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(54) LIFTING DEVICE FOR MANHOLE COVERS OR SIMILAR

(57) A lifting device (1) for lifting and moving a manhole cover (9) comprises a variable geometry structure comprising in turn a lifting portion (2), configured to support at least one grip (4), the lifting portion (2) and the handle (3) being hinged directly and reciprocally around an axis of rotation (5), wherein the lifting device (1) comprises locking members (6) configured to selectively lock in a predetermined position the handle (3) with respect to the lifting portion (2) among a plurality of predetermined use configurations.

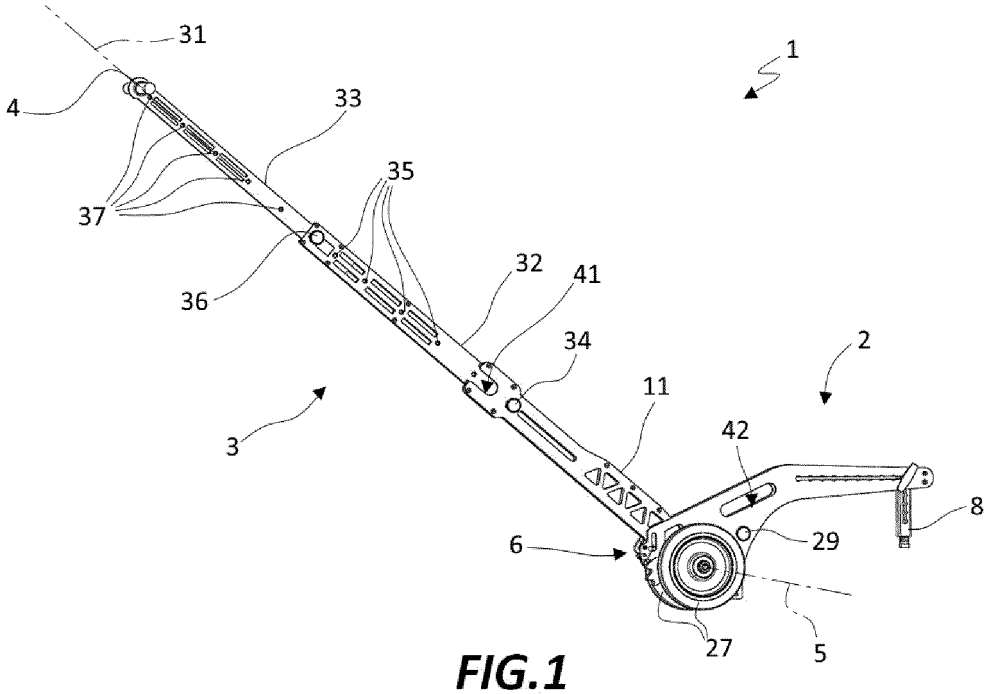

FIG.1

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Description

[0001] The present invention relates to a lifting device for lifting and moving manhole covers or similar closing elements.

[0002] The use of manhole covers or similar closing elements is known in order to occlude an access opening to an underlying duct or to a well, wherein this opening is placed along a road surface or a walkable surface, positioned flush or substantially flush to the same.

[0003] The manhole covers can have different conformations, for example square, rectangular, circular, in accordance with the shape of the opening to be occluded and are combined by a high weight that makes it difficult to move or remove from the seat wherein they are positioned.

[0004] In general, manhole covers are made of metal and due to their weight and size they are difficult to handle.

[0005] Lifting devices are known for lifting and moving manhole covers configured as a lever element (of the first kind) provided at one end with a tool through which to hook a manhole cover to be lifted and at the opposite end with a handle through which a user can maneuver the device itself and apply the force to lift the manhole cover. These lifting devices have a fulcrum interposed between the tool and the handle, around which the lifting device can be operated in rotation to determine the lifting of the manhole cover.

[0006] As known, the physical principle of the lever allows to multiply the force exerted by a user at the handle (driving force) to allow the manhole to be lifted, thus overcoming its resisting force.

[0007] In addition, such a lifting device allows an operator to lift a manhole cover while maintaining a safe distance from the opening that is released following the removal of the manhole cover itself.

[0008] To promote the movement of the lifting device near the manhole cover to be lifted, the use of wheels operatively connected to the lifting device is known.

[0009] Documents US 4365925, FR 2427996 and TWM256379U describe lifting devices for lifting and handling manhole covers which exploit the aforementioned principle of the first kind of lever and have wheels to facilitate their movement.

[0010] In general, traditional lifting devices have an "L" or substantially "L" -shaped structure.

[0011] A drawback affecting traditional lifting devices concerns their limited functionality, with reference to the possibility of using them effectively if there are obstacles in correspondence with the manhole cover to be lifted or the maneuvering space available for lifting and moving the manhole cover is reduced.

[0012] A user, in fact, may not be able to operate the lifting device, that is, once the manhole cover has been hooked to the lifting device, the user may not have sufficient maneuvering space to lift the manhole cover.

[0013] Therefore, the need to have an optimal maneuvering space in order to use the lifting device in a profitable way is evident.

[0014] In the field there is a need to have a lifting device which can be selectively connected to a manhole cover to free an opening previously occluded by the manhole cover itself, which is not affected by the drawbacks of traditional solutions described above.

[0015] The purpose of the present invention is to allow the opening and handling of manhole covers in a simple, efficient and economical way by means of a manual lifting device.

[0016] Another object of the present invention is to facilitate the portability and handling of the lifting device.

[0017] A further object of the present invention is to ensure a high strength and rigidity to the lifting device to ensure safe use by a user and to avoid accidents during its use.

[0018] Yet another object is to reduce the physical effort required of a user during the lifting and subsequent handling of a manhole cover, to facilitate the user's work and ensure his safety.

[0019] A further object of the present invention is to minimize the maintenance required of a lifting device for lifting and handling manhole covers as part of a long-lasting use solution.

[0020] Yet another object of the invention is to obtain an extremely compact size of the lifting device when it is not in operation, such as to facilitate the storage of small motor vehicles even inside the driver's cab and, at the same time, to be able to have always at hand a device suitable for opening manhole covers that are particularly heavy in terms of size and weight.

[0021] The specific object of the invention is a lifting device for lifting and moving a manhole cover, wherein the lifting device comprises a variable geometry structure comprising in turn:

- a lifting portion, configured to support at least one hooking tool to which the manhole cover can be hooked,
- a handle at one end of which there is at least one grip, the lifting portion and the handle being hinged directly to each other around an axis of rotation,
- locking members configured to selectively abut a bottom end of the handle to lock the handle in position with respect to the lifting portion between a plurality of use configurations, wherein the lifting device assumes an "L" or substantially " L ", wherein the lifting portion can delimit a seat for housing at least one bottom end of a bottom portion of the handle, wherein the seat is delimited at a connection end between the lifting portion and the handle, wherein the locking members can comprise a lever, hinged to the lifting portion around an actuation axis, parallel to the rotation axis, wherein the lever is configured to selectively move an abutment element between a position of locking, wherein the abutment element abuts against the bottom end of the bottom portion

or of the handle, preventing its relative rotation with respect to the lifting portion, and a release position, wherein the abutment element disengages the bottom end of the bottom portion of the handle, allowing the relative rotation of the handle with respect to the lift.

[0022] According to another aspect of the invention, the lifting device can be selectively configured between the plurality of use configurations and a non-use configuration, wherein in the non-use configuration the lifting device has the handle in a leaning or at least partially housed position in the lifting portion.

[0023] According to a further aspect of the invention, the lifting portion can comprise two plate elements mutually connected in a spaced apart position to define the seat wherein the bottom end of the bottom portion is housed and hinged or wherein the lifting comprises a fork element comprising two plate elements delimiting the seat wherein the bottom end of the bottom portion is housed and hinged.

[0024] According to an additional aspect of the invention, the lifting portion and the handle can be reciprocally hinged by means of a pin that defines the rotation axis.

[0025] According to another aspect of the invention, the handle can have at least one indentation which protrudes from the bottom end and which extends along an arc of circumference, wherein the indentation has a plurality of alternating grooves and ridges, in wherein each of the indentation slots is shaped to be selectively engaged, in abutment, by the engagement element.

[0026] According to a further aspect of the invention, the handle can have two indentations each lying on a respective plane, wherein the planes of arrangement of the indentations are parallel to each other and spaced at least equal to the dimension of the transversal thickness of the lever along the direction of rotation.

[0027] According to an additional aspect of the invention, the lever can have an end configured as a fork, bearing two arms parallel to each other, each of the arms delimiting a through seat for housing a cylinder to which the abutment element is operationally connected by means of a rod, wherein the rod can be moved, like a pendulum, between the arms of the lever.

[0028] According to another aspect of the invention, the lever can have a control end for operating the lever between a locking position, wherein the lever is placed against and held in position at one end of the lifting portion, and a release end, wherein the lever is rotated away from the lifting portion.

[0029] According to a further aspect of the invention, the lifting portion can comprise a first spacer and a second spacer interposed between the plate elements, wherein the first spacer is placed in correspondence with the lever and has a shaped portion complementary to a stop portion of the lever, in such a way that when the lever is placed in the locking configuration, the abutment portion is placed in abutment and held in position against the first spacer.

[0030] According to an additional aspect of the invention, the handle can be of the two-stage telescopic type.

[0031] According to another aspect of the invention, the handle can comprise the bottom portion, a central portion telescopically housed in the bottom portion and a top portion telescopically housed in the central portion, a bottom pin for selectively locking the central portion in position with respect to the bottom portion and a central pin configured to selectively lock the top portion in position with respect to the central portion so as to vary the overall length of the handle along a longitudinal direction of the handle, perpendicular to the axis of rotation. The advantages offered by a lifting device for lifting and handling manhole covers or similar closing elements according to the invention are evident.

[0032] The lifting device for the lifting and handling of manhole covers has an extremely resistant and flexible use structure to ensure effective lifting of manhole covers, even of heavy weight, requiring a reduced effort on the part of a user.

[0033] Furthermore, the lifting device for lifting and handling manhole covers or similar closing elements has a structure of flexible use, i.e. capable of assuming different configurations of use in order to be adapted, from time to time, to specific needs of a user. For example, the structure of the lifting device can be adjusted according to the size and weight of the manhole cover to be lifted.

[0034] Furthermore, the configuration of the lifting device can be adjusted according to the available maneuvering space, thus allowing to effectively apply a drive force to the lifting device.

[0035] As is known, the ability of a lever to multiply the force exerted at one of its ends to lift a weight connected to an opposite end of the lever itself is a function of the position of the point of application of the driving force applied to the lever, of that of the weight to be lift (resisting force) and the relative positioning of the fulcrum, i.e. the point around which the lever can rotate.

[0036] The present invention will now be described, for illustrative but not limitative purposes, according to its preferred embodiments, with particular reference to the Figures of the attached drawings, wherein:

Figure 1 shows a perspective view of a lifting device for manhole covers according to the invention, in a possible configuration of use;

Figure 2 shows a perspective view of a lifting device for manhole covers according to the invention in a non-use configuration;

Figure 3 shows a top view of the lifting device referred to in Figure 1;

Figure 4 shows a side view of the lifting device for manhole covers of Figure 1, wherein some components have been omitted;

Figure 5 shows a side schematic view of some configurations of use that the manhole lifting device according to the invention can assume;

Figure 6 shows a detailed perspective view of some components of the lifting device for manhole covers according to the invention;

Figure 7 shows a detailed perspective view, from a different angle than that of Figure 6, of some components of the lifting device for manhole covers according to the invention;

Figures 8 and 9 show perspective views, from different angles, of some components of the lifting device for manhole covers according to the invention, in one of the possible configurations of use;

Figure 10 shows a perspective view of a lifting device for manhole covers according to the invention during the lifting of a manhole cover;

Figure 11 shows a detailed perspective view of a lifting device for manhole covers according to the invention;

Figure 12 shows an alternative embodiment of some components of the lifting device according to the invention;

Figure 13 shows an alternative embodiment of some components of the lifting device according to the invention.

[0037] With reference to Figure 1, a preferred embodiment of a lifting device for lifting and handling manhole covers 1 can be observed according to the invention, hereinafter referred to as lifting device 1 for the sake of brevity.

[0038] The lifting device 1 comprises a variable geometry structure comprising, in turn, a lifting portion 2, to which at least one tool is operatively connected or connectable through which to hook a manhole cover to be lifted, a handle 3 at one end of which is present at least one handle 4, wherein the lifting portion 2 and the handle 3 are hinged directly to each other around a rotation axis 5.

[0039] The lifting device 1 also comprises locking members 6 configured to selectively lock the handle 3 in a predetermined position with respect to the lifting portion 2 between a plurality of predetermined use configurations of the lifting device 1.

[0040] Preferably, the locking members 6 are operatively connected to the lifting portion 2 and interact with the handle 3.

[0041] The various predetermined use configurations of the lifting device 1 differ from each other for the inclination assumed by the handle 3 in relation to the lifting portion 2 (see for example the diagram in Figure 5).

[0042] As better described below, the lifting device 1 has a variable geometry and can be selectively adjusted between a non-use configuration (see Figure 2), wherein the lifting device 1 assumes a configuration of minimum encumbrance with the handle 3 leaning against it or proximal to the lifting portion 2 and more configurations of use (see for example Figures 1 and 5), in each of which the handle 3 is positioned distal and inclined with respect to the lifting portion 2.

[0043] In this regard, it should be noted that in the configurations of use, the lifting device 1 assumes an "L" or substantially "L" configuration (see for example Figure 1).

[0044] The handle 3 can be moved relative to the lifting portion 2 along a plane that is perpendicular to the rotation axis 5.

[0045] The lifting device 1 operates according to the known physical principle of a first kind of lever. In general, such a lever has two portions or arms, of different length, between which a fulcrum is interposed.

[0046] The lifting device 1 has a fulcrum interposed between the lifting portion 2 and the handle 3

[0047] According to a preferred embodiment that will be better described below, the rotation fulcrum corresponds to the rotation axis 5.

[0048] The lifting device 1 is configured in such a way that the lifting portion 2 is the minor arm of the lever while the handle 3 is the major arm.

[0049] The lifting portion 2 is configured to support at least one tool through which to hook a manhole cover, to lift and move it.

[0050] The attached Figure 10 illustrates, by way of non-limiting example, a lifting device 1 carrying a magnetic-type tool 7 connected to the lifting portion 2 by means of a support 8.

[0051] This magnetic type tool 7 is configured to selectively hold or release a manhole cover 9 made of ferromagnetic material.

[0052] It is understood that further tool configurations are possible, not illustrated in the attached Figures, capable of hooking the manhole cover and retaining it according to a different principle. For example, an alternative tool configuration includes a mechanical element configured to hook the manhole cover. By way of example, this mechanical element can be configured as a hook or a hook or a similar element that can be inserted inside a suitable seat made in the manhole cover and configured to hold the manhole cover during the lifting phase and subsequent handling to free an opening 10 previously occluded by the manhole 9 itself.

[0053] The actual conformation of a tool usable in a lifting device 1 does not form the specific subject of the invention and will therefore not be described further.

[0054] According to a preferred embodiment illustrated in the attached Figures, the lifting portion 2 defines a seat for housing a bottom end of a bottom portion 11 of the handle 3.

[0055] This housing seat is delimited at the point where the handle 3 is hinged to the lifting portion 2.

[0056] According to a preferred embodiment, the lifting portion 2 comprises two plate elements 12 mutually connected.

[0057] The plate elements 12 have an elongated conformation and are mutually connected, spaced apart, delimiting a gap inside which at least one bottom portion 11 of the handle 3 is housed.

[0058] The plate elements 12 are identical to each other and each have an elongated or substantially elongated

configuration comprising a support portion, along which a support 8 for a tool 7 for coupling a manhole cover can be connected, in various operating positions, and a portion connection at which each of the plate elements 12 is hinged to the bottom portion 11 of the handle 3.

[0059] Preferably, the plate elements 12 are mutually connected at least at opposite ends through respective bolted or threaded connections so as to leave a large gap along the gap.

[0060] In this regard, the lifting device 1 comprises at least a first spacer 13, interposed between the two plate elements 12 in correspondence with the connection portion and at least a second spacer 14, also interposed between the two plate elements 12 at the opposite end with respect to the connecting portion, i.e. at the support portion.

[0061] The at least one first spacer 13 and the at least one second spacer 14 are releasably linked to the plate elements 12 through the aforementioned bolted or threaded connections, according to methods within the reach of the person skilled in the field.

[0062] The first spacer 13 and the second spacer 14 each have at least one through seat engageable by at least one threaded or bolted connection element.

[0063] As said, the lifting portion 2 and the handle 3 are reciprocally hinged at a rotation axis 5.

[0064] With reference to the preferred embodiment illustrated in the attached Figures, the lifting portion 2 and the handle 3 are reciprocally hinged by means of a pin 15 which defines the rotation axis 5.

[0065] The handle 3 has a through hole in correspondence with the bottom portion 11 engaged by the pin 15.

[0066] Similarly, the lifting portion 2 has, in correspondence with the connection with the bottom portion 11 of the handle 3, through openings suitable for being engaged by the pin 15. More precisely, each of the plate elements 12 has a respective through opening 16 engaged from pin 15 (see for example Figure 7).

[0067] The through opening 16 of a first of the plate elements 12 is aligned with the through opening 16 of the other between the plate elements 12.

[0068] The relative position between the handle 3 and the lifting portion 2, i.e. their relative inclination, is selectively maintained in a firm and safe manner by means of the locking members 6 (see the schematic representation of some inclinations of the handle 3 with respect to the lifting portion 2 shown in Figure 5).

[0069] According to a preferred embodiment illustrated in detail in the attached Figures 6 or 7, the locking members 6 comprise a lever 17 hinged to the lifting portion 2 and configured to selectively move an abutment element 18 between a locking position, wherein the abutment element 18 abuts against the bottom portion 11 of the handle 3, preventing its relative rotation with respect to the lifting portion 2, and a release position, wherein the abutment element 18 disengages the bottom portion 11 of the handle 3, allowing the relative rotation of the handle 3 with respect to the lifting portion 2.

[0070] In this regard, it should be noted that the handle 3 has at least one indentation 19 which protrudes from the bottom portion 11 and which extends along an arc of circumference (see for example the detailed views of Figures 6 and 7).

[0071] Preferably, the bottom portion 11 of the handle 3 has two end portions provided with an identical indentation 19.

[0072] Each indentation 19 is spaced from the other along a direction parallel to the rotation axis 5.

[0073] In detail, the separation distance between each indentation 19 is equal to or greater than the dimension of the transversal thickness of the lever 17, where the dimension of the transversal thickness means the dimension of the lever 17 along a direction parallel to the axis of rotation 5.

[0074] Each indentation 19 has a plurality of alternating grooves and ridges.

[0075] Each of the groove of the indentation 19 is shaped to be selectively engaged, in abutment, by the abutment element 18.

[0076] As mentioned, the indentation 19 develops along an arc of circumference, so that during the rotation of the handle 3 with respect to the lifting portion 2, the indentation 19 is maintained in proximity to the locking members 6, varying from time to time the groove which is positioned facing the abutment element 18 and, therefore, which can be engaged by the latter.

[0077] The attached Figures 6 and 7 show detailed views of the preferred conformation of the locking members 6.

[0078] The lever 17 is hinged to the lifting portion 2, at the end proximal to the bottom portion 11 of the handle 3, in such a way as to be selectively rotatable between the locking configuration and the release configuration around an actuation axis 20, parallel to the axis of rotation 5.

[0079] The abutment element 18 is configured as a cylinder.

[0080] The abutment element 18 is operatively connected to the lifting portion 2. More in detail, the abutment element 18 has opposite ends engaged in a rotatable and slidable manner along respective slots 21 delimited to the opposite sides of the lifting portion 2 close to the axis of rotation 5 (see, for example, Figure 6). In practice, the slots 21 guide the abutment element 18 following the activation of the lever 17.

[0081] The slots 21 are positioned in such a way that with the lever 17 placed in the locking position, the abutment element 18 is in abutment with one of the seats delimited along the indentation 19.

[0082] The lever 17 has an end configured as a fork 22, bearing two arms parallel to each other. The fork 22, in turn, delimits at each of the arms a through seat for housing a cylinder 23.

[0083] The cylinder 23 is rotatably housed relative to the fork 22.

[0084] The cylinder 23 is also connected to the abut-

ment element 18 by means of a rod 24.

[0085] The rod 24 can be moved like a pendulum between the arms of the lever 17, following the rotation of the cylinder 23 to which it is connected.

[0086] In practice, the abutment element 18 is hinged to the lever 17 around an axis parallel to the drive axis 20 and the rotation axis 5 and is guided by the slots 21 along the lifting portion 2.

[0087] As said, the lever 17 is hinged to the lifting portion 2 and, therefore, the cylinder 23 can be selectively operated along an arc-circumference trajectory. It follows that the movement of the abutment element 18 is determined by the movement of the lever 17 and guided by the slots 21.

[0088] The lever 17 has a control end 25 through which to operate the lever 17 itself between a locking position, wherein the lever 17 is leaning against one end of the lifting portion 2, and a release position, wherein the lever 17 is rotated away from the lifting portion 2.

[0089] The control end 25 extends outside the lifting device 1 at the bottom portion 11 of the handle 3, resulting easily accessible.

[0090] More in detail, the control end 25 protrudes from the side of the lifting device 1 in correspondence with which, during use, a user is positioned.

[0091] The control end 25 can be easily controlled, for example, by means of a foot, thus promoting an easy use and adjustment of the lifting device 1 in the absence of any difficulty on the part of a user, who does not necessarily have to bend down to operate the locking members 6.

[0092] As mentioned, the abutment element 18 is configured as a cylinder capable of selectively engaging one of the seats delimited along the at least one indentation 19.

[0093] Depending on the seat engaged by the abutment element 18, the relative inclination of the handle 3 is determined with respect to the lifting portion 2 and its locking in position.

[0094] As mentioned, the abutment element 18 is connected to the cylinder 23 through the rod 24. Preferably, the connection of the rod 24 to the abutment element 18 and to the cylinder 23 is of the threaded type. This makes it possible to easily disconnect the striking element 18 from the rod 24 in the event that maintenance is required as well as allowing the recovery of any backlash due to machining tolerances, thus ensuring easy maintenance and effective functioning of the locking members 6.

[0095] From the above it is clear that the locking members 6 allow to easily adjust the inclination of the handle 3 with respect to the lifting portion 2 and to keep the handle 3 firmly in position during the use of the lifting device 1.

[0096] Adjustment is easy since a user does not have to use any tool or disassemble any component of the lifting device 1 to rotate the handle 3 with respect to the lifting portion 2 and then constrain them in one of the predetermined positions according to specific needs.

[0097] According to a preferred embodiment, the first spacer 13 acts as an abutment and holding element for the lever 17 of the locking members 6.

[0098] More precisely, the first spacer 13 has a shaped portion complementary to an abutment portion 26 of the lever 17, so that when the lever 17 is placed in a locking configuration, the abutment portion 26 is placed in abutment and retained against the first spacer 13.

[0099] The latter prevents accidental disengagement of the lever 17, preventing the locking members 6 from being accidentally released.

[0100] In order to be able to release the lever 17, in fact, it is necessary to operate it away from the lifting portion 2, overcoming the resistance initially determined by the first spacer 13.

[0101] According to an aspect of the invention, the lifting device 1 comprises wheels 27 configured to facilitate the movement of the lifting device 1 and therefore its transport in proximity of a manhole cover to be lifted as well as to facilitate the movement of the manhole connected and raised by means of the device for lifting. lifting 1 itself.

[0102] Preferably, the wheels 27 are operatively connected to the pin 15, i.e. they are fitted on the pin 15 from opposite sides with respect to the lifting portion, wherein the pin 15 mutually connects the lifting portion 2 and the handle 3, hinging them to each other.

[0103] The pin 15 extends laterally from opposite sides of the lifting portion 2, i.e. from the plate elements 12 and, therefore, from opposite sides of the lifting device 1, so as to provide a support to which the wheels 27 are connected (see Figure 7).

[0104] The wheels 27 are connected to the pin 15 by means of a threaded connection, for example by means of a nut which engages a threaded portion at the end of the pin 15 which protrude externally from respective between the plate elements 12.

[0105] It is understood that alternative embodiments of the threaded connection are possible, not illustrated in the attached Figures, for example by means of a screw which engages a threaded seat made at each end of the pin 15.

[0106] Further embodiments of the connection between the wheels 27 and the pin 15 are possible, for example by means of cotter pins, or similar elements according to methods within the reach of the person skilled in the art.

[0107] The wheels 27 being connected to the pin 15 rotate around the rotation axis 5.

[0108] The wheels 27 each have a radius such as to keep the lifting portion 2 raised with respect to the ground along which the lifting device 1 can be moved, promoting an easy movement of the latter.

[0109] The wheels 27 determine the positioning of the fulcrum of the lifting device 1 in correspondence with the rotation axis 5.

[0110] The lifting device 1 comprises bushings 28 fitted along the ends of the pin 15 external to the lifting portion 2, configured to keep the wheels 27 spaced from the

sides of the lifting portion 2 itself (see Figures 6 and 7).

[0111] The lifting device 1 comprises a locking element 29 to selectively constrain the lifting portion 2 and the handle 3 to each other, when the lifting device 1 is placed in the non-use configuration, i.e. with the handle 3 completely folded, leaning against or proximal to the connecting portion 2.

[0112] The locking element 29 is configured as a pin operatively connected to a side of the lifting portion 2, that is to say to one of the plate elements 12, and can be selectively moved between an engagement or release position respectively to selectively engage or release a seat 30 delimited along one side of the handle 3 (see Figure 4).

[0113] The locking element 29 allows to selectively lock the lifting device 1 in the non-use configuration, favoring its transport and handling in a practical and safe way.

[0114] According to a preferred embodiment, the handle 3 is of the two-stage telescopic type and, therefore, it is possible to vary its length along a longitudinal direction 31, i.e. along a direction that lies along a plane orthogonal to the rotation axis 5 and passes through the handle 3.

[0115] The handle 3 comprises the bottom portion 11, a central portion 32 telescopically connected to the bottom portion 11 and a top portion 33, in turn telescopically connected to the central portion 32.

[0116] More in detail, the central portion 32 is telescopically housed in the bottom portion 11 and the top portion 33 is telescopically housed in the central portion 32.

[0117] The handle 3 is therefore of the extensible type in order to selectively assume a configuration of minimum extension, wherein the top portion 33 is housed inside the central portion 32 and both are housed in the bottom portion 11 (see, for example, Figure 2) and a configuration of maximum extension wherein the top portion 33 is completely extracted from the central portion 32 and the central portion 32, in turn, is completely extracted from the bottom portion 11 (see, for example, Figure 1).

[0118] It is understood that the handle 3 can assume intermediate configurations between that of maximum extension and that of minimum extension (see for example Figures 8 and 9).

[0119] In this regard, the lifting device 1 comprises a bottom pin 34, operatively connected to the bottom portion 11 and configured to selectively engage a seat between central seats 35 delimited along the central portion 32.

[0120] When the bottom pin 34 is engaged along one of the central seats 35, it allows the central portion 32 and the bottom portion 11 to be mutually and firmly connected.

[0121] Furthermore, the lifting device 1 comprises a central pin 36, operatively connected to the central portion 32 and configured to selectively engage one of the top seats 37 delimited along the top portion 33 of the handle 3 (see for example Figure 1).

[0122] It should be noted that the number and positioning of the central seats 35 and of the top seats 37 defines the intermediate positions, between the position of maximum and minimum extension, wherein it is possible to position the handle 3.

[0123] Preferably, the bottom pin 34 is connected to the bottom portion 11 through an elastically yielding connection, configured to hold the pin protruding inside the bottom portion 11 to engage one of the central seats 35.

[0124] Similarly, the central pin 36 is connected to the central portion 32 through an elastically yielding connection, configured to hold the central pin 36 protruding inside the central portion 32, to engage one of the top seats 37.

[0125] With reference to the embodiment illustrated in the attached Figures, the bottom portion 11 comprises two plate elements mutually connected by means of a bolted connection.

[0126] The plate elements of the bottom portion 11 are kept spaced apart by means of bottom collars 38 interposed between them.

[0127] These bottom collars 38 are shaped as elongated elements along a direction parallel to the longitudinal direction 31 so as to delimit opposite sides of the bottom portion and give it a box-like or substantially box-like configuration.

[0128] In particular, the bottom collars 38 are positioned at a top end of the bottom portion 11 from which the central portion 32 protrudes.

[0129] The bottom portion 11 can comprise at least one further bottom collar 39 positioned in proximity to the connection between the bottom portion 11 and the lifting portion 2, so as to give high stability and mechanical rigidity to the bottom portion 11 itself (see for example Figure 8).

[0130] The bottom portion 11 can comprise further collar elements according to specific use requirements.

[0131] Similarly, the central portion 32 comprises two plate elements elongated along a direction parallel to the longitudinal direction 31 and connected to each other by respective bolted connections.

[0132] The central portion 32 comprises central collars 40, configured as elongated elements that delimit opposite sides of the central portion 32 and give it a box-like or substantially box-like configuration.

[0133] The top portion 33, on the other hand, is made by means of a single plate or bar element -having an elongated shape along the longitudinal direction 31.

[0134] It is understood that an alternative embodiment of the lifting device 1 is possible, not illustrated in the attached Figures, wherein the bottom portion 11 and the central portion 32 are each made by means of tubular or box-like elements or in any case by means of hollow elements with a square section. or rectangular able to withstand the bending and torsional stresses to which the handle 3 is subjected during the lifting and handling of a manhole cover connected to the lifting device 1 itself.

[0135] According to a preferred embodiment, the bot-

tom portion 11 of the handle 3 has a top end shaped in such a way as to define a housing seat 41 wherein to house the central pin 36 and its possible elastically yielding support. In addition, the housing seat 41 can be configured to also house the handle 4 positioned at the top end of the top portion 33.

[0136] In this way, it is possible to house the top portion 33 completely or substantially almost completely inside the central portion 32, reducing the bulk of the handle 3 along the longitudinal direction 31 when the handle 3 is placed in a retracted configuration.

[0137] It should be noted that the lifting portion 2 can comprise handles to facilitate gripping and handling of the lifting device 1.

[0138] Preferably, the handles are made by means of elongated slots 42 which extend passing through the lifting portion 2.

[0139] The elongated slots 42 have dimensions such as to allow the insertion of at least one hand by a user in correspondence with the lifting portion 2, to facilitate gripping and transport of the lifting device 1, for example to store it or extract it from a vehicle or from a warehouse or, again, to position it in correspondence with a manhole cover to be lifted.

[0140] If the lifting portion 2 is made by means of plate elements 12 connected to each other, the elongated slots 42 extend through one or both of the plate elements 12 (see for example Figures 1, 2 and 9).

[0141] Below is a brief description of the operation of the lifting device 1, during a phase of lifting and handling a manhole cover 9.

[0142] The lifting device 1 is positioned near the manhole cover 9 to be lifted.

[0143] The lifting device 1 is placed in one of the configurations of use, with the handle 3 extended and inclined relative to the lifting portion 2 to define an "L" or substantially "L" -shaped structure.

[0144] The dimensions of the lifting device 1 are adjusted, with particular reference to the inclination of the handle 3 with respect to the lifting portion 2, ie with respect to the main direction along which the lifting portion 2 develops.

[0145] In this regard, one acts on the locking members 6, to unlock the handle 3 with respect to the lifting portion 2, thus allowing the relative rotation of the handle 3 with respect to the lifting portion 2 around the rotation axis 5.

[0146] In particular, on the lever 17 it is act, rotating the same away from the lifting portion 2, causing the rotation of the cylinder 23 and the movement of the abutment element 18 connected to it through the rod 24.

[0147] By doing so, the abutment element 18 is disengaged from the indentation 19 of the bottom portion 11 of the handle 3, moving the abutment element 18 away from the seat of the indentation 19 previously engaged, unlocking the handle 3 and allowing its rotation relative to the lifting 2.

[0148] The handle 3 is moved until it is brought into a new position of use and, therefore, the locking members 6 are acted upon so as to re-constrain the handle 3 to the lifting portion 2.

[0149] In practice, the lever 17 is pushed against the lifting portion 2, causing engagement of the abutment element 18 with one of the seats delimited along the indentation 19.

[0150] The possibility of varying the inclination of the handle 3 with respect to the lifting portion 2 is particularly useful for various purposes.

[0151] First of all, the configuration of the lifting device 1 can be adjusted according to the size and weight of the manhole cover to be lifted.

[0152] Furthermore, the dimensions of the lifting device 1 can be adjusted according to the maneuvering space available to a user to allow him to apply an optimal driving force through the lifting device 1.

[0153] Furthermore, being able to vary the relative inclination between the handle 3 and the lifting portion 2, the lifting device 1 allows to keep in the open and raised position, in extremely safe conditions, also covers of the hinged type, i.e. covers which they have at least one section hinged to the road surface. For example, by placing the handle 3 perpendicular or substantially perpendicular to the lifting portion 2, it is possible to open a hinged-type manhole cover by rotating it away from the previously occluded opening, until the handle 3 rests against the road surface. Since the lifting portion 2 is perpendicular to the handle 3, the manhole cover hooked to the lifting portion 2 is also placed perpendicular to the road surface and firmly held in the raised position by the lifting device 1.

[0154] Furthermore, the lifting device 1 has a high flexibility of use, comprising a handle 3 of the telescopic type which allows to increase the possibility of modifying the dimensions of the lifting device 1 according to specific use requirements.

[0155] It is pointed out that the conformation of the lifting portion 2, of the handle 3 and of the locking members 6 ensure a high resistance and rigidity to the lifting device 1, guaranteeing a high safety of use even in the case of lifting heavy manhole covers.

[0156] The presence of wheels 27 facilitates the movement of the lifting device 1 to position it in correspondence with the manhole 9 to be lifted and to move the manhole 9 once it has been hooked and lifted, requiring a limited effort by a user.

[0157] The attached Figure 12 illustrates, by way of non-limiting example, a detail of an alternative embodiment of the lifting device according to the invention, indicated as a whole with 100, which differs from the previous embodiment in relation to the configuration of the lifting portion 102.

[0158] Hereinafter, only the components of the lifting device 100 which differ from the previous embodiment, to which reference should be made in full for the remaining components, will be described.

[0159] The lifting portion 102 differs from the previous embodiment in that it comprises a fork element that performs a similar function with respect to the plate elements

12, that is to say that it supports a support 108 to which to connect a tool through which to attach a manhole cover and allows the hinged connection between the lifting portion 102 and the handle 103.

[0160] The fork element includes a central longitudinal element 150 which has an end from which two plate elements 112 protrude, spaced apart, which define opposite arms of the fork element itself.

[0161] The central longitudinal element 150 is made as a tubular element.

[0162] The two plate elements 112 delimit the seat wherein the bottom portion 111 of the handle 103 is housed and hinged according to the same methods described in relation to the previous embodiment to which reference is made.

[0163] The lifting portion 102 comprises a spacer element 113 interposed between the two plate elements 112 at the end opposite the central longitudinal element 150, i.e. at the end where the bottom portion 111 of the handle 103.

[0164] The at least one spacer 113 is removably connected to the plate elements 112 through a threaded connection according to the same methods described in relation to the previous embodiment to which reference is made.

[0165] The at least one spacer 113 allows to keep the two plate elements 112 in position, that is to say at a predetermined mutual distance so as to allow the relative rotation of the handle 103 with respect to the lifting portion 102, without hindering it.

[0166] The central longitudinal element 150 is configured to support a support 108 to which to connect at least one tool for gripping a manhole cover.

[0167] The central longitudinal element 150 includes various connection points at which to connect the support 108 to adjust the relative position of the support 108 along the lifting portion 102, depending for example on the dimensions of the manhole cover to be lifted.

[0168] The attached Figure 13 illustrates a further embodiment of the lifting device according to the invention, indicated as a whole with 200, which differs from the previous embodiments in relation to the configuration of the plate elements, of the bottom portion of the handle as well as of the locking devices.

[0169] In the following description, the same reference numbers used to indicate the corresponding components of the lifting device 1 will be used, increasing them by two hundred units.

[0170] The lifting device 200, similarly to the previous embodiments, comprises a lifting portion 202 and a handle 203 hinged directly to each other, so as to be mutually rotatable about an axis of rotation 205, and locking members 206 for locking selectively in a predetermined position among a plurality of predetermined positions the handle 203 with respect to the lifting portion 202.

[0171] The lifting portion 202 comprises two plate elements 212 mutually connected in a spaced apart position, which delimit an interspace inside which at least a bottom portion 211 of the handle 203 is housed.

[0172] Each of the plate elements 212 has a connecting end, i.e. an end in correspondence with the portion wherein the handle 203 is hinged to the lifting portion 202, configured as circular or as a circular sector, carrying a plurality of through openings 260 positioned spaced apart along an arc of circumference.

[0173] Similarly, the bottom portion 211 of the handle 203 has an end shaped as circular or as a circular sector and bearing at least one through opening, not shown in the attached Figure 13, configured to selectively face into the overall dimensions of one of the through openings 260 of the elements plate 202, depending on the angular position with which the handle 203 is positioned with respect to the plate elements 212.

[0174] The locking members 206 are configured as a pin or a lever configured to simultaneously engage the opening between the through openings 260 through which the at least one delimited opening passing through the bottom portion 211 of the handle 203 faces and thus mutually locking the handle 203 and lifting portion 202.

[0175] It is understood that according to an alternative version of the invention, not illustrated in the attached figures, the locking members 206 comprise a pin movably connected by means of an elastically yielding connection to one of the plate elements 212 and configured to selectively extend beyond said plate element 212 and selectively engaging the at least one delimited opening along the bottom portion 211.

[0176] This pin is selectively movable between a release position, wherein it does not engage the at least one through opening delimited through the bottom portion 211 of the handle 203, allowing the relative rotation of the handle 203 with respect to the lifting portion 202, and a position of engagement wherein this at least one through opening engages, mutually constraining the handle 203 and the lifting portion 202 and preventing their mutual rotation.

[0177] From the above it is evident that the lifting device 1, 100, 200 according to the invention is able to achieve the intended purposes.

[0178] The lifting device 1, 100, 200 in fact, has a high flexibility of use, being able to be adjusted in different configurations thanks to the hinged connection between the lifting portion 2, 102, 202 and the handle 3, 203.

[0179] Furthermore, since the handle 3, 103, 203 is hinged directly to the lifting portion 2, 102, 202, the handle 3, 103, 203 can be placed against or near the lifting portion 2, 102, 202, reducing the overall dimensions of the lifting device 1, 100, 200 when it is not to be used, for example during its transport and storage in a vehicle.

[0180] Furthermore, it should be noted that the lifting device 1, 100, 200 has an extremely reduced transverse size, that is to say a size along a direction parallel to the rotation axis 5 (see in this regard the top view of Figure 3) in favor of a high flexibility of use as well as transport.

[0181] The lifting device 1, 100, 200 has a high mechanical strength with particular reference to the pres-

ence of a lifting portion which includes two plate elements 12, 112, 212 capable of distributing the stresses generated during the lifting and handling of a manhole 9, ensuring high resistance and safety of use to the lifting device 1, 100, 200.

[0182] In the foregoing, the preferred embodiments have been described and variants of the present invention have been suggested, but it is to be understood that those skilled in the art will be able to make modifications and changes without thereby departing from the relative scope of protection, as defined by the claims attached.

Claims

1. Lifting device (1; 100) for lifting and moving a manhole cover (9), wherein the lifting device (1; 100) comprises a variable geometry structure comprising in turn:

- a lifting portion (2; 102), configured to support at least one tool through which to hook said manhole cover (9),
- a handle (3; 103) at one end of which there is at least one handle (4),
said lifting portion (2; 102) and said handle (3; 103) being hinged directly to each other around a rotation axis (5),
- locking members (6) configured to selectively abut a bottom end of said handle (3; 103) to lock said handle (3; 103) in a predetermined position with respect to said lifting portion (2; 102) to define a configuration of use among a plurality of predetermined use configurations wherein said lifting device (1) assumes an "L" or substantially "L" shape or wherein said handle (3; 103; 203) is inclined with respect to said lifting portion (2; 102), wherein said lifting portion (2; 102) defines a seat for housing at least one bottom end of a bottom portion (11) of said handle (3; 103), wherein said seat is delimited at a connection end between said lifting portion (2; 102) and said handle (3; 103),

characterized in that said locking members (6) comprise a lever (17) hinged to said lifting portion (2) around an actuation axis (20) parallel to said rotation axis (5), wherein said lever (17) is configured to selectively move an abutment element (18) between a locking position, wherein said abutment element (18) abuts against said bottom end of said bottom portion (11) of said handle (3), preventing its relative rotation with respect to said lifting portion (2), and a release position, wherein said abutment element (18) disengages said bottom end of said bottom portion (11) of said handle (3), allowing the relative rotation of said handle (3) with respect to said lifting portion (2).

2. Lifting device (1; 100) according to claim 1, wherein said lifting device (1; 100) is selectively configurable between said plurality of predetermined use configurations and a non-use configuration, wherein said lifting device (1; 100) in said non-use configuration has said handle (3; 103) in a leaning position or housed at least partially in said lifting portion (2; 102).

3. Lifting device (1; 100) according to claim 1, wherein said lifting portion (2; 102) comprises two plate elements (12; 112) mutually connected in a spaced position to delimit said seat wherein it is housed and hinged said bottom end of said bottom portion (11) or wherein said lifting portion (102) comprises a fork element (150) comprising two plate elements (112) delimiting said seat wherein said end is housed and hinged bottom portion of said bottom portion (111).

4. Lifting device (1; 100) according to any one of the preceding claims, wherein said lifting portion (2; 102) and said handle (3; 103) are reciprocally hinged by means of a pin (15) which defines said axis of rotation (5).

5. Lifting device (1) according to claim 1, wherein said handle (3) has at least one indentation (19) which extends from said bottom portion (11) and which extends along an arc of circumference, wherein said indentation (19) has a plurality of alternating grooves and ridges, wherein each groove of said indentation (19) is shaped to be selectively engaged, in abutment, by said abutment element (18).

6. Lifting device (1) according to claim 5, wherein said handle (3) has two indentations (19) each lying on a respective plane, wherein the planes of arrangement of said indentations (19) are parallel to each other and spaced by a distance at least equal to the dimension of the transverse thickness of said lever (17) along said direction of rotation (5).

7. Lifting device (1) according to one of claims 1, 5, 6 wherein said lever (17) has an end configured as a fork (22) carrying two arms parallel to each other, each of said arms delimiting a through seat wherein a cylinder (23) is housed, said abutment element (18) being operatively connected by means of a rod (24) to said cylinder (23), wherein said rod (24) can be moved, like a pendulum, between said arms of said lever (17).

8. Lifting device (1) according to any one of claims 1, 5 to 7, wherein said lever (17) has a control end (25) for operating said lever (17) between a locking position, wherein said lever (17) is placed against and held in position at one end of said lifting portion (2), positioning said abutment element (18) in said locking position, and a release position, wherein said le-

ver (17) it is rotated away from said lifting portion (2), positioning said abutment element (18) in said release position.

9. Lifting device (1) according to any one of claims 5-8 when dependent on claim 3, wherein said lifting portion (2) comprises a first spacer (13) and a second spacer (14) interposed between said elements plate (12), wherein said first spacer (13) is placed in correspondence with said lever (17) and has a shaped portion complementary to a abutment portion (26) of said lever (17), so that when said lever (17) is placed in a locking configuration, said abutment portion (26) is placed in abutment and held in position against said first spacer (13).

10. Lifting device (1) according to any one of the preceding claims, wherein said handle (3) is of the two-stage telescopic type.

11. Lifting device (1) according to the preceding claim, wherein said handle (3) comprises said bottom portion (11), a central portion (32) telescopically housed in said bottom portion (11) and a top portion (33) telescopically housed in said central portion (32), a bottom pin (34) for selectively locking said central portion (32) in position with respect to said bottom portion (11)
and a central pin (36) configured to selectively lock in position said top portion (33) with respect to said central portion (32) so as to vary the overall length of said handle (3) along a longitudinal direction (31) of said handle (3), perpendicular to said axis of rotation (5).

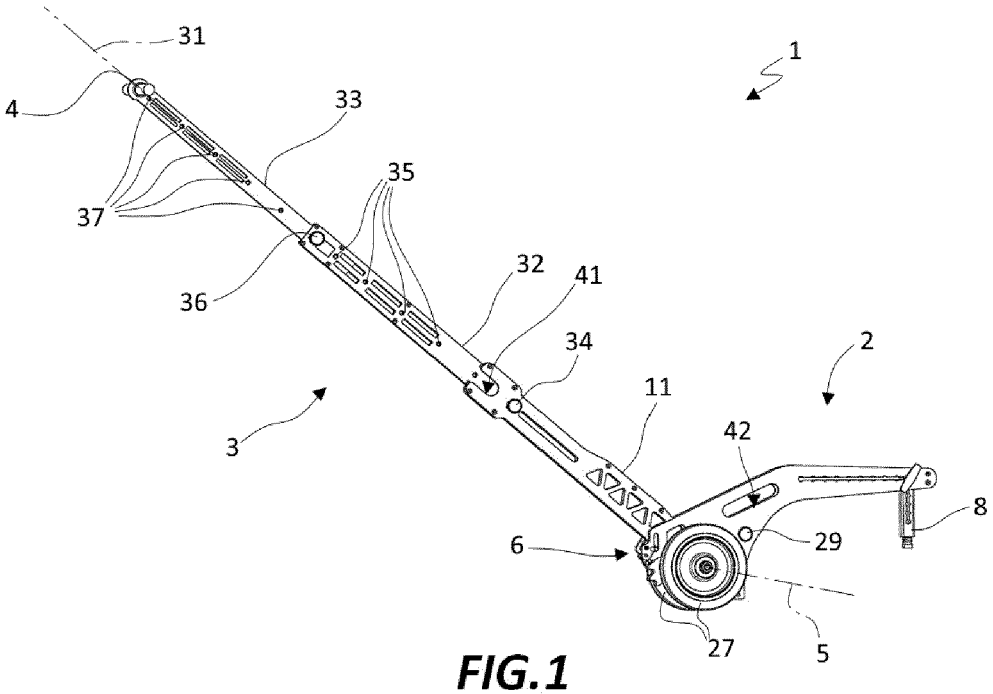


FIG.1

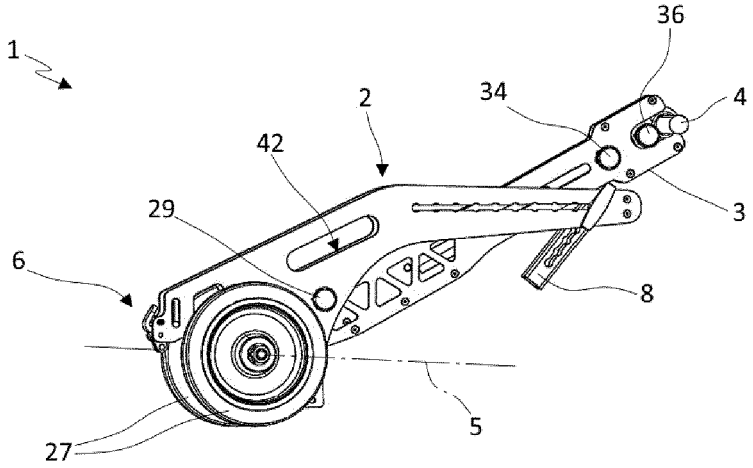


FIG.2

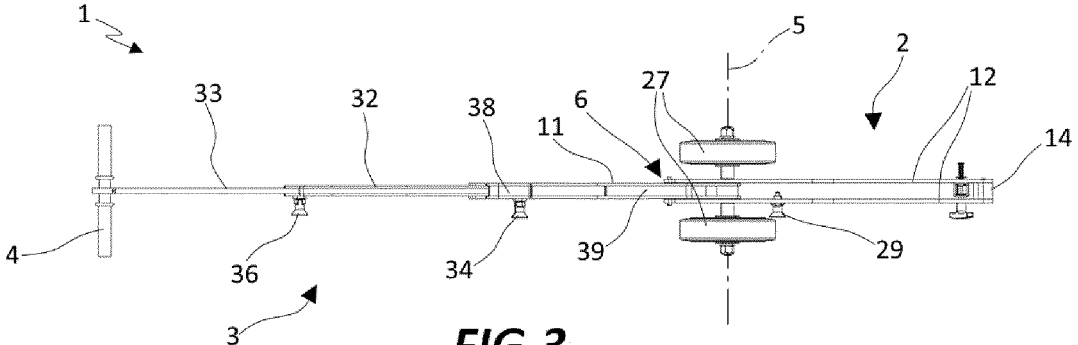


FIG.3

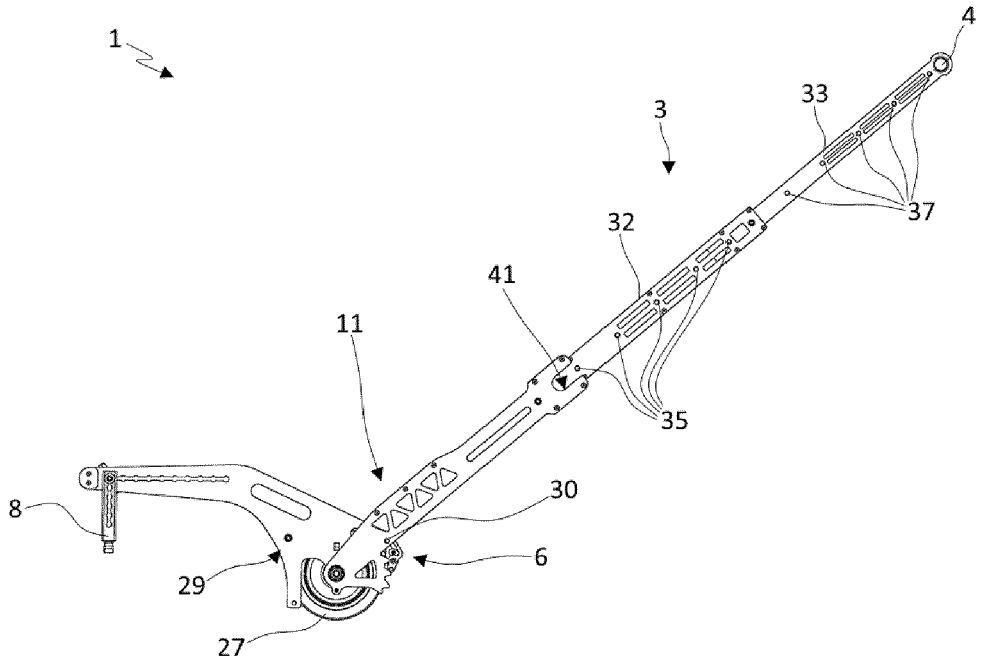


FIG.4

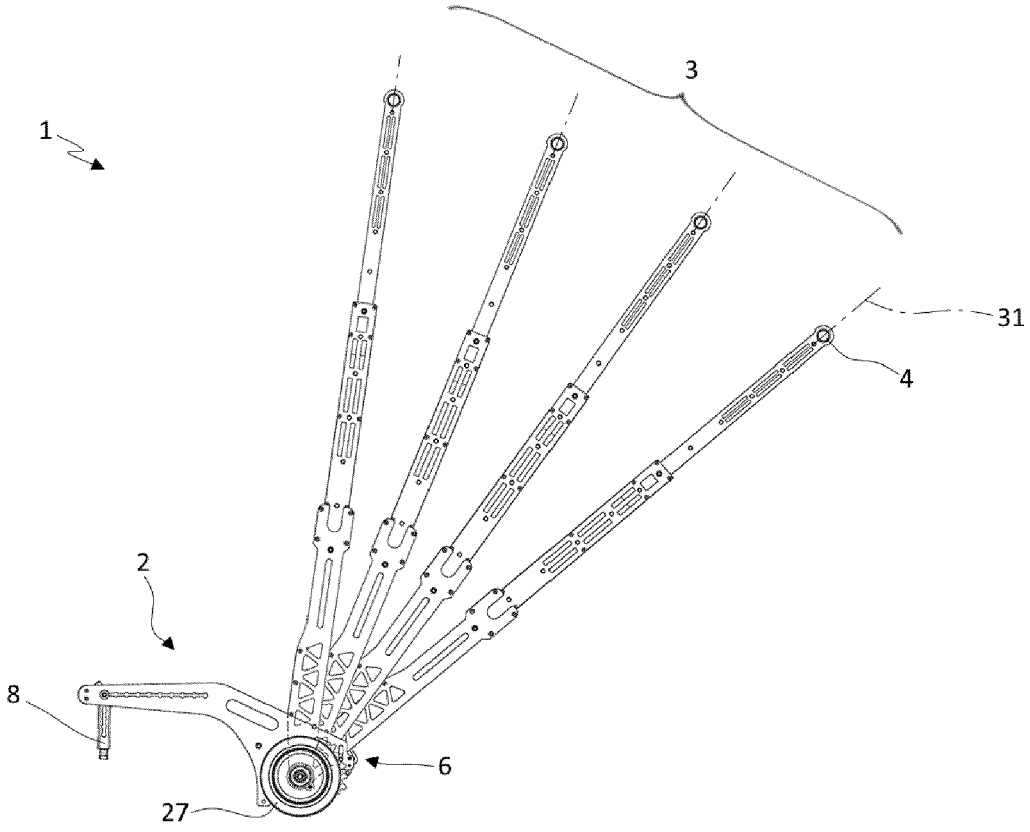
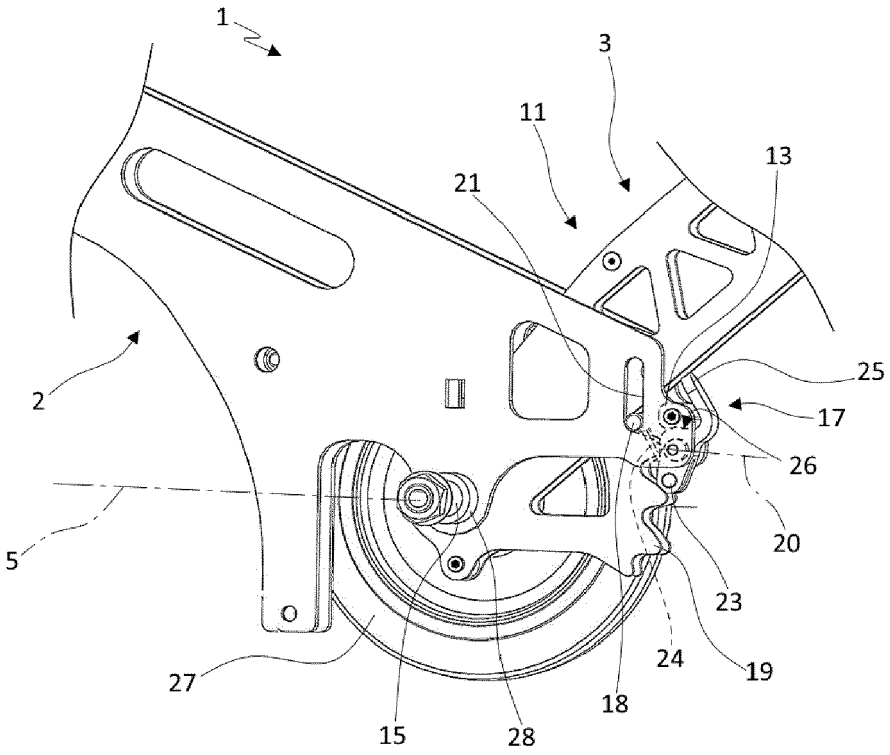


FIG.5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3
11
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13
2
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5
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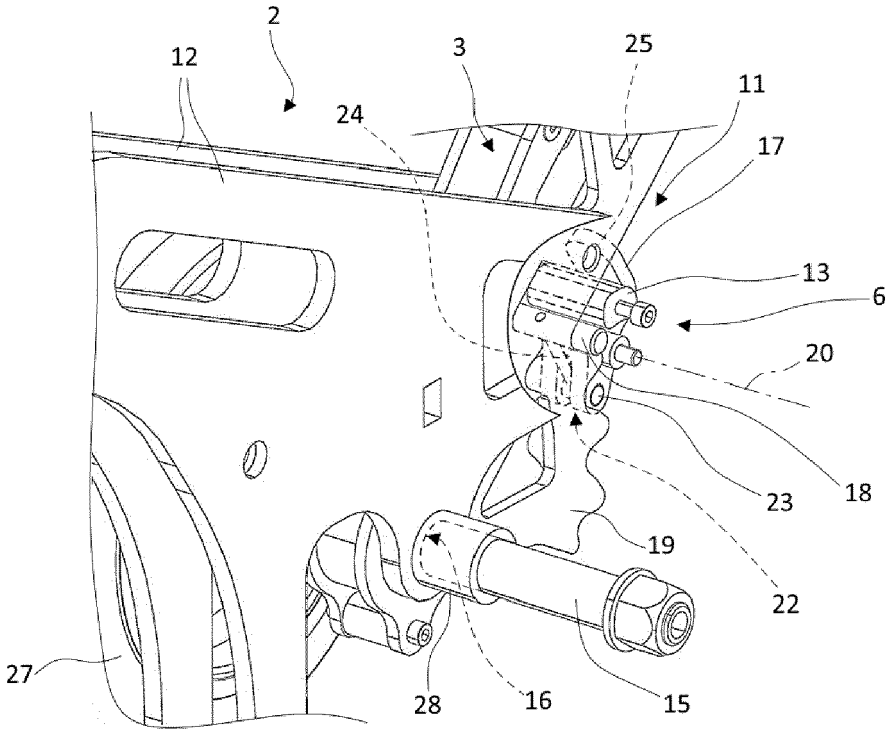
18
15
28

FIG.6


2
12
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23
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22
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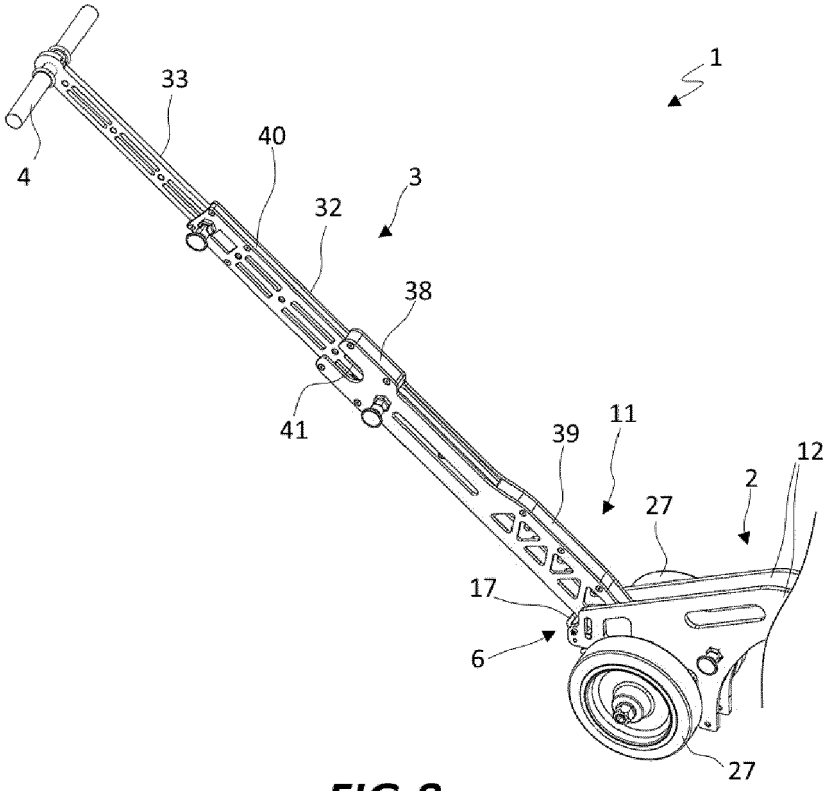
28
16
15

FIG.7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17
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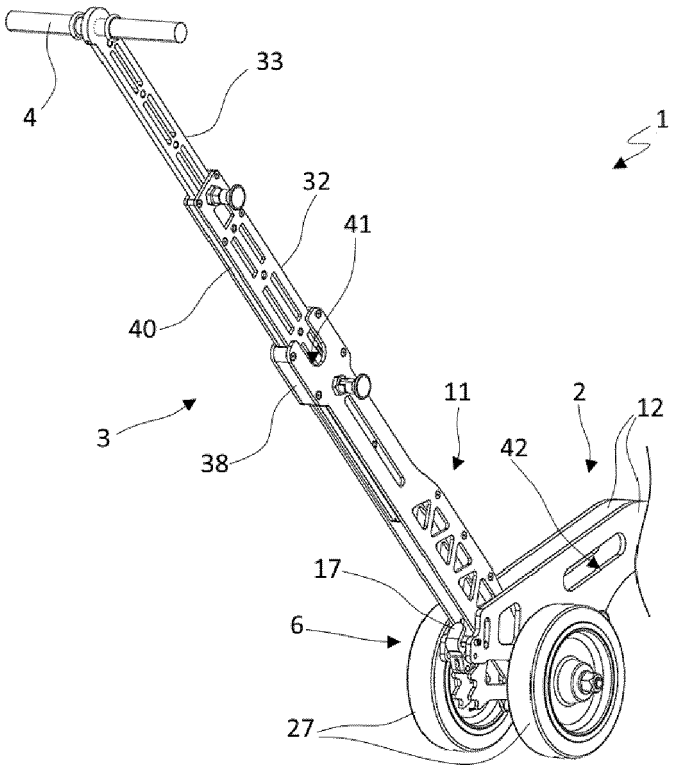
27

FIG.8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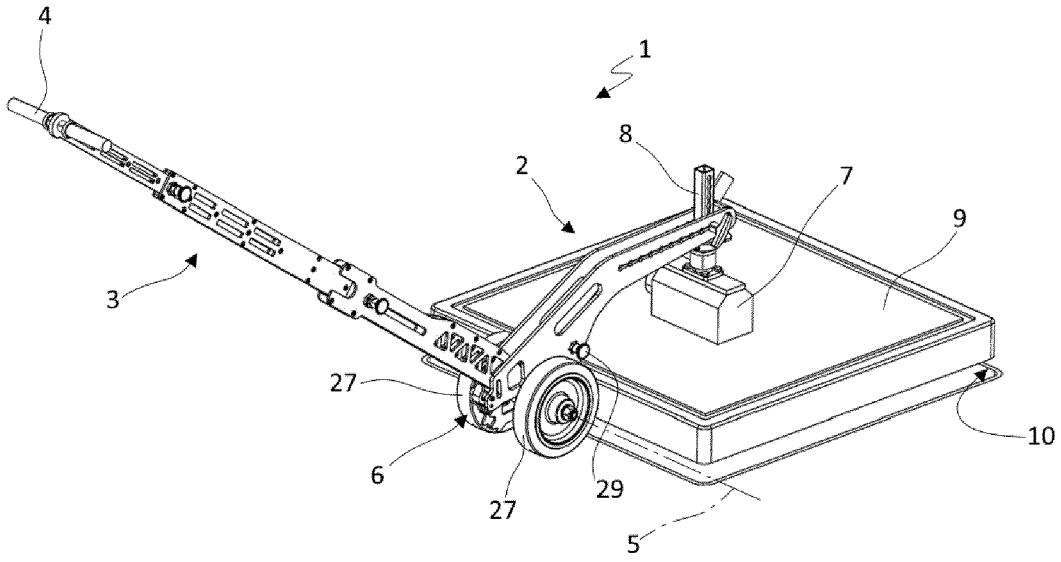
42
17
6
27

FIG.9


4
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7
9
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27
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6
29
27
5

FIG.10

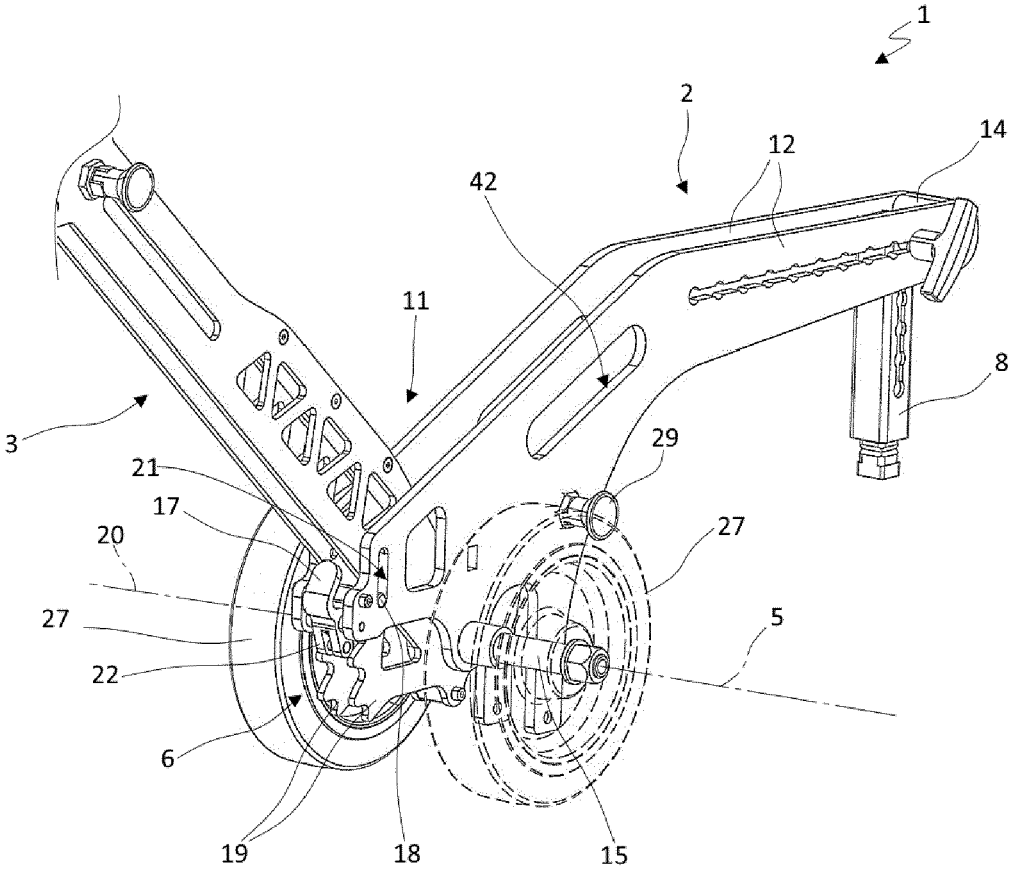
1
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FIG.11

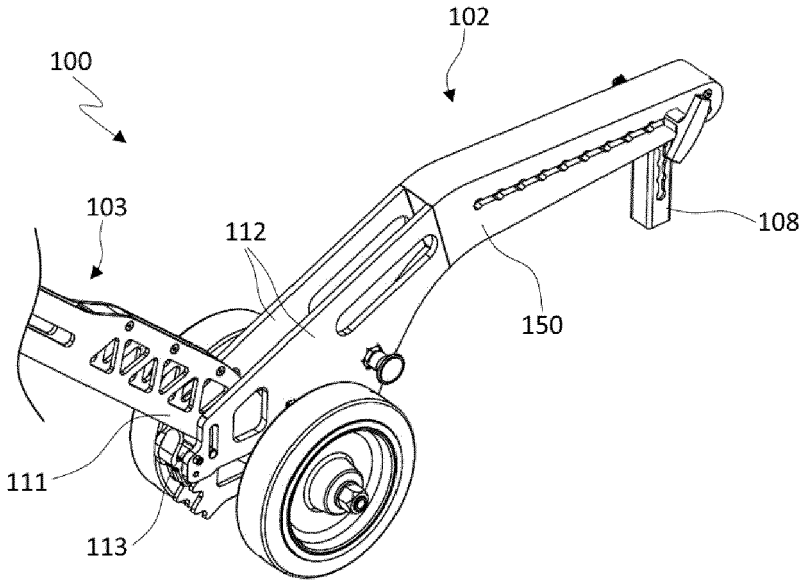

FIG.12

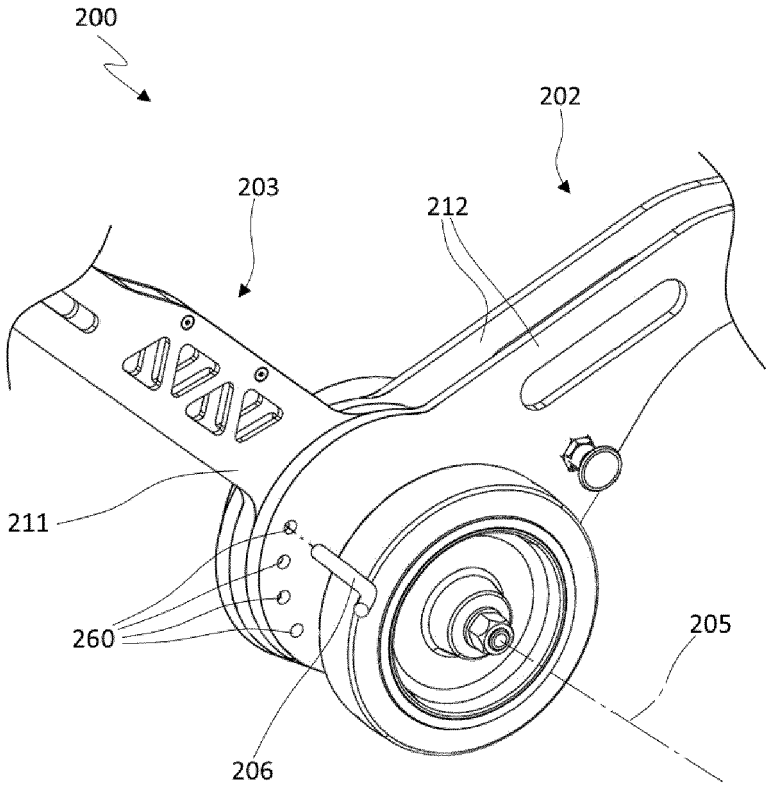

FIG.13

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EUROPEAN SEARCH REPORT

Application Number
EP 22 19 1551

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	US 7 503 743 B1 (FRIEDRICH PETER [US]) 17 March 2009 (2009-03-17) * abstract; figures 9, 10A, 10B, 10C, 10D * * column 8 *	1,2,4,5, 9,11	INV. B66F15/00 B66F19/00
A	US 4 653 728 A (MOCHIZUKI OTOHIKO [JP] ET AL) 31 March 1987 (1987-03-31) * abstract; figure 1 *	1,10	

TECHNICAL FIELDS SEARCHED (IPC)

B66F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	28 December 2022	Verheul, Omiros

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L : document cited for other reasons

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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 22 19 1551

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28-12-2022

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EPO FORM P0459

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

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- FR 2427996 **[0009]**
- TW M256379 U **[0009]**