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(54) **LIFT ARM AND VEHICLE LIFT**

HUBARM UND FAHRZEUGLIFT

BRAS DE LEVAGE ET ÉLÉVATEUR DE VÉHICULE

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Description

FIELD OF THE INVENTION

[0001] The present invention relates to a lift arm as well as a vehicle lift and a vehicle lift process using said arm. The present invention may be used in the automotive field for servicing vehicles, e.g., cars, trucks or agricultural vehicles.

BACKGROUND

[0002] Column lifts comprise one or more vertical support columns each of which carries a carriage provided with a pair of adjustable and/or extendable arms, as shown in the US Patent No. US 4,825,977: the ends of the arms comprise height-adjustable pads configured to receive the vehicle to be lifted. The movement of each carriage is performed by electromechanical systems, e.g., an electric motor operating on a mother-screw type system, or by hydraulic cylinders.

[0003] U.S. Patent Application No. US 2020/0079627 A1 describes a two-column lift comprising, for each column, two telescopic lift arms hinged to a carriage vertically movable along the respective column. Each arm extends along a rectilinear direction and terminally carries an adapter configured to contact a vehicle: the adapter is hinged to the arm. Rotation between the adapter and the arm may be locked by a further pin insertable through appropriate holes defined on respective plates of the adapter and the telescopic arm. US 2020/0079627 A1 discloses the preamble of claim 1.

[0004] US patent application No. US 2019/0276287 A1 also describes a two-column lift comprising, for each column, a first and a second arm hinged to a carriage vertically movable along the respective column. The first arm may be telescopic and extends along a rectilinear direction; the second arm includes a base body, directly hinged to the carriage, and a distal body hinged to the base body: the distal body includes a height adjustable support configured to contact a vehicle. In detail, the base body and the distal body are equal in length and hinged at an intermediate joint. Relative rotation between the base body and the distal body of the second arm may be locked by a lever carried by the base body engaging a toothed disc on the second arm.

[0005] The Applicant observed that lifts of the state of the art are not devoid of limitations and drawbacks. Such lifts have articulated lift arms having a complex, bulky, and difficult to implement rotation lock system; such lock systems are not capable of ensuring rapid and safe locking of the rotation of the articulated arm, a condition which negatively affects on safety and productivity. Although the known lifts are used for lifting vehicles, the Applicant observed that such lifts are not devoid of limitations and drawbacks, therefore being subject to improvement from various points.

OBJECT OF THE INVENTION

[0006] The object of the present invention is to overcome at least one of the drawbacks and/or limitations of the previous solutions.

[0007] An object of the present invention is to provide a lift arm and a respective lift having a simple and compact structure, which has low production costs and which at the same time is structurally robust, and able to safely and quickly lift vehicles. Furthermore, an object of the present invention is to provide a lift arm and a respective vehicle lift capable of guaranteeing the effective and quick lifting of a wide range of transport means. Furthermore, another object of the present invention is to provide a lift capable of operating in a safe and reliable manner, in particular capable of lifting vehicles without damaging said vehicle and/or components of the lift itself.

[0008] These and other objects, which will be more apparent from the following description, are substantially attained by a lift arm and a vehicle lift according to one or more of the attached claims and/or the aspects below.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] Some embodiments and some aspects of the invention will be hereafter described with reference to the attached exemplifying and therefore not-limiting drawings, in which:

- Figure 1 is a perspective view of a lift according to the present invention;
- Figure 2 shows a detail of the lift in Figure 1;
- Figure 3 is a perspective view of a lift arm according to the present invention;
- Figure 4 shows a detail of a lift arm according to the present invention;
- Figures 5 and 5A show details of a lift arm according to the present invention where an insert of said lift arm is in grip position;
- Figure 6 is a further view of a detail of a lift arm according to the present invention where an insert of said lift arm is in release position;
- Figures 7 and 8 are sectional views of a lift arm according to the present invention.

DEFINITIONS AND CONVENTIONS

[0010] In the detailed description, corresponding parts illustrated in the various figures are indicated with same reference numbers. The figures could include representations that are not in scale; parts and components illustrated in the figures might be schematic representations.

[0011] The terms "*horizontal*" or "*vertical*", used in relation to components of the lift, refer to a condition of use of the lift during which the lift executes, or is usable, for executing raising/lowering of a vehicle.

DETAILED DESCRIPTION

Lift arm 30

[0012] Reference number 30 indicates a lift arm for a vehicle lift. For example, the lift arm 30 may be used in the automotive industry for servicing vehicles, e.g., cars, trucks, agricultural vehicles. The lift arm 30 is usable in association with at least one column of a vehicle lift to allow lifting of the vehicle with respect to the ground.

[0013] The lift arm 30 includes a base body 31 extending between a first and a second end portion 31a, 31b along an, optionally rectilinear, extension path D. In detail, the base body 31 has an elongated conformation; the base body 31 has a predetermined length defined by the maximum distance between the first and the second end portions 31a, 31b: said length of base body 31 may be, for example, equal to or greater than 500 mm, optionally comprised between 500 mm and 1200 mm.

[0014] The length of base body 31 may be fixed or adjustable. In the accompanying figures, the lift arm 30 is extendable: the distance between the first and second end portions 31a, 31b is adjustable, for example by means of an actuator 60 (Figure 8). The actuator 60 may comprise at least one of: a hydraulic cylinder, a pneumatic cylinder, an electric motor.

[0015] In particular, the base body 31 may have a first section and a second section, which are movable with respect to each other along the extension path D of the base body 31 to adjust a length of the base body 31. For example, the first section may extend from the first end portion 31a to a centerline portion of the base body 31 while the second section may extend from the second end portion 31b to the centerline portion of the base body 31.

[0016] The actuator 60 may be engaged, on one side, to the first section and, on the other side, to the second section: activation of the actuator 60 allows to approach or move away the first and second end portions 31a, 31b.

[0017] For example, the base body 31 may be at least partly hollow and internally define a housing compartment A suitable for at least partly receiving said actuator 60: in such a configuration, the actuator 60 would be at least partly hidden within the base body 31.

[0018] In particular, both the first section and the second section of the base body 31 may be hollow and internally define a respective housing compartment (Figure 8); the second section of the base body 31 may be placed at least partially within the first section and be slidably movable at least partially within said first section of the same base body 31. The actuator 60 is arranged within the housing compartments defined by the first and second sections of the base body 31: the housing compartments of the first and second sections of the base body 31 communicate with each other and cooperate to define a single housing compartment A of the base body 31 (Figure 8). From a structural point of view, the base body 31 may present a box shape, for example, the base

body may have a cross section, in plane orthogonal to the extension path D of the base body 31, having substantially square or rectangular shape. Such cross section may be constant along the entire extension of the base body or it may get smaller moving towards the second end portion. In particular, the first section of the base body may have cross section greater than the cross section of the second section of the same base body 31; in this way, the first section may internally receive the second section of the base body and guide movement of the second section of the same base body 31. Obviously, the possibility of fixed, non-extendable, base body 31 is not excluded.

[0019] As shown in Figure 8, the base body 31 may comprise at least one attachment portion 33 configured for engagement of the lift arm 30 to at least one carriage 3 of a lift 1 (see Figures 1 and 2). The attachment portion 33 may comprise at least one plate suitable for being hinged, for example by means of a cylindrical pin, to a carriage 3 of a lift, such that the lift arm may rotate with respect to the carriage about an axis Y, in particular orthogonal to the extension path of the base body 31.

[0020] At the second end portion 31b, the base body 31 comprises an engagement portion coupling the base body 31 with a distal body 32 of the same lift arm 30. In particular, the engagement portion of the base body 31 comprises at least one plate 35 (see Figures 4 and 7) having at least one through hole for receiving a cylindrical pin 39 configured to engage the base body 31 and the distal body 32. In detail, the engagement portion of the base body 31 comprises two plates 35 spaced apart from each other, each of which has at least one through hole suitable to receive the cylindrical pin 39. The plate(s) 35 define the second end portion 31b of the base body 31 receiving and engaging the distal body 32.

[0021] The distal body 32 extends between a first and a second end portions 32a, 32b, along a respective extension path T, optionally rectilinear (Figures 6 and 8). In detail, the distal body 32 has an elongated conformation; the distal body 32 has a length defined by the maximum distance between the first and second end portions 32a, 32b: such length of the distal body may be equal to or greater than 100 mm, and may be optionally comprised between 100 mm and 500 mm. The length of the base body 31 is greater than the length of the distal body 32; for example, the ratio between the length of the base body 31 and the length of the distal body 32 may be greater than 3, and optionally between 4 and 8.

[0022] The base body 31 and the distal body 32 may relatively rotate at least around an axis Z. The distal body 32 is hinged to the base body 31 at the second end portion 31b. In detail, the base body 31 and the distal body 32 are hinged at the second end portion 31b of the base body 31 and at the first end portion 32a of the distal body 32. The distal body 32 is thus a movable extension of the base body 31. The Z-axis of relative rotation between the base body 31 and the distal body 32 is orthogonal to the extension path D of the base body 31, in particular, the

Z-axis may be orthogonal to both extension paths D and T respectively of base body 31 and distal body 32. In detail, the base body 31 is coupled to the distal body 32 by a flat hinge allowing only the relative rotation of the bodies 31, 32 about the single axis Z.

[0023] In greater detail, the base body 31 and the distal body 32 are movable at least between:

- an aligned position (Figures 3-5 and 8) where the extension paths D, T respectively of base body 31 and distal body 32, are substantially parallel to each other,
- an offset position (Figures 2 and 6) where the extension paths D, T respectively of base body 31 and distal body 32, are angularly offset from each other.

[0024] In the offset position, the extension paths D, T intersect and essentially define an ideal plane; the axis Z of rotation of base body 31 relative to distal body 32 is orthogonal to said ideal plane. In the aligned position, the base body 31 and the distal body 32 define a maximum length of the lift arm 30, which is therefore defined by the maximum distance between the second end portion 32b of the distal body 32 and the first end portion 31a of the base body 31; this maximum length may be equal to or greater than 600 mm, optionally comprised between 600 mm and 2000 mm. The distal body 32 comprises, at the first end portion 32a, a respective engagement portion coupled with the engagement portion of the base body 31. In detail, the engagement portion of the distal body 32 comprises at least one plate 34 at least partially overlapping plate 35 of the base body 31. In greater detail, the embodiment in which the base body 31 has two spaced apart plates 35, plate 34 of the distal body 32 is placed between said two plates 35. Plate 34 of the distal body 32 comprises a respective through hole aligned with the at least one through hole of plate 35 of the base body 31. The base body 31 is engaged to the distal body 32 by cylindrical pin 39 (Figure 4) which crosses the through-holes of the respective plates 34 and 35.

[0025] Lift arm 30 may further comprise at least one support 5 carried by the distal body 32 and configured to directly contact the vehicle. In detail, the support 5 is arranged at the second end portion 32b of the distal body 32 and protrudes from the distal body along a direction which is transverse, optionally orthogonal, to the extension path T of the distal body (in particular orthogonally to the ideal plane defined by the extension paths D and T of the base body 31 and the distal body 32). Support 5 may move relative to the distal body 32 towards to and away from the ideal plane. As schematically shown in figure 7, also support 5 may freely rotate, with respect to distal body 32 about an own axis W; axis W may be substantially parallel to axis Z of rotation of the base body 31 relative the distal body 32.

[0026] Lift arm 30 further comprises a lock system 40 configured to block relative rotation between the base body 31 and the distal body 32. The base body 31 and the

distal body 32 are movable with respect to each other such that the distal body 32 may be oriented to properly contact the vehicle without causing damage to vehicle parts, for example to a vehicle battery pack; after having properly orientated the distal body 32, the relative position between the distal body 32 and the base body 31 may be locked to provide the lift arm with a certain stability and to avoid undesired movements that could cause the vehicle roll over lift arm 30. The lock system 40 comprises at least one insert 41 movable at least between:

- a release position (see, for example, Figure 6) where insert 41 is configured for allowing relative rotational between the base body 31 and the distal body 32, and
- a gripping position (see, for example, Figures 5, 5A and 7) where insert 41 is configured for blocking relative rotational between the base body 31 and the distal body 32.

[0027] Insert 41 is carried by at least one of said base body 31 and said distal body 32 and it is slidably movable with respect to said bodies between the gripping position and the release position, and vice versa along at least a trajectory substantially parallel to at least one section of at least one of the extension path D of the base body 31 and the extension path T of the distal body 32.

[0028] In the accompanying figures, a non-limiting example of an insert 41 carried directly by the base body 31 is shown: the insert 41 is slidably movable between the gripping position and the release position, and vice versa, along a trajectory substantially parallel to the extension path D of the base body 31.

[0029] The insert 41 has a substantially parallelepiped, optionally rectangular parallelepiped, shape, and longitudinally extends between a head surface 40b facing the distal body 32, and a bottom surface 40a facing the first end portion 31a of the same base body 31 carrying the insert 41. In such configuration, the insert 41 (carried by the base body 31) has an engagement portion 46 which, in the gripping position, is configured to constrain an engagement portion 50 of the distal body 32: the engagement portion 46 of the insert 41 emerges from the head surface 40b in the direction of the distal body 32. The engagement portion 46 of the insert 41 may comprise at least one tooth 46a configured to cooperate with a toothed profile 51 of the engagement portion 50 of the distal body 32; in particular, the engagement portion 46 of the insert 41 may comprise a plurality of teeth 46a (Figure 6) configured to cooperate with the toothed profile 51 of the engagement portion 50 of the distal body 32. The teeth 46a of the engagement portion 46 may be aligned along a direction which is transverse, optionally orthogonal, to the movement direction of the insert 41, namely being aligned according to an alignment direction, which is orthogonal to the extension path D of the base body 31 and parallel to the ideal plane. In detail, as shown in the accompanying figures, the head surface 40b may be flat:

the plurality of teeth 46a may emerge from said flat head surface 40b.

[0030] It is not excluded the possibility of a curved head surface 40b: in such configuration, the plurality of teeth 46a of the insert 41 would be aligned along an arc profile such that said teeth 46a may essentially define a portion of a toothed wheel suitable to engage the toothed profile 51 of the distal body 32. For example, the insert 41 may have a number of teeth 46a equal to or greater than 2, optionally between 3 and 5.

[0031] Similarly, the toothed profile 51 of the engagement portion 50 of the distal body 32 may comprise, in a non-limiting way, a plurality of teeth aligned along a respective arc shaped trajectory; the plurality of teeth of the engagement portion 50 of the distal body 32, in the gripping position of the insert 41, is configured to cooperate with the at least one tooth 46a of the engagement portion 46 of the insert 41 to block relative rotation between the base body 31 and the distal body 32. The arc-shaped trajectory of alignment of the teeth of toothed profile 51 lies in a plane substantially parallel to the ideal plane. In detail, the toothed profile 51 is defined at the first end portion 32a and is directed towards the base body 31; the toothed profile 51 emerges substantially from a curved end surface of distal body 32 and therefore directly faces tooth 46a of insert 41 (see, for example, the detail Figures 5A and 6). However, the use of a toothed profile 51 extending along a rectilinear trajectory, i.e., emerging towards the base body 31 from a flat end surface of the distal body 32 (condition not illustrated), is not excluded.

[0032] The insert 41 may be placed at an external surface of the base body 31 or integrated within the base body 31. The insert 41 is placed, in a non-limiting way, within a seat 44 of the base body 31 (Figures 5-6). The seat 44 is placed at the second end portion 31b and has a substantially "U" shape, with concavity directed towards the distal body 32: the seat 44 of the base body 31 is open. In fact, the seat 44 is at least partially counter-shaped to the insert 41 so that the insert is guided in its movement between the release position and the gripping position, and vice versa.

[0033] As can be seen for example from Figure 6, insert 41, at least in the release position, is entirely housed in the seat 44 of the base body 31. In the gripping position, the head surface 40b of the insert 41 is placed near a front free edge of said seat: the at least one tooth 46a (optionally the plurality of teeth 46a) of insert 41, in the gripping position, at least partially protrudes from seat 44 to contact the toothed profile 51 of the distal body.

[0034] The lock system 40 may comprise a return element 42 configured to thrust on the insert 41 and force it to normally stay in the gripping position. In fact, the return element 42 is configured to normally keep insert 41 in the gripping position where insert 41 is constrained to the engagement portion 50 of the distal body 32 to thereby prevent relative rotation between the base body 31 and the distal body 32.

[0035] In detail, the return element 42, on one side, contacts the base body 31 and, on the other side, contacts the insert 41 to keep the insert normally in the gripping position. In greater detail, return element 42 is placed entirely inside seat 44 between a bottom wall of the seat 44 and the bottom wall 40a of the insert: the return element pushes the bottom of insert 41 to force the engagement of tooth 46a with toothed profile 51 of the distal body 32. The return element 42 may be an elastic return element and may comprise at least one of: a torsion spring, a compression spring, a tension spring, an air spring, a leaf spring. In the accompanying figures, the return element comprises, in a non-limiting way, a compression spring, on one side, resting on the bottom wall of the seat (wall directly facing the bottom surface 40a of the insert 41), and, on the opposite side, at least partially housed inside a guide seat on bottom surface 40a of the insert 41. It is not excluded the possibility of using a different return element 42, for example an actuator comprising at least one of: a magnetic or electromagnetic actuator, a hydraulic actuator, or a pneumatic actuator.

[0036] The insert 41 may be moved from the gripping position to the release position by an operator manual action or by an actuator, for example comprising at least one of: a magnetic or electromagnetic actuator, a hydraulic actuator or a pneumatic actuator. Lift arm 30 may also comprise at least one maneuvering element 43 engaged to the insert 41 and emerging from at least one of the base body 31 and the distal body 32; the maneuvering element 43 is configured to be manually operated to move the insert 41 at least between the gripping position and the release position. In detail, the maneuvering element 43 includes a push portion 43b directly engaged to the insert 41 and a lever 43a allowing an operator to impose a movement to the insert 41 at least between the gripping position and the release position.

[0037] In detail, the insert 41 may comprise at least one seat 41a (Figure 7) within which the thrust portion 43b of the maneuvering element 43 is engaged. Seat 41a may have a cylindrical shape whereas the thrust portion 43b of the maneuvering element 43 may comprise a cylindrical pin at least partially counter-shaped to seat 41a. The thrust portion 43b is displaced thanks to manual intervention of the operator, from outside the base body 31, on lever 43a: displacement of the thrust portion 43b allows guiding the sliding insert from the gripping position to the release position to allow consequent disengagement of tooth 46a from toothed profile 51.

[0038] Figure 5A shows the maneuvering element 43 which, in addition to being engaged in the insert, may further have a support end 43c allowing the maneuvering element to engage the base body 31. In detail, the base body 31 has a recess 47 delimited by at least one abutment wall; recess 47 is placed at the side of seat 44 of the same base body 31: recess 47 and seat 44 of base body 31 are in communication with each other and define a single pocket suitable to receive insert 41 and at least part

of maneuvering element 43 (see, for example, Figure 5A). The support end 43c of maneuvering element 43 opposed to the lever 43a and it is configured to be positioned within the recess, resting against the abutment wall to allow an operator, during (optionally manual) movement of the maneuvering element 43 from the gripping position to the release position, to leverage abutment wall of the recess 47. Following operation of the lever 43a and movement of insert 41 from the gripping position to the release position, base body 31 may relative freely rotate the distal body 32 with respect to the base body 31. Once the desired orientation of the distal body 32 relative to the base body 31 has been reached, the operator in charge can release lever 43a of the maneuvering element so that return element 42 can quickly return insert 41 (sliding the same along extension path D or along the extension path T) to the gripping position in which tooth 46a of the insert is stably engaged to toothed profile 51.

[0039] As mentioned above, in the accompanying figured, insert 41 may be, in a non-limiting way, directly carried by the base body 31. It is not excluded the possibility to arrange an insert 41 directly carried by distal body 32 and slidably movable with respect to said distal body along the extension path T. In such configuration, the insert 41 would be arranged in proximity of the first end portion 32a of the distal body 32, directly facing a portion of engagement of the base body 31, which would be placed at the second end portion 31b of the base body 31, directly facing the insert 41.

Lift

[0040] It is also an aspect of the present invention a vehicle lift 1, for example usable in the automotive industry for servicing various types of vehicles, including: cars, trucks or agricultural vehicles.

[0041] Lift 1 may comprise at least one column 2 extending, in use, along a vertical direction between a base portion 2a and a top portion 2b (see, for example, Figure 1). Column 2 defines the vertical support element which may be fixed to the ground, for example by means of screw-bolt systems, and configured to support the vehicle above the ground. Column 2 may comprise a base plate 20, optionally made of metal, configured to be fixed to the ground and from which a metal support frame 21 emerges. The support frame 21 may be hollow to internally accommodate one or more components of the lift 1. The support frame 21 may have, along its entire extension, a constant profile cross-section, optionally having a substantially "C" or substantially "V" shaped profile. In detail, the support frame 21 is made of one or more layers of sheet metal.

[0042] The lift 1 may comprise a single column 2 or a plurality of distinct and spaced apart columns 2. Figure 1 illustrates, in a non-limiting way, a lift 1 comprising two columns 2 (a first and a second column): the columns are spaced apart from each other and extend, parallel to each

other, along a vertical direction. The columns are spaced apart to allow positioning of at least one vehicle between the columns.

[0043] As shown in Figure 1, lift 1 comprises at least one carriage 3 engaged with column 2 and slidably movable along said column. In detail, lift 1 includes a carriage 3 for each column 2. Carriage 3 carries at least one lift arm 30 suitable for contacting the vehicle and moving it with respect to the ground, for example for allowing an operator to service the vehicle. Carriage 3 is mobile along column 2 towards and away from base portion 2a (optionally from the plate 20).

[0044] Carriage 3 carries at least one lift arm 30 according to the above description and/or according to any one of the accompanying claims. Lift arm 30 is configured to contact the vehicle to allow lifting and lowering. Lift arm 30 is positioned transverse to, for example orthogonal to, column 2. Lift arm 30 may be oriented, i.e., movable relative to the carriage by rotation about an axis Y, parallel to the direction of extension of column 2: rotation axis Y may develop outside support frame 21 as, for example, illustrated in Figure 1. In detail, carriage 3 includes a coupling portion configured to abut on attachment portion 33 of lift arm 30 to define a hinge-type joint (optionally a flat hinge). The axis of rotation Y of lift arm 30 is substantially parallel to axis Z of relative rotation between base body 31 and distal body 32 (see, for example, Figure 2).

[0045] Carriage 3 may engage two lift arms 30 (see, for example, Figures 1 and 2) both configured to contact a vehicle. Lift arms 30 may lie substantially in a single plane orthogonal to the direction of extension of column 2. At least one of said lift arms 30 may be orientable, i.e., movable by rotation about a respective axis Y parallel to a column extension direction. Lift 1 of Figures 1 and 2 has, in a non-limiting way, a first and second lift arms both being orientable; in addition or alternatively, at least one of the lift arms may be extendable.

[0046] As specified above, lift 1 may comprise a first and a second column. If lift 1 comprises only one column, then lift 1 also has only one carriage 3. Figure 1 shows an exemplary lift 1 having a first and a second column each of which comprises a carriage 3 according to above description. Each carriage 3 is movable along the respective column 2 by action of a movement system of known type, for example by means of one or more hydraulic actuators or by means of a screw-nut system operated by an electric motor 7. In Figure 1, a column lift is shown having a movement system comprising an electric motor 7 for each column housed inside a specific casing 15 arranged at the top portion 2b of the column 2.

Lifting process

[0047] It is also an aspect not according to the claimed invention a process for lifting vehicles using a lift 1 according to the above description. The process involves the following steps:

- arranging carriage 3 in proximity to the ground, for example operating electric motor 7 and causing sliding of the carriage 3 along column 2. Such phase allows to bring the lift arm 30 at the ground;
- placing a vehicle above the at least one lift arm 30,
- moving carriage 3 along column 2 to bring the at least one lift arm 30 into contact with the vehicle to lift the vehicle above the ground.

[0048] Following placing of the vehicle above the lift arm 30 and prior to contacting the vehicle with the arm 30, the process may include a step of orienting distal body 32 with respect to base body 31 to place the distal body at a desired angle with respect to the base body 31. The orientation step allows lift arm 30 to properly contact the vehicle (e.g., the vehicle body) without causing any damage to components of the vehicle, such as the battery pack of an electric car (fully hybrid or plug-in car).

[0049] This orientation step may include the following sub-steps:

- arranging insert 41 of lock system 40 in the release position,
- rotating distal body 32 with respect to base body 31 about the respective axis Z to arrange said distal body at a desired angle with respect to the base body 31,
- arranging insert 41 of lock system 40 in the gripping position to lock said distal body 32 and base body 31 at the desired angle; this step may be performed by return element 42 following release of lever 43.

[0050] The sub-step of arranging the insert 41 in the release position comprises the sub-steps of manually moving lever 43a of maneuvering element 43 such that thrust portion 43b may act on insert 41 to disengage the at least one tooth 46a thereof from the toothed profile 51 of distal body 32.

[0051] After having correctly oriented the distal body 32 and the base body 31, the process may proceed with the lifting of the arm 30, for example by moving carriage 3 along the column, by operating electric motor 7: the arm 30, after having contacted the vehicle, lifts the vehicle above the ground.

Servicing process of a vehicle

[0052] Not according to the claimed invention is a process for servicing a vehicle using a lift 1 or a lift arm 30 according to the above description.

[0053] The process may be performed on electric or hybrid vehicles having a battery pack. In such configuration, the process may comprise the following steps:

- lifting the vehicle, for example by the process described above,
- removing the battery pack from the vehicle,
- lowering the battery pack maintaining it within a

volume comprised between the lift arms 30 and each column without interfering with the arm. Such step being performed moving the battery pack along a substantially vertical path.

[0054] In fact, thanks to the orientable lift arms 30 it is possible to arrange the distal body 32 of each arm 30 such that the arms 30 does not interfere with the vehicle body and with the battery pack of the vehicle. In other words, orienting the distal body 32 of each lift arm prevents the arm to obstruct the removal of the battery pack under the vehicle.

ADVANTAGES

[0055] The present invention has considerable advantages over the solution of the state of the art. In particular, use of an insert 41 movable along the base body 31 and/or the distal body 32 can provides a safe and compact lock system 40 allowing an operator to quickly lock and unlock the base body 31 and the distal body 32. In fact, as the insert moves along base body 31, elements protruding from the lift arm are minimized thus minimizing risks of inadvertent activation by an operator/vehicle, during lift operations.

[0056] Moreover, the structure of the lift arm 30 can provide a wide positioning area of the support 5 thanks to the presence of the joint between the base body 31 and the distal body 32, which therefore avoids undesired contacts with car components, for example with the battery pack of electric cars which needs to move along a vertical downward direction under the vehicle: the particular structure of the lift arm therefore can allow easy removal of the battery of an electric vehicle.

Claims

1. Lift arm (30) for vehicle lift (1), said lift arm (30) comprising:

- at least one base body (31) extending between a first end portion (31a) and a second end portion (31b) along an extension path (D),
- at least one distal body (32) extending between a respective first end portion (32a) and a second end portion (32b) along a respective extension path (T), wherein the distal body (32) is rotatably mounted to the base body (31) about at least one axis (Z),
- at least one lock system (40) configured to block the relative rotation between the base body (31) and the distal body (32), said lock system (40) comprising at least one insert (41) movable at least between:

- a release position where said insert (41) is configured to allow relative rotation be-

tween the base body (31) and the distal body (32), and

◦ a gripping position where said insert (41) is configured to block relative rotation between the base body (31) and the distal body (32),

characterized by the fact that the insert (41) of the lock system (40) is carried by at least one of said base body (31) and distal body (32), wherein the insert (41) is slidably movable with respect to at least one of said base body and distal body between the gripping position and the release position, and vice versa, along at least one trajectory substantially parallel to at least one section of at least one of said extension path (D) of the base body (31) and said extension path (T) of the distal body (32).

2. Lift arm of claim 1, wherein the base body (31) and the distal body (32) are hinged at the second end portion (31b) of the base body (31) and at the first end portion (32a) of the distal body (32), wherein the axis (Z) of relative rotation between the base body (31) and the distal body (32) is orthogonal both to the extension paths (D, T) of the base body (31) and the distal body (32).
3. Lift arm according to any one of the preceding claims, wherein the base body (31) and the distal body (32) are movable at least between:
 - an aligned position where the extension paths (D, T) respectively of the base body (31) and the distal body (32) are substantially parallel to each other,
 - an offset position where the extension paths (D, T) respectively of the base body (31) and the distal body (32) are angularly offset from each other.
4. Lift arm according to any one of the preceding claims, wherein the extension paths (D, T) respectively of the base body (31) and the distal body (32), in the offset position, intersect on an ideal plane, wherein the axis (Z) of relative rotation between the base body (31) and the distal body (32) is orthogonal to said ideal plane.
5. Lift arm according to any one of the preceding claims, wherein the insert (41) is carried by the base body (31), wherein the insert (41) is slidably movable between the gripping position and the release position, and vice versa, along a trajectory parallel to the extension path (D) of the base body (31).
6. Lift arm according to any one of the preceding claims, wherein the insert (41) comprises at least one en-

gagement portion (46), wherein the distal body (32) comprises a respective engagement portion (50), wherein the engagement portion (46) of the insert (41), in the gripping position, is configured to constrain the engagement portion (50) of the distal body (32) to block relative rotation between said distal body and the base body (31).

7. Lift arm of the preceding claim, wherein the engagement portion (46) of the insert (41) comprises at least one tooth (46a) configured to cooperate with a toothed profile (51) of the engagement portion (50) of the distal body (32), wherein the toothed profile (51) is defined at the first end portion (32a) of the distal body (32) and faces the base body (31).
8. Lift arm of the preceding claim, wherein the toothed profile (51) of the engagement portion (50) of the distal body (32) comprises a plurality of teeth aligned along a circular arc trajectory and configured to cooperate with the at least one tooth of the engagement portion (46) of the insert (41) to block relative rotation between the base body (31) and the distal body (32).
9. Lift arm of claim 7 or 8, wherein the engagement portion (46) of the insert (41) comprises a plurality of teeth (46a) configured to cooperate with the toothed profile (51) of the distal body (32), wherein the teeth of the plurality of teeth (46a) of the engagement portion (46) of the insert (41) are aligned along a direction transversal, optionally orthogonal, with respect to the movement direction of the insert (41).
10. Lift arm according to any one of the preceding claims, wherein the lock system (40) comprises at least one return element (42) in contact, on one side, with the base body (31) and, on another side, with the insert (41), wherein the return element (42) is configured to maintain the insert (41) in the gripping position.
11. Lift arm of the preceding claim, wherein the return element (42) comprises at least one of: a torsion spring, a compression spring, a tension spring, a pneumatic spring, and a leaf spring.
12. Lift arm according to any one of the preceding claims, wherein the base body (31) comprises, at the second end portion (31b), a seat (44), wherein the insert (41) is slidably movable in the seat (44).
13. Lift arm of the preceding claim, wherein the seat (44) has a profile with concavity directed towards the distal body (32), wherein the insert (41) is at least partially counter-shaped to the seat (44) of the base body (31).
14. Lift arm according to any one of the preceding claims,

wherein the lock system (40) comprises at least one maneuvering element (43) engaged to the insert (41) and emerging from at least one of said base body (31) and distal body (32), said maneuvering element (43) being configured to move the insert (41) at least between the gripping position and the release position.

15. A vehicle lift (1) comprising:

- at least one column (2) extending, in use, along a vertical direction (V),
- at least one carriage (3) engaged to the column (2) and slidingly movable along said column,
- at least one lift arm (30) according to any one of the preceding claims carried by the carriage.

Patentansprüche

1. Hebearm (30) für eine Fahrzeug-Hebevorrichtung (1), der Hebearm (30) umfassend:

- wenigstens einen Basiskörper (31), welcher sich zwischen einem ersten Endabschnitt (31a) und einem zweiten Endabschnitt (31b) entlang eines Erstreckungspfads (D) erstreckt,
- wenigstens einen distalen Körper (32), welcher sich zwischen einem entsprechenden ersten Endabschnitt (32a) und einem zweiten Endabschnitt (32b) entlang eines entsprechenden Erstreckungspfads (T) erstreckt, wobei der distale Körper (32) an dem Basiskörper (31) um wenigstens eine Achse (Z) rotierbar montiert ist,
- wenigstens ein Verriegelungssystem (40), welches dazu eingerichtet ist, die relative Rotation zwischen dem Basiskörper (31) und dem distalen Körper (32) zu blockieren, wobei das Verriegelungssystem (40) wenigstens einen Einsatz (41) umfasst, welcher bewegbar ist wenigstens zwischen:

- einer Freigabeposition, in welcher der Einsatz (41) dazu eingerichtet ist, eine relative Rotation zwischen dem Basiskörper (31) und dem distalen Körper (32) zu erlauben, und
- einer Greifposition, in welcher der Einsatz (41) dazu eingerichtet ist, eine relative Rotation zwischen dem Basiskörper (31) und dem distalen Körper (32) zu blockieren,

dadurch gekennzeichnet, dass der Einsatz (41) des Verriegelungssystems (40) von wenigstens einem aus dem Basiskörper (31) und dem distalen Körper (32) getragen ist, wobei der Einsatz (41) gleitbar bezüglich wenigstens einem aus dem Basiskörper und dem distalen Körper zwischen der Greif-

position und der Freigabeposition und umgekehrt entlang wenigstens einer Bahnkurve bewegbar ist, welche im Wesentlichen parallel zu wenigstens einem Abschnitt von wenigstens einem aus dem Erstreckungspfad (D) des Basiskörpers (31) und dem Erstreckungspfad (T) des distalen Körpers (32) ist.

2. Hebearm nach Anspruch 1, wobei der Basiskörper (31) und der distale Körper (32) an dem zweiten Endabschnitt (31b) des Basiskörpers (31) und dem ersten Endabschnitt (32a) des distalen Körpers (32) angelenkt sind, wobei die Achse (Z) der relativen Rotation zwischen dem Basiskörper (31) und dem distalen Körper (32) orthogonal zu den Erstreckungspfaden (D, T) sowohl des Basiskörpers (31) als auch des distalen Körpers (32) ist.

3. Hebearm nach einem der vorhergehenden Ansprüche, wobei der Basiskörper (31) und der distale Körper (32) bewegbar sind zwischen wenigstens:

- einer ausgerichteten Position, in welcher die jeweiligen Erstreckungspfade (D, T) des Basiskörpers (31) und des distalen Körpers (32) im Wesentlichen parallel zueinander sind,
- einer versetzten Position, in welcher die jeweiligen Erstreckungspfade (D, T) des Basiskörpers (31) und des distalen Körpers (32) voneinander winkelfersetzt sind.

4. Hebearm nach einem der vorhergehenden Ansprüche, wobei die jeweiligen Erstreckungspfade (D, T) des Basiskörpers (31) und des distalen Körpers (32) in der versetzten Position sich an einer idealen Ebene schneiden, wobei die Achse (Z) der relativen Rotation zwischen dem Basiskörper (31) und dem distalen Körper (32) orthogonal zu der idealen Ebene ist.

5. Hebearm nach einem der vorhergehenden Ansprüche, wobei der Einsatz (41) von dem Basiskörper (31) getragen ist, wobei der Einsatz (41) gleitbar zwischen der Greifposition und der Freigabeposition und umgekehrt entlang einer Bahnkurve parallel zu dem Erstreckungspfad (D) des Basiskörpers (31) bewegbar ist.

6. Hebearm nach einem der vorhergehenden Ansprüche, wobei der Einsatz (41) wenigstens einen Eingriffsabschnitt (46) umfasst, wobei der distale Körper (32) einen entsprechenden Eingriffsabschnitt (50) umfasst, wobei der Eingriffsabschnitt (46) des Einsatzes (41) in der Greifposition dazu eingerichtet ist, den Eingriffsabschnitt (50) des distalen Körpers (32) einzuschränken, um eine relative Rotation zwischen dem distalen Körper und dem Basiskörper (31) zu blo-

ckieren.

7. Hebearm nach dem vorhergehenden Anspruch, wobei der Eingriffsabschnitt (46) des Einsatzes (41) wenigstens einen Zahn (46a) umfasst, welcher dazu eingerichtet ist, mit einem gezahnten Profil (51) des Eingriffsabschnitts (50) des distalen Körpers (32) zusammenzuwirken, wobei das gezahnte Profil (51) an dem ersten Endabschnitt (32a) des distalen Körpers (32) definiert ist und zu dem Basiskörper (31) weist. 5
8. Hebearm nach dem vorhergehenden Anspruch, wobei das gezahnte Profil (51) des Eingriffsabschnitts (50) des distalen Körpers (32) eine Mehrzahl von Zähnen umfasst, welche entlang einer kreisförmigen Bogen-Bahnkurve ausgerichtet und dazu eingerichtet sind, mit dem wenigstens einen Zahn des Eingriffsabschnitts (46) des Einsatzes (41) zusammenzuwirken, um eine relative Rotation zwischen dem Basiskörper (31) und dem distalen Körper (32) zu blockieren. 10
9. Hebearm nach Anspruch 7 oder 8, wobei der Eingriffsabschnitt (46) des Einsatzes (41) eine Mehrzahl von Zähnen (46a) umfasst, welche dazu eingerichtet sind, mit dem gezahnten Profil (51) des distalen Körpers (32) zusammenzuwirken, wobei die Zähne der Mehrzahl von Zähnen (46a) des Eingriffsabschnitts (46) des Einsatzes (41) entlang einer Richtung ausgerichtet sind, welche transversal, optional orthogonal, bezüglich der Bewegungsrichtung des Einsatzes (41) ist. 20
10. Hebearm nach einem der vorhergehenden Ansprüche, wobei das Verriegelungssystem (40) wenigstens ein Rückstellelement (42) in Kontakt an einer Seite mit dem Basiskörper (31) und an einer anderen Seite mit dem Einsatz (41) umfasst, wobei das Rückstellelement (42) dazu eingerichtet ist, den Einsatz (41) in der Greifposition zu halten. 25
11. Hebearm nach dem vorhergehenden Anspruch, wobei das Rückstellelement (42) wenigstens eines umfasst aus: einer Torsionsfeder, einer Kompressionsfeder, einer Spannfeder, einer pneumatischen Feder und einer Blattfeder. 30
12. Hebearm nach einem der vorhergehenden Ansprüche, wobei der Basiskörper (31) an dem zweiten Endabschnitt (31b) einen Sitz (44) umfasst, wobei der Einsatz (41) gleitbar in dem Sitz (44) bewegbar ist. 35
13. Hebearm nach dem vorhergehenden Anspruch, wobei der Sitz (44) ein Profil mit einer Konkavität aufweist, welche in Richtung des distalen Körpers (32) gerichtet ist, wobei der Einsatz (41) wenigstens teil- 40

weise zu dem Sitz (44) des Basiskörpers (31) gegengeformt ist.

14. Hebearm nach einem der vorhergehenden Ansprüche, wobei das Verriegelungssystem (40) wenigstens ein Manövrierelement (43) umfasst, welches mit dem Einsatz (41) eingreift und von wenigstens einem aus dem Basiskörper (31) und dem distalen Körper (32) hervortritt, wobei das Manövrierelement (43) dazu eingerichtet ist, den Einsatz (41) wenigstens zwischen der Greifposition und der Freigabe- position zu bewegen. 45

15. Fahrzeug-Hebevorrichtung (1), umfassend:

- wenigstens eine Säule (2), welche sich in Verwendung entlang einer vertikalen Richtung (V) erstreckt,
- wenigstens einen Schlitten (3), welcher mit der Säule (2) eingreift und gleitbar entlang der Säule bewegbar ist,
- wenigstens einen Hebearm (30) nach einem der vorhergehenden Ansprüche, welcher von dem Schlitten getragen ist.

Revendications

1. Bras de levage (30) pour pont élévateur de véhicule (1), ledit bras de levage (30) comprenant : 30
 - au moins un corps de base (31) s'étendant entre une première portion d'extrémité (31a) et une seconde portion d'extrémité (31b) le long d'un trajet d'extension (D),
 - au moins un corps distal (32) s'étendant entre une première portion d'extrémité (32a) respective et une seconde portion d'extrémité (32b) le long d'un trajet d'extension (T) respectif, dans lequel le corps distal (32) est monté de manière à pouvoir tourner au corps de base (31) autour d'au moins un axe (Z),
 - au moins un système de verrouillage (40) configuré pour bloquer la rotation relative entre le corps de base (31) et le corps distal (32), ledit système de verrouillage (40) comprenant au moins un insert (41) mobile au moins entre : 45
 - une position de libération où ledit insert (41) est configuré pour permettre une rotation relative entre le corps de base (31) et le corps distal (32), et
 - une position de préhension où ledit insert (41) est configuré pour bloquer une rotation relative entre le corps de base (31) et le corps distal (32),

caractérisé par le fait que l'insert (41) du système

- de verrouillage (40) est porté par au moins l'un desdits corps de base (31) et corps distal (32), dans lequel l'insert (41) est mobile de manière à pouvoir coulisser par rapport à au moins l'un desdits corps de base et corps distal entre la position de préhension et la position de libération, et *vice versa*, le long au moins d'une trajectoire sensiblement parallèle à au moins une section d'au moins l'un dudit trajet d'extension (D) du corps de base (31) et dudit trajet d'extension (T) du corps distal (32).
2. Bras de levage selon la revendication 1, dans lequel le corps de base (31) et le corps distal (32) sont articulés au niveau de la seconde portion d'extrémité (31b) du corps de base (31) et au niveau de la première portion d'extrémité (32a) du corps distal (32), dans lequel l'axe (Z) de rotation relative entre le corps de base (31) et le corps distal (32) est orthogonal à la fois par rapport aux trajets d'extension (D, T) du corps de base (31) et du corps distal (32).
 3. Bras de levage selon l'une quelconque des revendications précédentes, dans lequel le corps de base (31) et le corps distal (32) sont mobiles au moins entre :
 - une position alignée où les trajets d'extension (D, T) respectivement du corps de base (31) et du corps distal (32) sont sensiblement parallèles l'un à l'autre,
 - une position décalée où les trajets d'extension (D, T) respectivement du corps de base (31) et du corps distal (32) sont angulairement décalés l'un par rapport à l'autre.
 4. Bras de levage selon l'une quelconque des revendications précédentes, dans lequel les trajets d'extension (D, T) respectivement du corps de base (31) et du corps distal (32), dans la position décalée, entrent en intersection sur un plan idéal, dans lequel l'axe (Z) de rotation relative entre le corps de base (31) et le corps distal (32) est orthogonal par rapport audit plan idéal.
 5. Bras de levage selon l'une quelconque des revendications précédentes, dans lequel l'insert (41) est porté par le corps de base (31), dans lequel l'insert (41) est mobile de manière à pouvoir coulisser entre la position de préhension et la position de libération, et *vice versa*, le long d'une trajectoire parallèle au trajet d'extension (D) du corps de base (31).
 6. Bras de levage selon l'une quelconque des revendications précédentes, dans lequel l'insert (41) comprend au moins une portion d'engagement (46), dans lequel le corps distal (32) comprend une portion d'engagement respective (50), dans lequel la portion d'engagement (46) de l'insert (41), dans la position de préhension, est configurée pour contraindre la portion d'engagement (50) du corps distal (32) afin de bloquer une rotation relative entre lesdits corps distal et corps de base (31).
 7. Bras de levage selon la revendication précédente, dans lequel la portion d'engagement (46) de l'insert (41) comprend au moins une dent (46a) configurée pour coopérer avec un profil denté (51) de la portion d'engagement (50) du corps distal (32), dans lequel le profil denté (51) est défini au niveau de la première portion d'extrémité (32a) du corps distal (32) et fait face au corps de base (31).
 8. Bras de levage selon la revendication précédente, dans lequel le profil denté (51) de la portion d'engagement (50) du corps distal (32) comprend une pluralité de dents alignées le long d'une trajectoire en arc circulaire et configuré pour coopérer avec la au moins une dent de la portion d'engagement (46) de l'insert (41) pour bloquer une rotation relative entre le corps de base (31) et le corps distal (32).
 9. Bras de levage selon la revendication 7 ou 8, dans lequel la portion d'engagement (46) de l'insert (41) comprend une pluralité de dents (46a) configurées pour coopérer avec le profil denté (51) du corps distal (32), dans lequel les dents de la pluralité de dents (46a) de la portion d'engagement (46) de l'insert (41) sont alignées le long d'une direction transversale, éventuellement orthogonale, par rapport à la direction de mouvement de l'insert (41).
 10. Bras de levage selon l'une quelconque des revendications précédentes, dans lequel le système de verrouillage (40) comprend au moins un élément de retour (42) en contact, sur un côté, avec le corps de base (31) et, sur un autre côté, avec l'insert (41), dans lequel l'élément de retour (42) est configuré pour maintenir l'insert (41) dans la position de préhension.
 11. Bras de levage selon la revendication précédente, dans lequel l'élément de retour (42) comprend au moins l'un parmi : un ressort de torsion, un ressort de compression, un ressort de tension, un ressort pneumatique, et un ressort à lames.
 12. Bras de levage selon l'une quelconque des revendications précédentes, dans lequel le corps de base (31) comprend, au niveau de la seconde portion d'extrémité (31b), une assise (44), dans lequel l'insert (41) est mobile de manière à pouvoir coulisser dans l'assise (44).
 13. Bras de levage selon la revendication précédente,

dans lequel l'assise (44) présente un profil ayant une concavité orientée vers le corps distal (32), dans lequel l'insert (41) est au moins partiellement en contre-forme par rapport à l'assise (44) du corps de base (31).

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- 14.** Bras de levage selon l'une quelconque des revendications précédentes, dans lequel le système de verrouillage (40) comprend au moins un élément de manœuvre (43) engagé au niveau de l'insert (41) et émergeant d'au moins l'un desdits corps de base (31) et corps distal (32), ledit élément de manœuvre (43) étant configuré pour déplacer l'insert (41) au moins entre la position de préhension et la position de libération.

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- 15.** Pont élévateur de véhicule (1) comprenant :

- au moins une colonne (2) s'étendant, durant l'utilisation, le long d'un sens vertical (V),
- au moins un chariot (3) engagé au niveau de la colonne (2) et mobile de manière à pouvoir coulisser le long de ladite colonne,
- au moins un bras de levage (30) selon l'une quelconque des revendications précédentes porté par le chariot.

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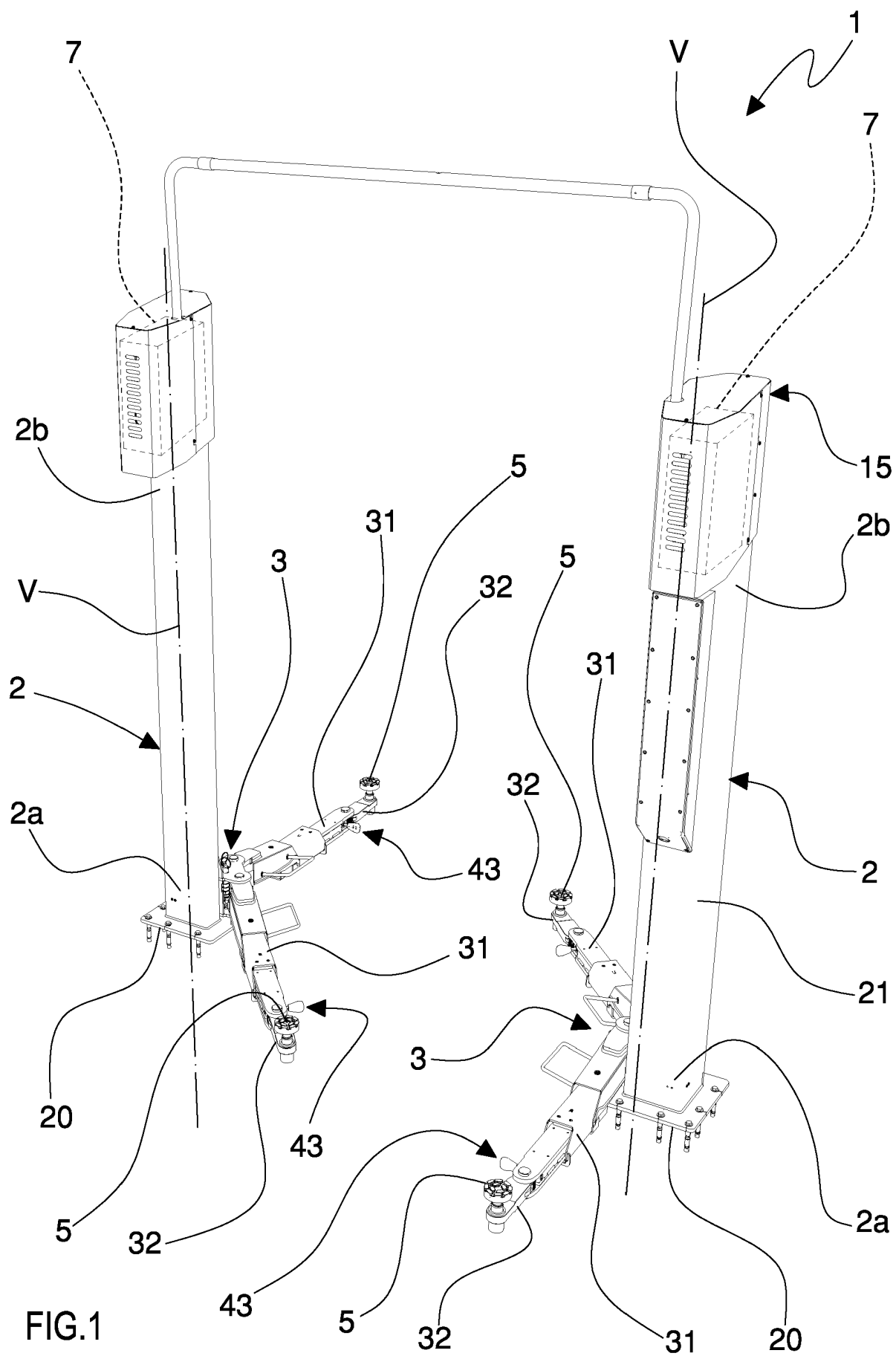
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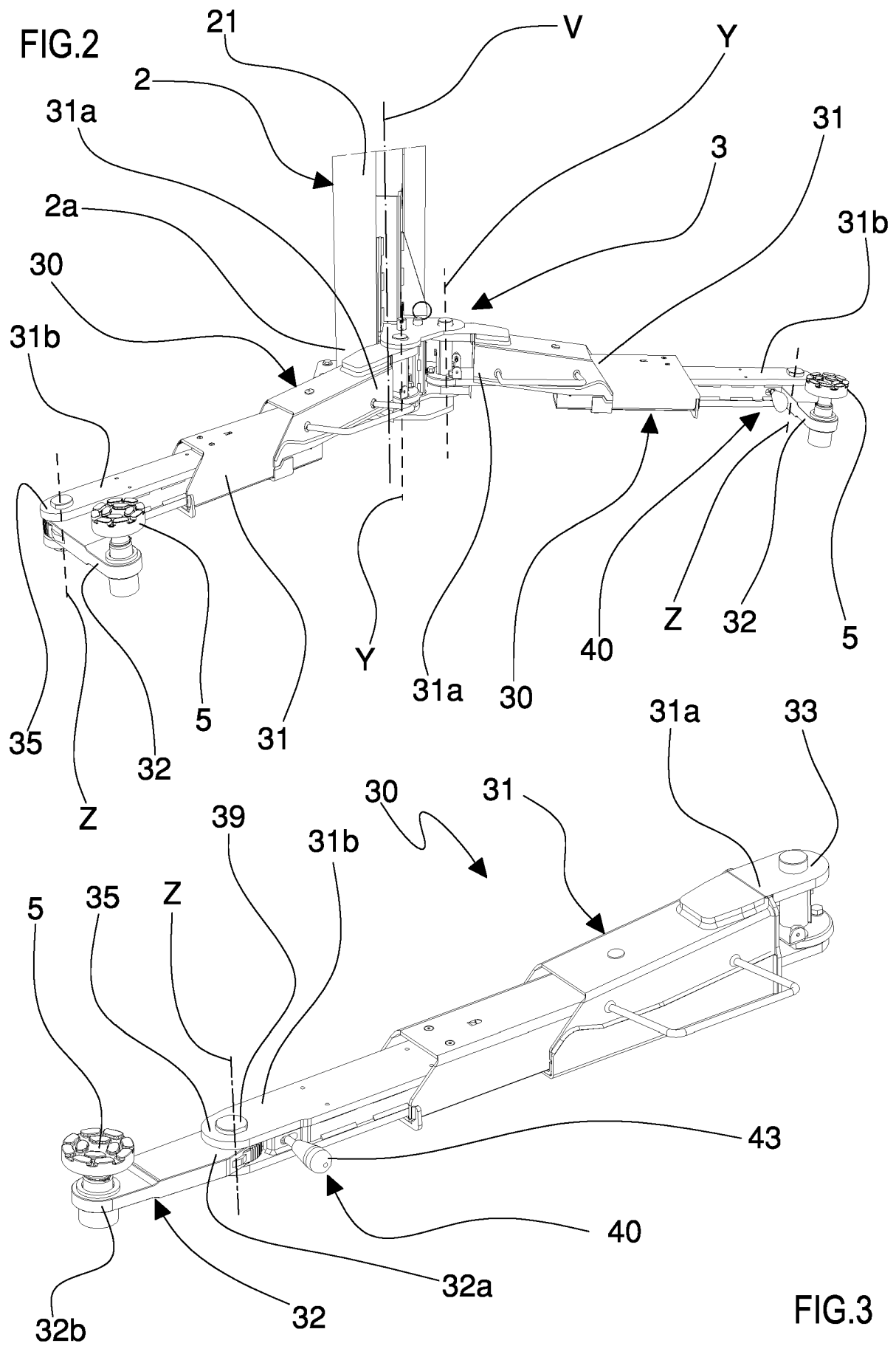
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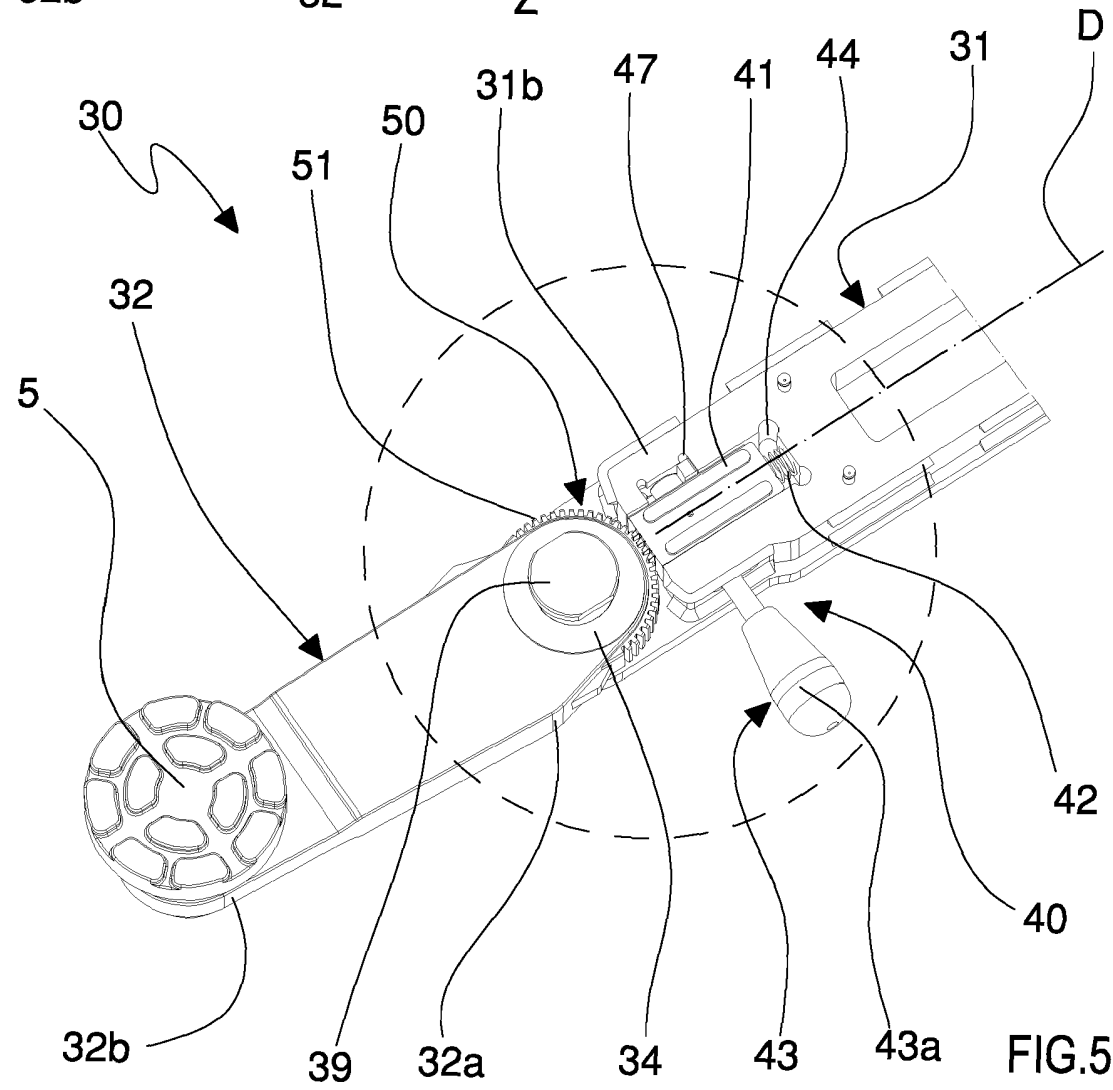
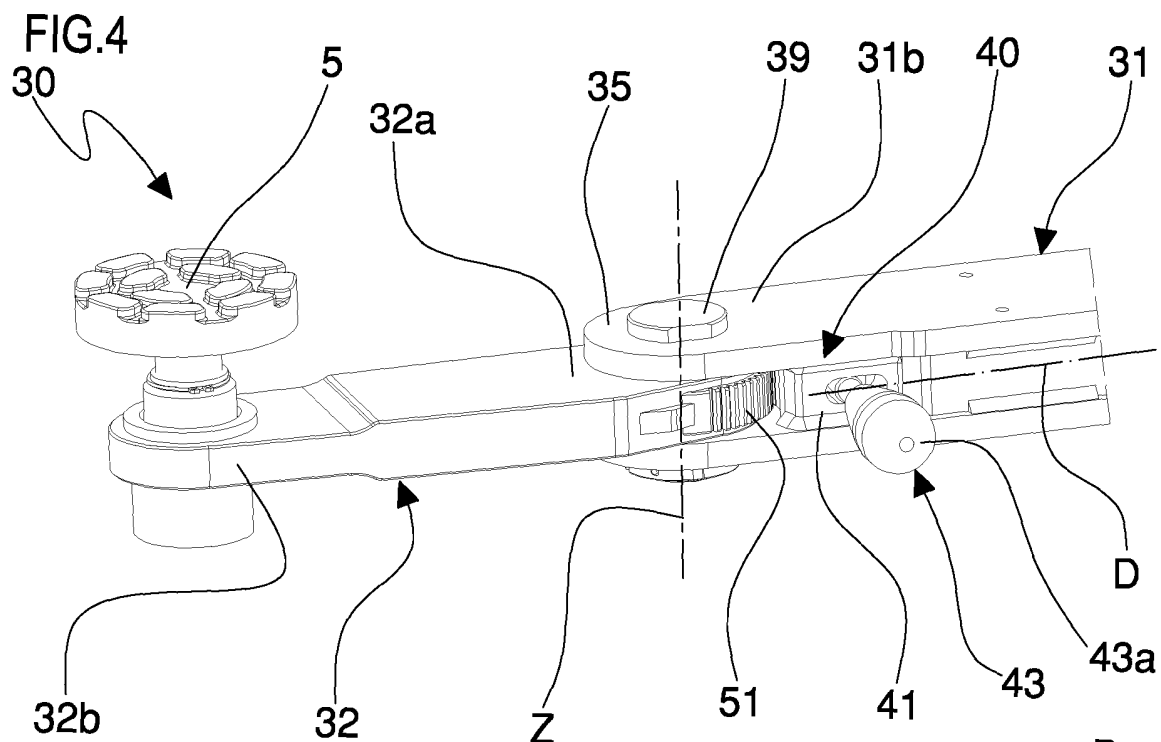
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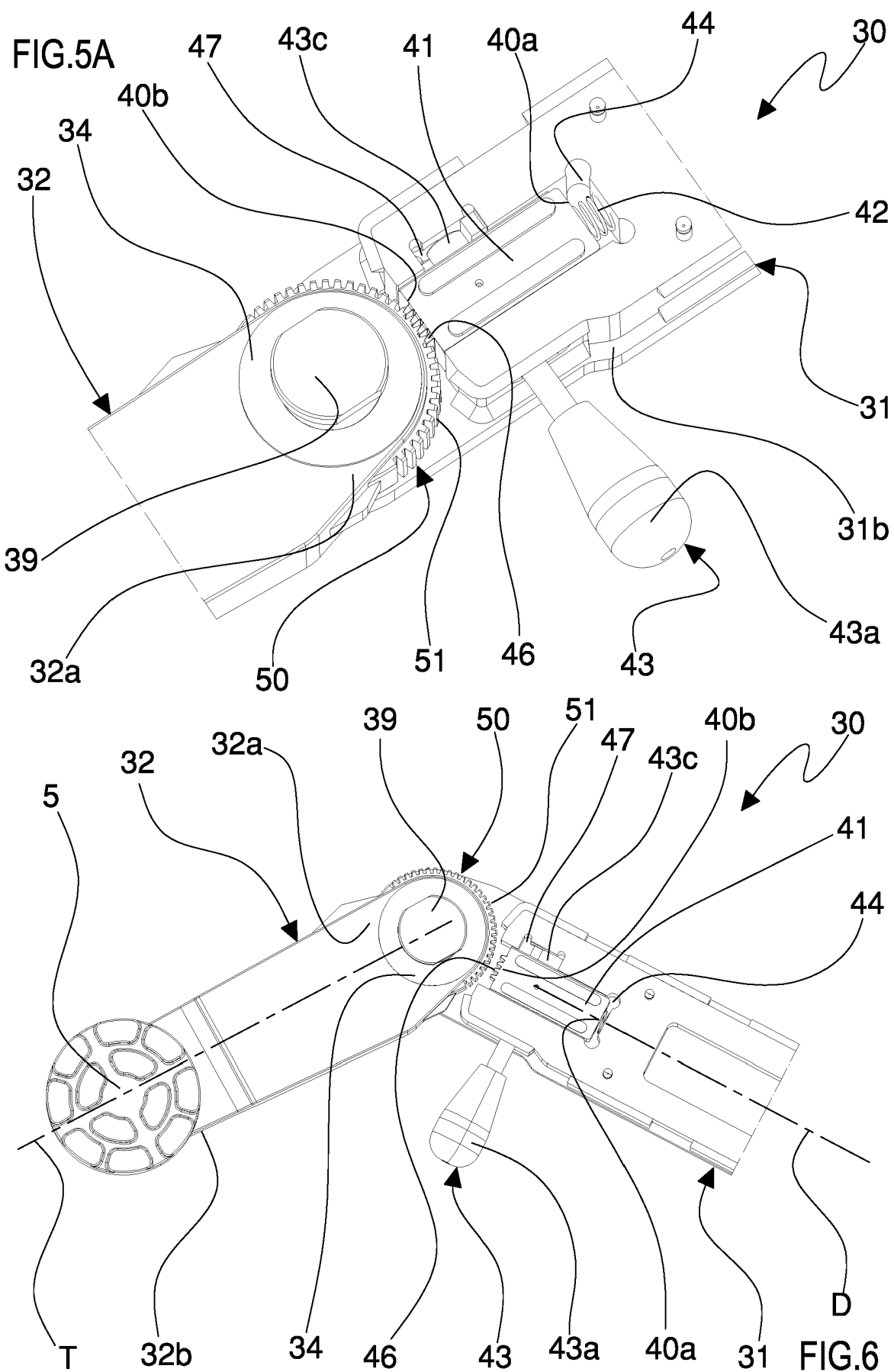
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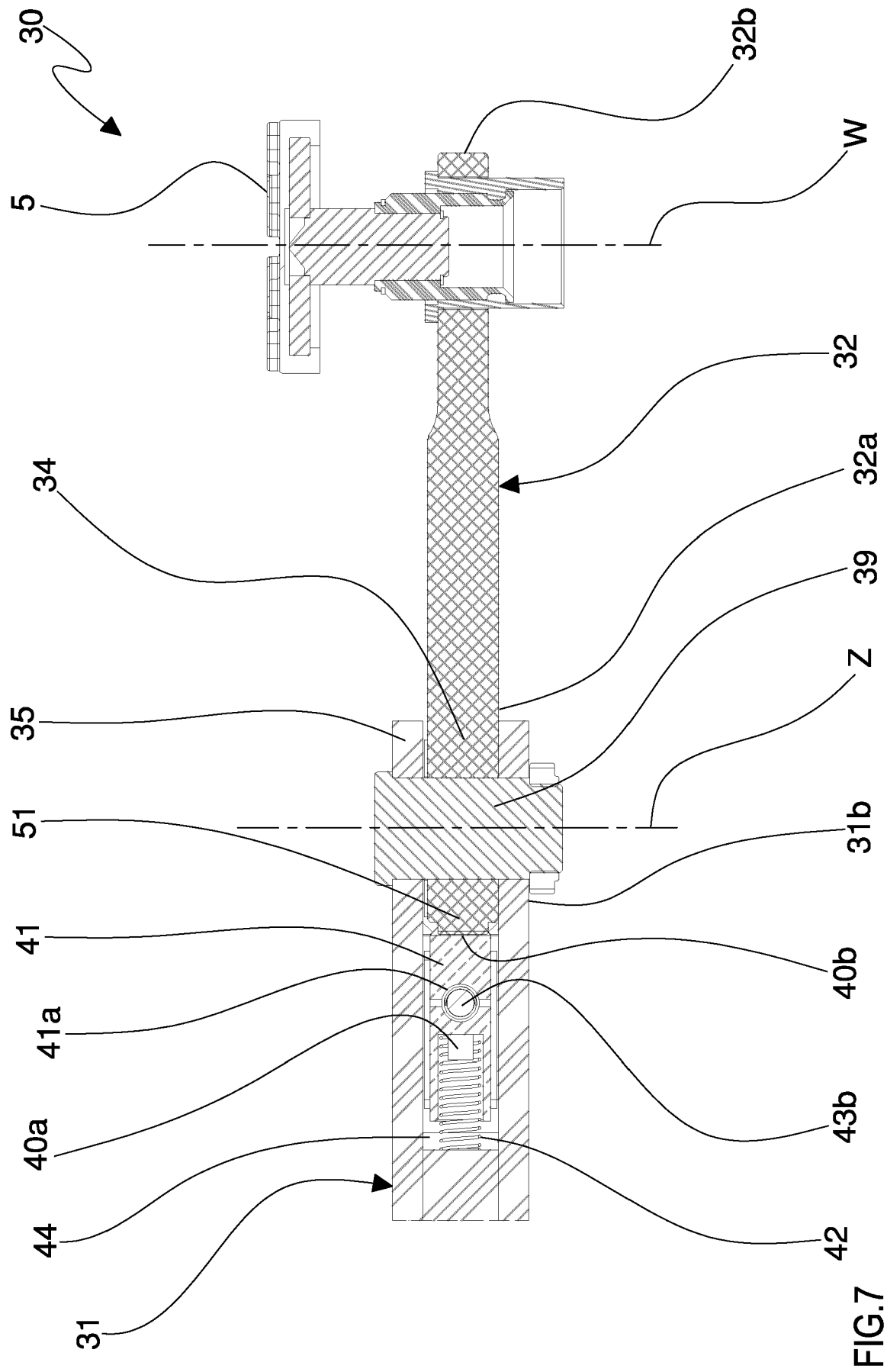
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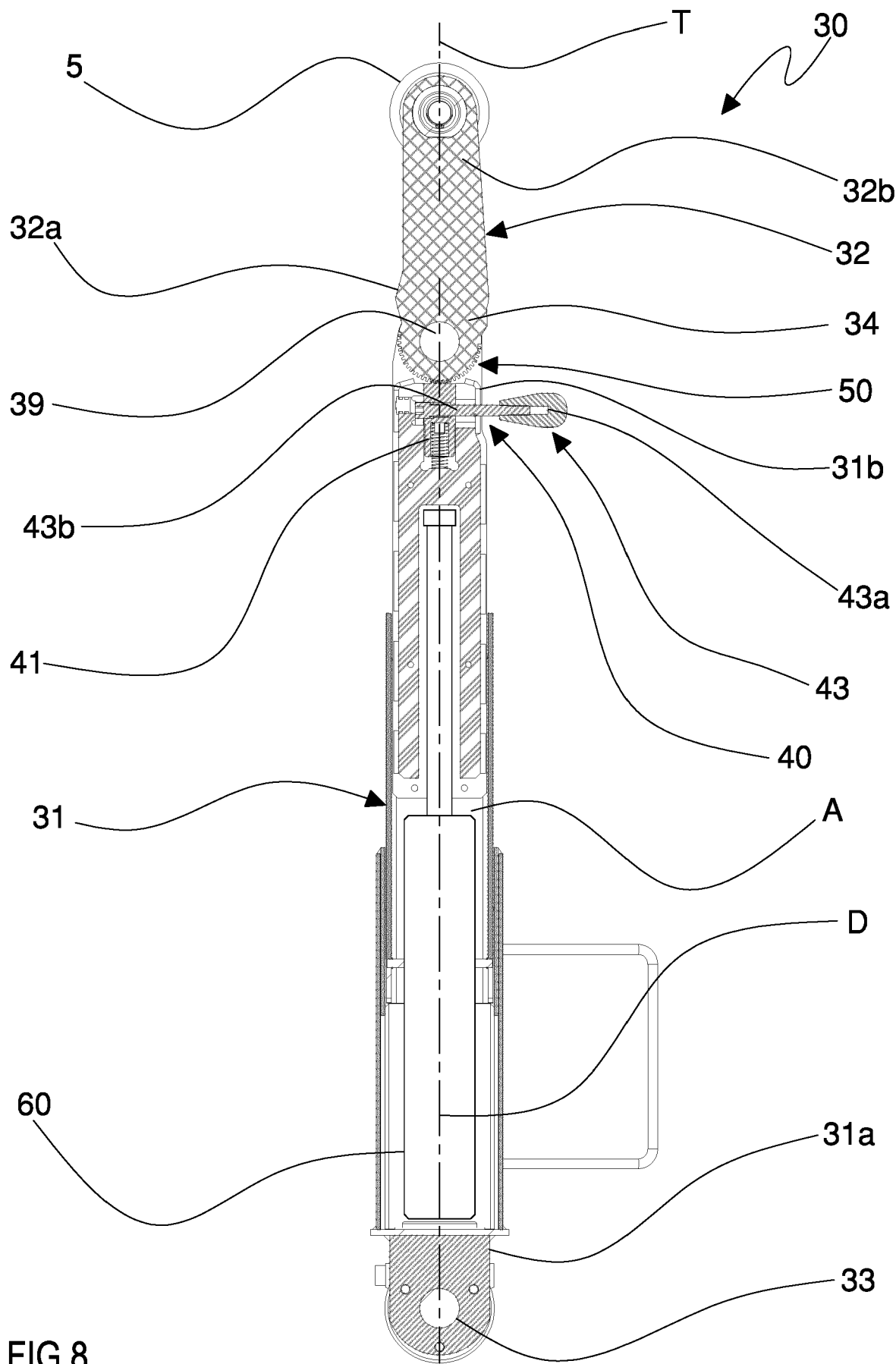


FIG.8

REFERENCES CITED IN THE DESCRIPTION

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