotation to a position enabling removal of the tool from the opening of the plate part or during the translation movement for removing the tool itself from the opening of the plate part, the tool carries the locking means into a locked position. This method hereby guarantees that the locking means lock the plate part to its edge when a tool is removed from the opening of the plate part. A movement of the tool from the insertion position to the handling position operates the locking means from a locked position to an unlocked position.

[0028] In a preferred embodiment the tool can only be inserted into and removed from the plate part in the first insertion position, whereby the tool cannot be taken out in the unlocked handling position.

[0029] In a preferred embodiment the method comprises the step of taking the tool out of the opening of the plate part, wherein the plate part is locked relative to the hole in the ground.

[0030] In a further preferred embodiment the tool is

oriented for handling the plate part in the second handling position, and the method further comprises the step of handling, if desired, and placing the plate part in a hole in the ground.

[0031] In yet another further preferred embodiment the opening in the plate part comprises a non-round form through which the tool can be inserted into and removed from the plate part in the first insertion position. The non-round form prevents the tool from being taken out of the non-round opening of the plate part in the second handling position, in which the locking means are situated in an unlocked position.

[0032] In a preferred embodiment of this method, when the tool is moved from the handling position to the insertion position, the tool operates the locking means from an unlocked position to a locked position. In this preferred embodiment moving of the tool from the handling position to the insertion position comprises of a rotation movement of the tool which, via a mechanical connection such as a gear rack or via a protrusion, is converted into a translation movement for locking and unlocking the locking means.

[0033] The handling position for handling the plate part with the tool, for instance for the purpose of removing from the hole or placing the plate part on the hole, corresponds with locking means situated in the unlocked position. Conversely, the insertion position for taking the tool out of the plate part corresponds with locking means situated in a locked position.

[0034] In a further preferred embodiment of the method, moving of the tool from a handling position for handling the plate part with the tool to an insertion position for taking the tool out of the plate part comprises of an angular displacement.

[0035] In yet another preferred embodiment of the invention the angular displacement between the handling position for handling the plate part with the tool and the insertion position for taking the tool out of the plate part is substantially 45°, 90°, 135°, 180°, 225°, 270° or 315°. The angular displacement more preferably comprises substantially 90°. By making the angular displacement at least a quarter-turn, a sufficiently robust system is provided which can only be unlocked by means of an intentionally applied angular displacement with an appropriate tool.

[0036] In an alternative method the locking means are moved, during removal of the tool from the opening of the plate part, to a locked position relative to the edge of the hole. The translation movement of inserting and removing the tool into and out of the opening of the plate part is converted into a translation movement for unlocking and locking the locking means.

[0037] In the following description an exemplary embodiment is further elucidated with reference to the drawing, in which:

Figure 1 is a perspective view of a hole in the ground on which a plate part is arranged;

Figure 2 shows a cross-sectional view of a plate part according to the present invention arranged in an edge of the hole;

Figure 3 is a perspective cross-sectional view of the locking means of the plate part shown in figure 2;

Figure 4 is a perspective cross-sectional view of the plate part shown in figure 2, wherein a tool is in engagement with the locking pin;

Figure 5 is a perspective cross-sectional view of the plate part shown in figure 2, wherein the tool is situated in a position for handling the plate part;

Figures 6A-6C show cross-sectional views of an alternative embodiment according to the present invention;

Figures 7A and 7B show cross-sectional views of a further alternative embodiment;

Figures 8A-8C show perspective views of a further alternative embodiment;

Figure 9A shows a perspective cross-sectional view of an alternative embodiment in a locked position;

Figure 9B is a bottom view of the locked position of the locking means shown in figure 9A;

Figure 10A is a perspective cross-sectional view of the embodiment of figure 9A in an unlocked position; and

Figure 10B is a bottom view of the unlocked position of the locking means shown in figure 10A.

[0038] The preferred embodiment of figures 1-5 comprises a closing device 1 arranged on hole 2, wherein hole 2 is a manhole having an edge 12. In the situation shown in figure 1 the manhole is closed by plate part 4, which will be further referred to as cover 4. Arranged in cover 4 is an opening 20 through which a tool 22 can be inserted. Tool 22 comprises a rod 24, a handle 26 and an outer end 28, wherein this outer end comprises a contact surface 30, protrusions 32 and a toothing 34.

[0039] Figure 2 shows a sectional view of a cover 4 arranged in edge 12. Cover 4 is of a lightweight plastic type, comprising outer walls 6 and intermediate walls 8. A foam filling 10 is arranged in the internal volume of cover 4, i.e. the volume enclosed by outer walls 6 and intermediate walls 8, in order to impart strength to cover 4. Although in the preferred embodiment shown in figure 2 the edge 12 is assembled in similar manner to cover 4, it will be apparent to a skilled person that alternative embodiments of edge 12 are also possible. A seal 14 can also be arranged between cover 4 and edge 12.

[0040] In cover 4 locking means comprising a locking pin 16 are arranged in a housing 38. In this preferred embodiment locking pin 16 has over a part of the pin a toothing 36 on which a toothing 34 arranged on outer end 28 of tool 22 can engage in order to enable movement of locking pin 16 between a position locking cover 4 to and unlocking cover 4 from edge 12. Locking pin 16 preferably has a form such that it is arranged form-fittingly in its peripheral direction in its recess of cover 4, for instance by embodying locking pin 16 with a flat side. Because

the degree of freedom of the rotation movement of locking pin 16 around its longitudinal axis is fixed, the orientation of locking pin 16 is guaranteed to be such that the toothing 36 arranged in locking pin 16 can be engaged at all times by toothing 34 of tool 22 via the opening. In the locked position of cover 4 to edge 12 the locking pin 16 is situated such that the outer end engages in recess 18 of edge 12. Although it is possible to envisage recess 18 being a hole, it is recommended to embody recess 18 as a peripheral channel.

[0041] In the embodiment where recess 18 is a hole, it is essential to position plate 4 in the correct manner in edge 12. An orienting protrusion 40 arranged on cover 4 can be inserted for the purpose of correct positioning of cover 4 into a recess 42, which also comprises a hole, arranged for orienting protrusion 40.

[0042] In a further preferred embodiment it is recommended that recess 18 comprises a channel arranged in peripheral direction in edge 12, whereby the recess 42 shown in figure 2 and recess 18 shown in the same view form the same component. By embodying recess 18 as channel the cover 4 can be placed more flexibly in edge 12, since pin 16 does not have to coincide per se with a specific hole for recess 18.

[0043] A bias can optionally be exerted on locking pin 16 by a spring (not shown) arranged behind locking pin 16 which ensures that locking pin 16 - even when it is exposed to vibrations as a result of traffic driving over the cover - remains in a locked position. The bias produced by the spring is preferably such that it provides locking pin 16 with sufficient resistance to undesired movement to an open position, but can be easily overcome with tool 22.

[0044] Figure 3 shows the locking means comprising a housing 38 in which a locking pin 16 is provided over at least a part of which is arranged a toothing 36. In the preferred embodiment housing 38 is open on the underside in order to prevent accumulation of dirt in housing 38. Arranged on the top side of housing 38 is an opening 20 through which tool 22 can be inserted with its outer end 28 into housing 38 of the locking means. Opening 20 has a form such that tool 22 can only be inserted (insertion positions) and removed in specific positions through opening 20. On outer end 28 of tool 22 is arranged a contact surface 30 which forms a boundary when tool 22 is placed into opening 20. Contact surface 30 is positioned on rod 24 such that - when contact surface 30 makes contact with the top side of housing 38 - toothing 34 engages with toothing 36 of locking pin 16 as shown in figure 4. Protrusions 32 on tool 22 are situated in the position shown in figure 4 such that the tool can be inserted into housing 38 through opening 20. When tool 22 is rotated to the position shown in figure 5, protrusions 32 will be displaced such that a part of housing 38 is situated between contact surface 30 and protrusion 32. The tool is in this way brought into engagement with housing 38 and therefore cover 4, so that with the tool in this position cover 4 can be handled for the

purpose of removing or re-placing cover 4 from or onto manhole 2.

[0045] During the rotation of tool 22 from the insertion position shown in figure 4 to the handling position shown in figure 5 the toothing 34 of tool 22 has engaged on toothing 36 of locking pin 16 such that locking pin 16 has moved from the position of cover 4 locked to edge 12 to the position of cover 4 unlocked from edge 12.

[0046] The closing device according to the present invention in accordance with the above described preferred embodiment provides a closing device for closing a hole in the ground, wherein the locking is such that it is impossible to withdraw tool 22 from cover 4 without leaving cover 4 locked to edge 12. Using the closing device according to the present invention a reliable and safe system is therefore provided which is particularly suitable for avoiding the risk in traffic situations of lightweight covers 4 springing upward or becoming otherwise detached and resulting in hazardous situations.

[0047] Figures 6A-6C show an alternative embodiment of a closing device according to the invention, comprising a cover 104 which is arranged in an edge 112 of a manhole and thereby closes the manhole. Arranged in cover 104 is an opening 120 through which a tool 122 can be inserted. Tool 122 comprises a rod 124, a handle 126 and an outer end 128, wherein this outer end comprises a contact surface 130 and protrusions 132. Locking pin 116 has an inclining contact surface 117 which, in the position of locking pin 116 locking the cover 104 to edge 112, is situated substantially in opening 120. When tool 122 is inserted into opening 120 (figure 6A) and pushes against the inclining contact surface 117, this inclining surface 117, and thereby the locking pin 116, is displaced transversely of the pushing direction of the tool. When tool 122 is pushed downward, locking pin 116 is moved to a position unlocking cover 104 from edge 112 (figure 6B), and cover 104 can be removed with tool 122 from edge 112 of the manhole once tool 122 has been brought with its protrusion 132 into engagement with recess 121 of cover 104 (figure 6C). When tool 122 is once again moved upward out of opening 120, spring 144 pushes locking pin 116 back to a position in which locking pin 116 locks cover 104 to edge 112 as shown in figure 6A.

[0048] It is noted that in the locked position locking pin 16 preferably also leaves a space clear such that dirt, which may have fallen into opening 120, flows out with (rain)water through opening 120 and falls into the manhole.

[0049] Figures 7A and 7B show a further preferred embodiment, wherein protrusion 232 of the tool drops into the recess of cover 204 (figure 7B) which is also used for locking pin 216. Because no additional recess need be arranged for protrusion 232, this simplifies the design and therefore the manufacture of cover 204.

[0050] Figures 8A-8C show an alternative embodiment wherein a bush 346 is arranged between locking pin 316 and tool 322. Bush 346 can be engaged by pro-

trusions 332 of tool 322 via recesses 348 arranged in bush 346. The bush 346 is itself provided with a toothing 350 which is arranged on the outer periphery and which engages on toothing 336 of locking pin 316. Bush 346 is supported on the underside of cover 304 by a flange plate 352.

[0051] This embodiment has the further advantage that the tool can be given a robust form with two protrusions 332, and in particular does not comprise a vulnerable toothing. Furthermore, locking pin 316 is arranged in this embodiment outside the space of opening 320 in cover 304 directly accessible with a random tool, which makes opening of the locking mechanism with a random tool more difficult. Cover 304 is hereby less susceptible to vandalism. In this embodiment locking pin 316 is moreover better protected from dirt, which will enhance reliability, reduce maintenance and increase lifespan.

[0052] Figure 8A shows the situation in which locking pin 316 locks cover 304 to edge 312. Recess 348 of bush 346 and recess 320 of cover 304 are mutually aligned such that tool 322 can be brought with its protrusions 332 into engagement through recess 320 with recess 348 of bush 346 (figure 8B). When tool 322 is rotated from the position shown in figure 8B to the position shown in figure 8C, bush 346 will co-rotate with tool 322 via the engagement between protrusions 332 and recess 348. Locking pin 316 is then operated via the engagement between toothing 350 arranged on the bush and toothing 336 of locking pin 316. Figure 8B shows the insertion position, while figure 8C shows the handling position.

[0053] When locking pin 316 is situated in a position where cover 304 is unlocked from edge 312, protrusions 332 of tool 322 are situated in the position enclosed in cover 304 shown in figure 8C. In this enclosed position tool 322 can be used to remove cover 304 from the edge 312 of the manhole.

[0054] In an alternative embodiment (figures 9 and 10) there is arranged in cover 404 a housing 438 which comprises on its top side an opening 420 through which the tool 422 fits. Protrusions 432 are arranged on rod 424 of tool 422. These protrusions fit into recess 448 of the bush 446 arranged rotatably in housing 438 and can engage on a stop 449 arranged in recess 448. Figure 9A shows the situation in which tool 422 is located outside cover 404 and locking pin 416 engages in opening 418 of edge 412 of the hole in the ground. In this position locking pin 416 locks cover 404 to the hole in the ground. Arranged on the outer periphery of bush 446 is a protrusion 450 which in the locked position (figures 9A, 9B) makes a preferably perpendicular contact on its front side 451 with an inclining surface 418 of an opening 417 arranged in locking pin 416. Due to this substantially perpendicular contact between surfaces 418 and 451 (figure 9B) the protrusion 450 has a locking function which prevents the possibility of displacing locking pin 416 to an unlocked position by means of exerting an inward directed force thereon. The reliability of the locking is therefore improved by the locking function of protrusion 450, and par-

ticularly unlocking of cover 404 by unauthorized persons is prevented. The construction is on the other hand very simple, not susceptible to accumulation of dirt and inexpensive to manufacture.

[0055] Figure 9A shows the insertion position and figure 10A the handling position, wherein the relative position between tool 422 and opening 420 prevents removal of tool 422 from cover 404.

[0056] Only with tool 422 is it possible to rotate bush 446 from a locked position to an unlocked position. During this rotation the protrusion 450 rotates inside opening 417 away from the inclining surface 418, and protrusion 450 will then make contact with the opposite inclining surface 419. When bush 446 is then rotated further into the position where the front side 451 of protrusion 450 makes a substantially perpendicular contact with inclining surface 419 (figure 10B), locking pin 416 is located in the outermost unlocked position. Because protrusions 432 of tool 422 do not fit through opening 420 in this position, the possibility of tool 422 being removed from plate part 404 in the unlocked position is prevented.

[0057] 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 specification of the invention. The scope of the invention is therefore defined solely by the following claims.

Claims

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

- a lightweight plate part for closing the hole in an edge thereof; and
- locking means for locking and unlocking the plate part relative to the edge, wherein the locking means comprise a mechanism which can be operated via an opening in the plate part.

2. Closing device as claimed in claim 1, wherein the locking means can be operated with a tool which can be inserted into the opening in the plate part.

3. Closing device as claimed in claim 1 or 2, wherein the opening in the plate part comprises a non-round form, and the tool which can be inserted into the non-round opening in the plate part is rotatable between a first insertion position, in which the tool can be inserted into and taken out of the opening, and a second handling position in which the tool urges the locking means into an unlocked position, and removal of the tool through the non-round opening is prevented.

4. Closing device as claimed in any of the foregoing claims, the locking means comprising a locking pin which can be engaged with the tool such that the

locking pin is moved from a locked position to an unlocked position when the tool is operated for the purpose of taking the plate part out of the hole.

5. Closing device as claimed in any of the foregoing claims, wherein at least a part of the locking pin comprises a toothing.

6. Closing device as claimed in claim 5, further comprising a bush arranged rotatably in the cover, wherein the bush comprises over at least a part of its outer periphery a toothing which can engage with the toothing of the locking pin.

7. Closing device as claimed in any of the claims 1-4, further comprising a bush arranged rotatably in the plate part, wherein the bush comprises on its outer periphery a protrusion which can engage with a recess arranged in the locking means.

8. Closing device as claimed in claim 7, wherein the locking means comprise a locking pin, and the recess arranged in the locking pin comprises an inclining surface at least on its outward facing side.

9. Closing device as claimed in claim 8, wherein the inclining surface is arranged substantially at an angle of 45° to the longitudinal axis of the locking pin.

10. Closing device as claimed in any of the claims 1-4, wherein the locking pin comprises an inclining contact surface.

11. Closing device as claimed in claim 10, wherein the contact surface makes an angle greater than 45° with the longitudinal axis of the locking pin.

12. Closing device as claimed in any of the foregoing claims, wherein the plate part is manufactured from at least one of the materials plastic, composite and lightweight metal.

13. Closing device as claimed in any of the foregoing claims, wherein the hole in the ground comprises a drain of a sewer system.

14. Closing system, comprising:

- a closing device as claimed in any of the claims 1-13; and
- a tool which can be inserted into the opening of the plate part, wherein the tool operates the locking means such that:

- the locking means are situated in a locked position of the plate part relative to the edge when the tool is situated in an insertion position where it is removable from the open-

ing; and

- the locking means are situated in an unlocked position of the plate part relative to the edge when the tool is situated in a handling position for handling the plate part in the opening of the plate part. 5

15. Method for respectively unlocking and locking a light-weight plate part relative to a hole in the ground, comprising the steps of: 10

- inserting a tool in a first insertion position into an opening of a plate part arranged for this purpose, wherein the plate part comprises locking means for locking the plate part relative to an edge of the hole; 15

- moving the tool from the first insertion position into a second handling position, wherein in the first insertion position the tool can be respectively inserted into and removed from the plate part; 20

- moving the tool from the second handling position to the first insertion position, wherein the tool operates the locking means from an unlocked position to a locked position. 25

16. Method as claimed in claim 15, wherein the tool can only be inserted into and removed from the plate part in the first insertion position.

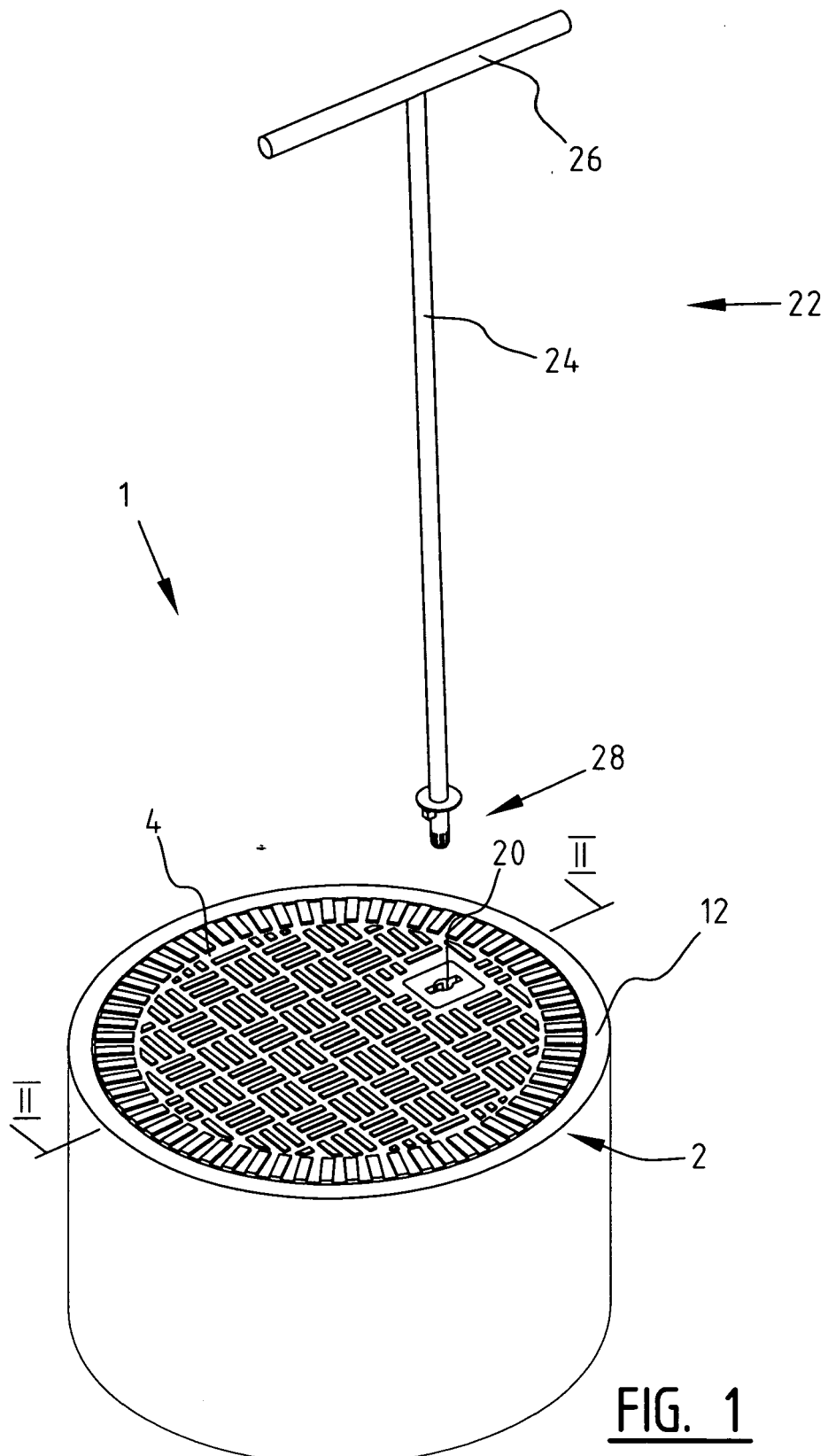
17. Method as claimed in claim 15 or 16, wherein the opening in the plate part comprises a non-round form through which the tool can be inserted into and removed from the plate part in the first insertion position, and which prevents the tool from being taken out of the non-round opening of the plate part in the second handling position, in which the locking means are situated in an unlocked position. 30 35

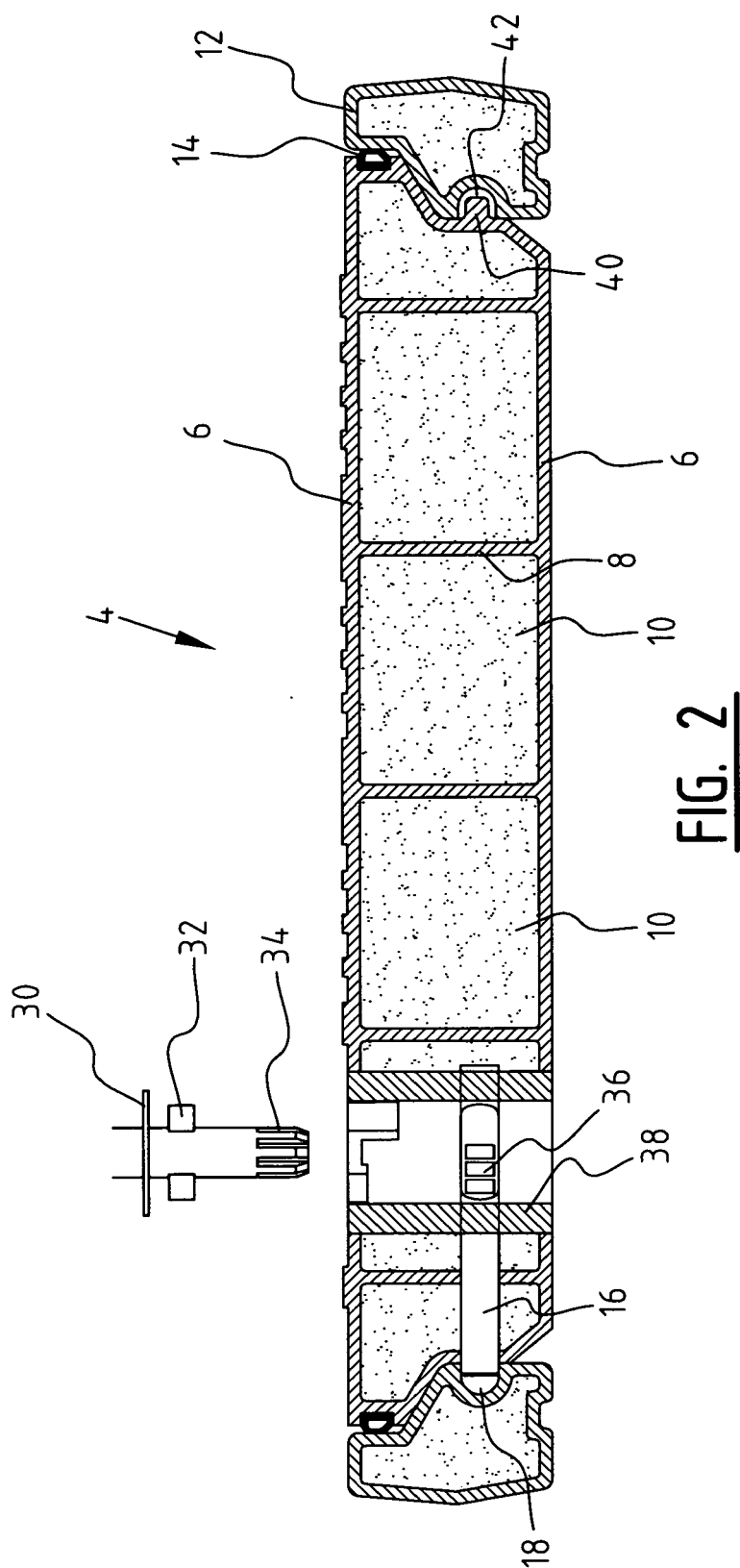
18. Method as claimed in any of the claims 15-17, wherein moving of the tool from the handling position for handling the plate part with the tool to the insertion position for taking the tool out of the plate part comprises of an angular displacement of the tool. 40

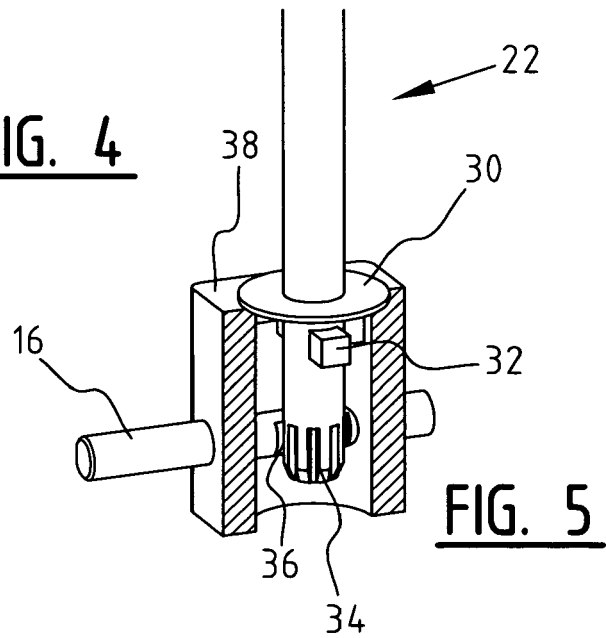
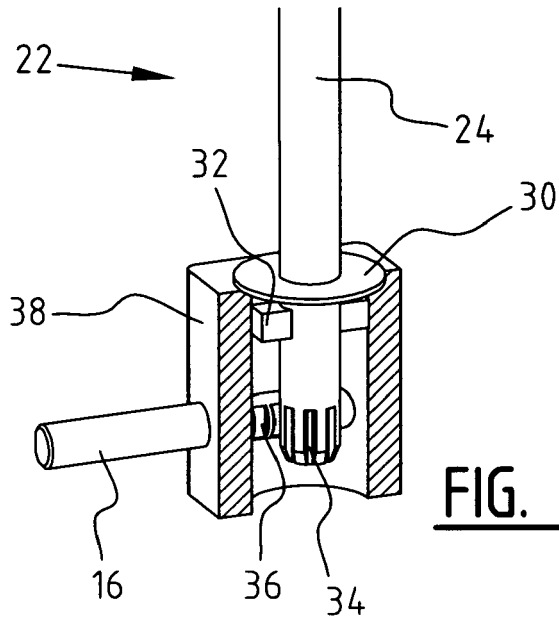
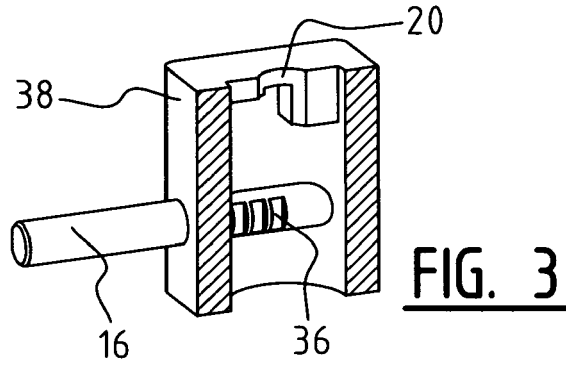
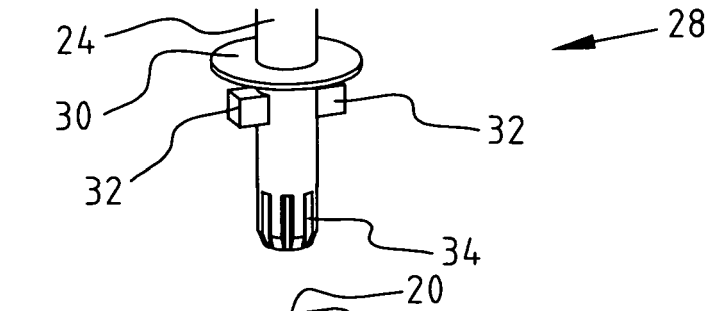
19. Method as claimed in claim 18, wherein the angular displacement is at least a quarter-turn 45

20. Method as claimed in any of the claims 15-19, wherein a closing device as claimed in any of the claims 1-13 or a closing system as claimed in claim 14 is applied. 50

55







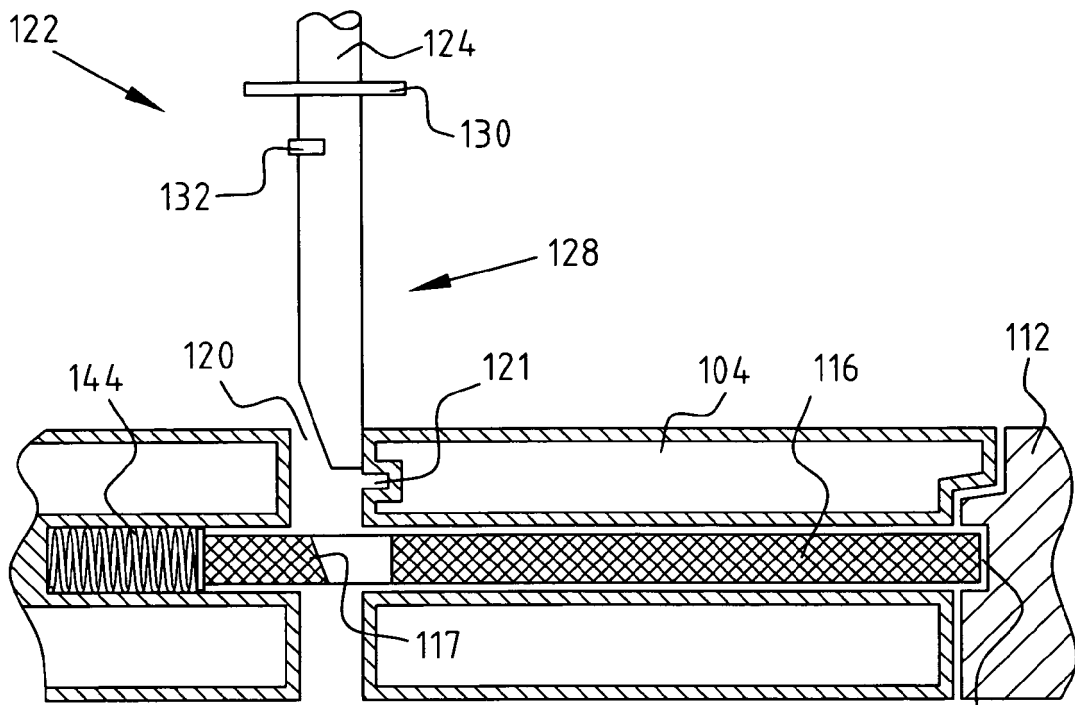


FIG. 6A

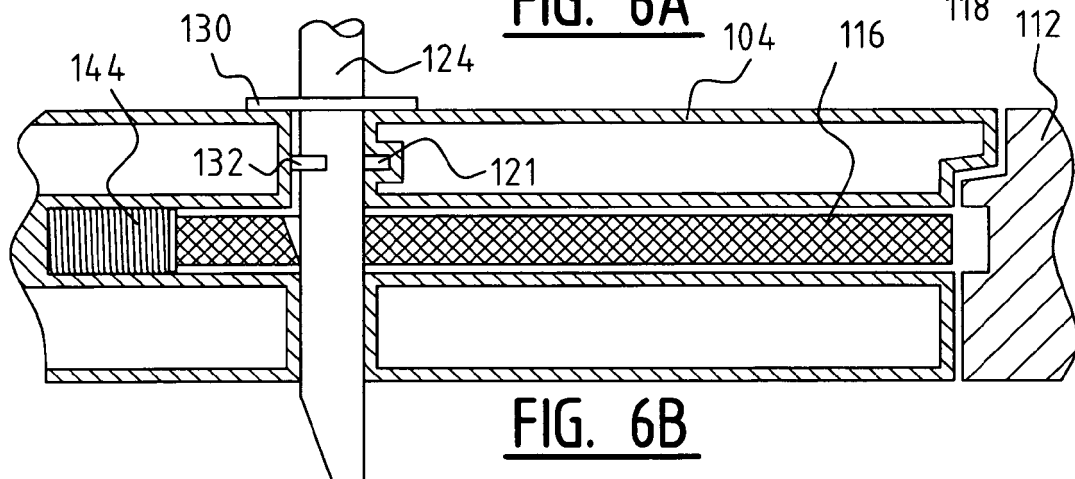


FIG. 6B

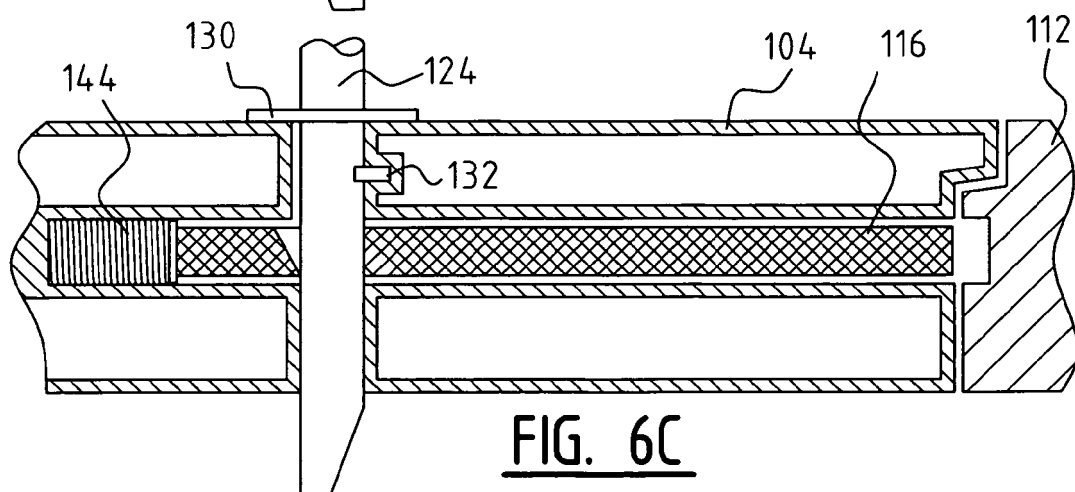
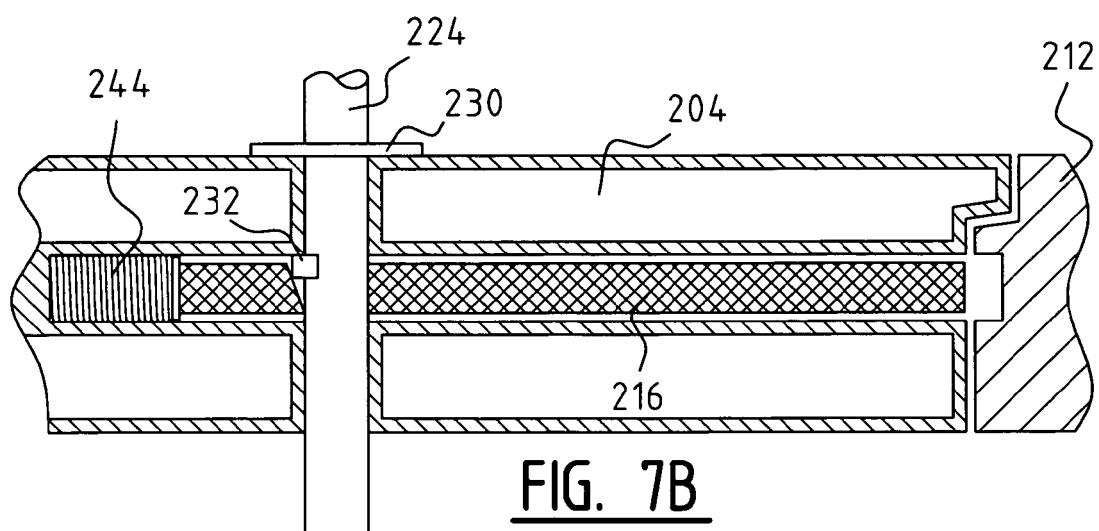
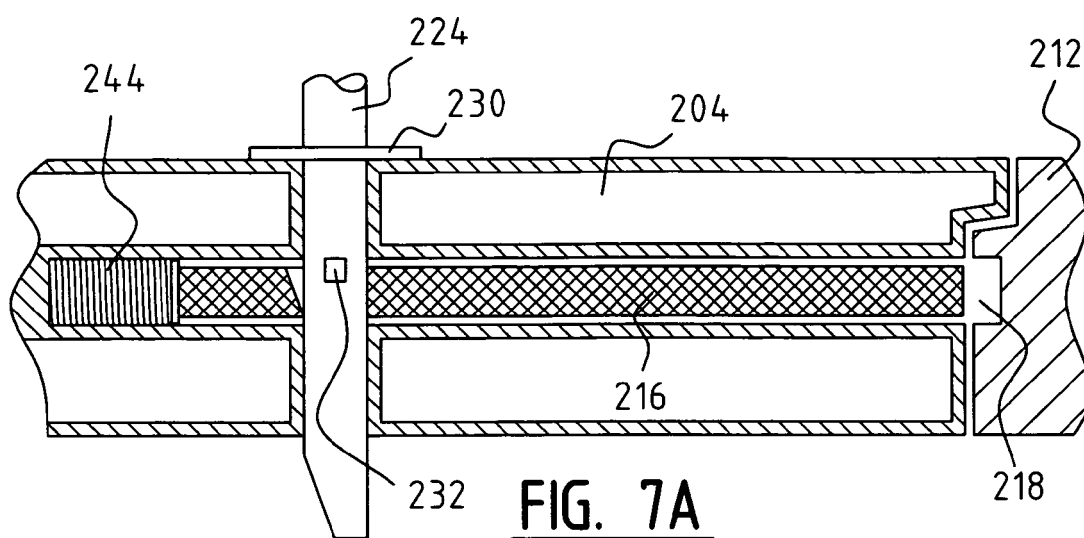


FIG. 6C



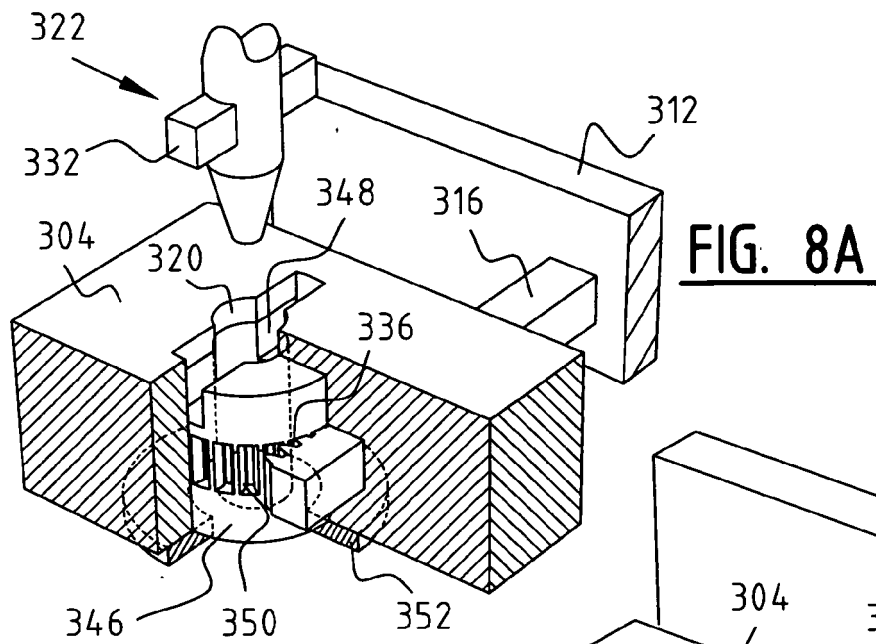
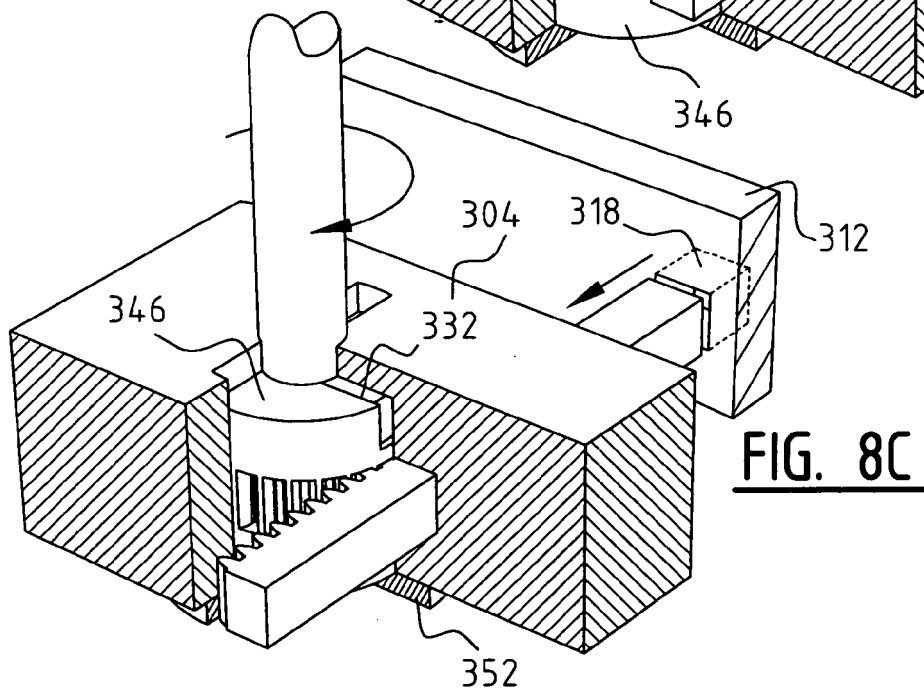
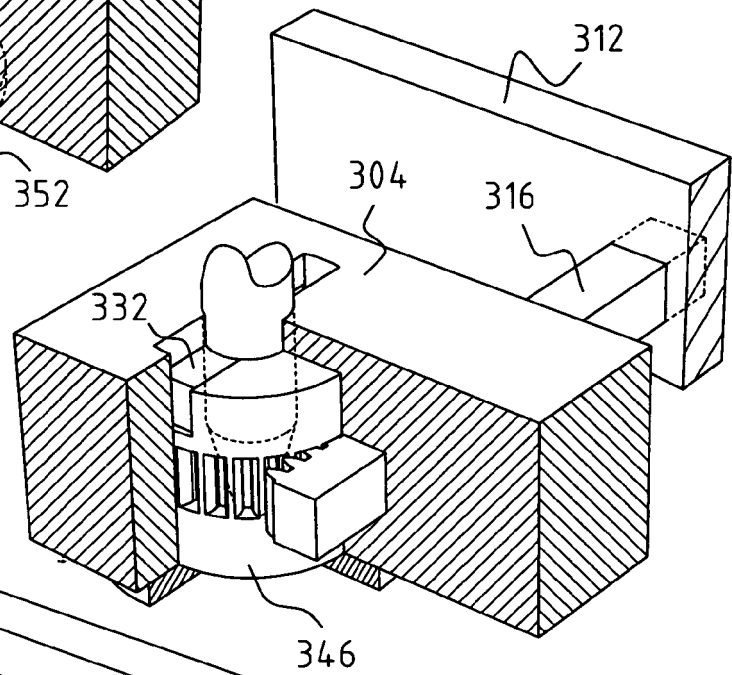
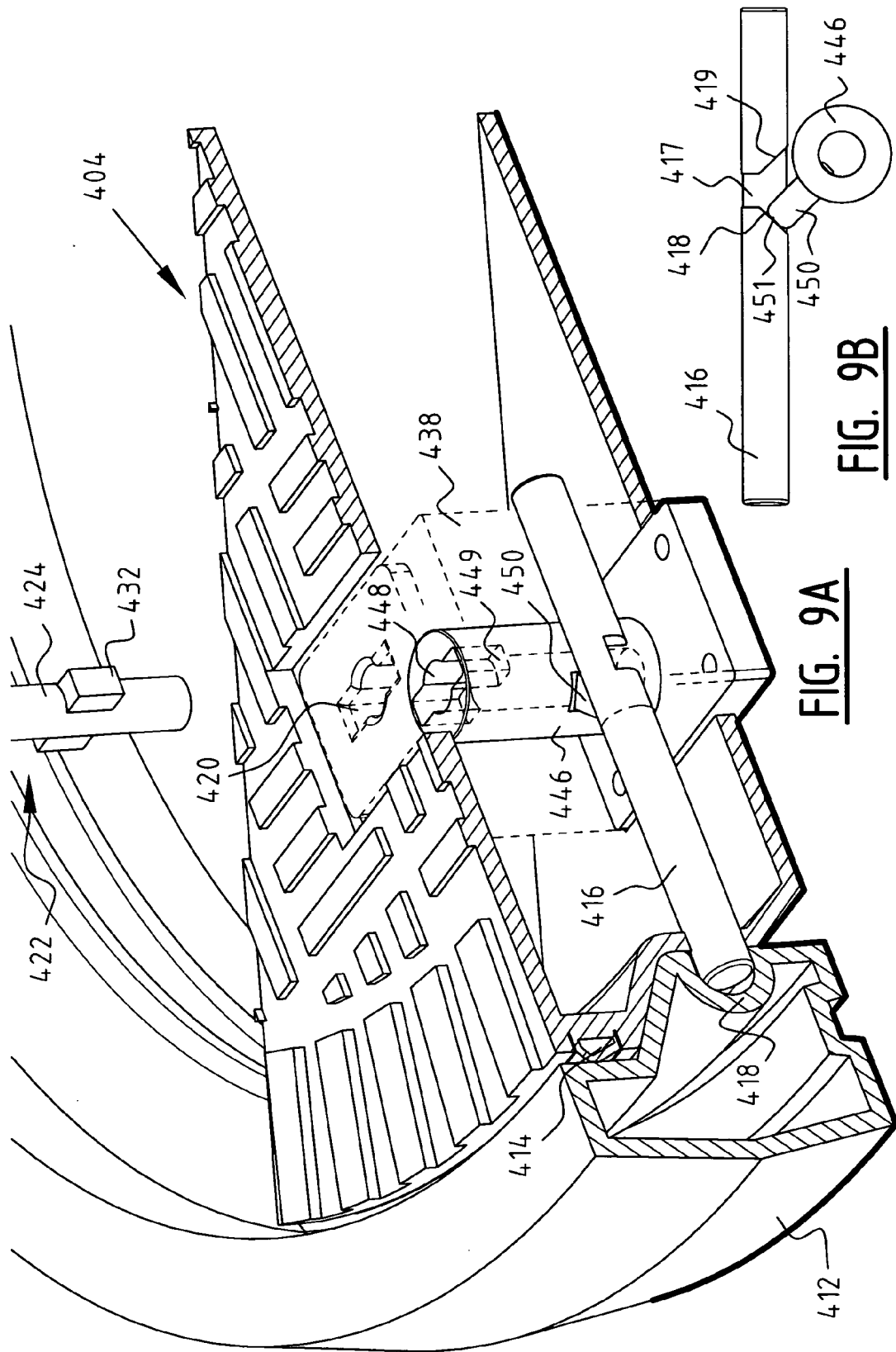


FIG. 8B





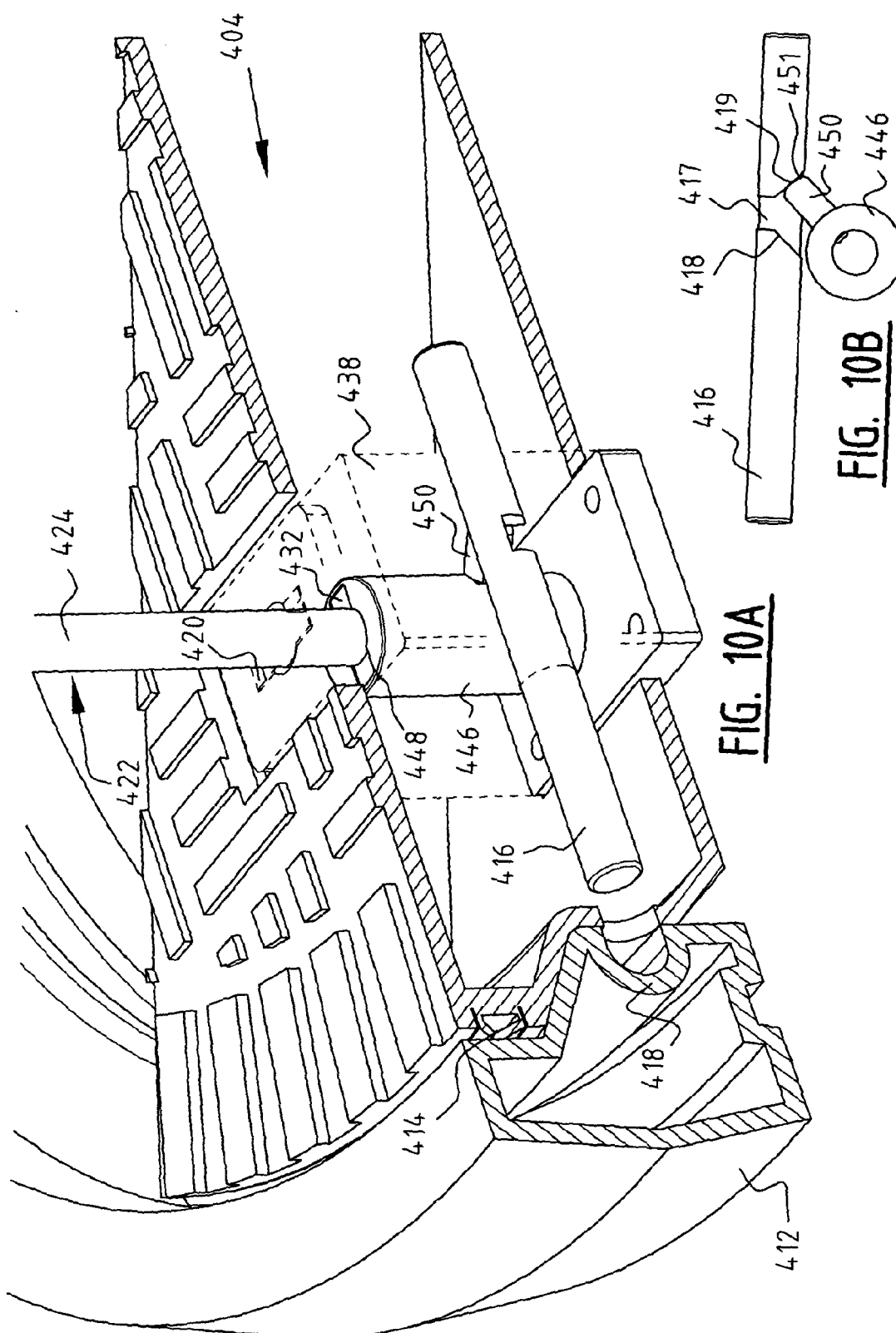


FIG. 10A

FIG. 10B