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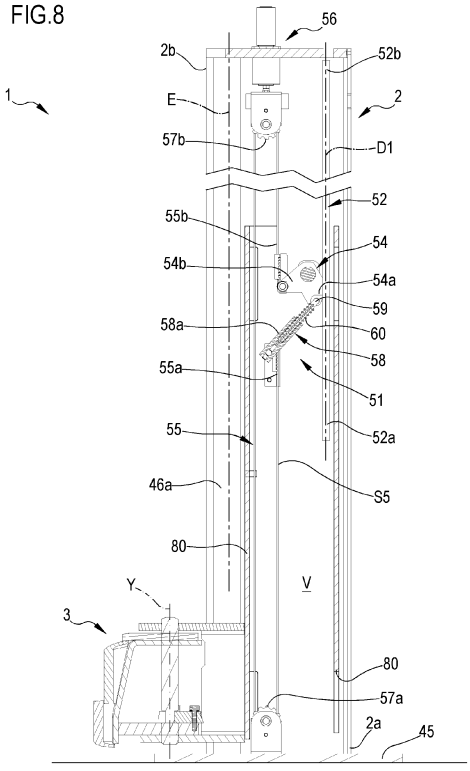
(54) LIFT AND PROCESS OF LIFTING VEHICLES

(57) The present invention concerns a lift (1) comprising a column (2), a handling system suitable for moving a carriage (3) along the column (2), a block (51) configured for locking the carriage (3) with respect to the column (2) in a plurality of operative positions. The block comprises an insert movable between a release position and a gripping position, a dragging element (55) wrapped between two idle members movable relatively the one with respect to other which connects the insert (54) to the carriage (3). The dragging element is configurable between: a pull condition where the dragging element is configured for holding the insert (54) in the release position, a release condition where the dragging element is configured for allowing the displacement of the insert (54) in the gripping position.

FIG.8



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Description

FIELD OF THE INVENTION

[0001] The present invention relates to a lift and a process of lifting vehicles. The present invention may find application in the automotive sector for vehicle assistance. However, the present invention may be used for lifting of various typologies of vehicles, including cars, trucks, agricultural vehicles.

BACKGROUND ART

[0002] In the field of automotive equipment are known different typologies of lifts used for vehicle assistance; for example, are known column lifts, underground lifts, underground cylinder lifts and hanging lifts. These lifts may have a safety system which allows to block the movement of the vehicle at a determined height above the ground.

[0003] The column lifts comprise one or more vertical support columns, each of which carries a carriage provided with a pair of swiveling arms configured for receive as support the vehicle to be lifted. The movement of each carriage may be performed by means of a hydraulic system or actuator. In detail, each column may comprise a frame and a carriage configured for sliding along the frame. The application n. US 2011/210298 A1 shows a column lift provided with a safety system suitable for preventing, in the event of a lift malfunction, a sudden fall of the arms. The safety system comprises an active actuator on a chain connected to the carriage, which is configured for moving a blocking insert suitable for engaging, in the event of a lift malfunction, a drilled guide fixed to the column.

[0004] The patent application n. DE 27 59 085 A1 and the patent n. DE 36 00 316 C2 show platform lifts for vehicles provided with a hydraulic lifting system. The platform is supported by four carriages, each one slidingly movable along a respective column. The application n. DE 27 59 085 A1 shows a safety system defined by a blocking insert normally arranged in engagement to a fixed guide carried by the column, manually disengageable by an operator by means of a lever. The patent n. DE 36 00 316 C2, on the other hand, shows a safety system defined by a blocking insert directly moved by an electromagnetic actuator suitable for forcing, in case of malfunction of the lift, the engagement of said blocking insert with a fixed guide carried by the column.

[0005] The Applicant noted that the known lifts are not free of limitations. In particular, the Applicant noted that the known safety systems of lifts are highly complex, as well as expensive, and therefore improvable under several aspects.

OBJECT OF THE INVENTION

[0006] Object of the present invention is therefore 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 having a simple and compact structure, which has low production costs, at the same time capable of safely and reliably functioning. It is also an object of the present invention to provide a lift capable of ensuring the effective and quick lifting of a wide range of transport means.

[0008] These objects and others, which will become more apparent from the following description, are substantially achieved by a lift and a process of lifting vehicles according to one or more of the attached claims.

SUMMARY

[0009] In a 1st aspect it is provided an actuator (5) comprising:

a cylinder (6),
a piston (7) slidingly movable in the cylinder, wherein the piston (7) defines, in cooperation with the cylinder (6), a first and a second chamber (C1", C2"),

wherein the piston (7) comprises a through opening (8) which puts in fluid communication the first and the second chamber (C1", C2").

[0010] In a 2nd aspect according to the preceding aspect the piston (7) extends in thickness between a first and a second head surface (7a, 7b) respectively delimiting part of the first and second chamber (C1", C2"). In a 3rd aspect according to the preceding aspect the through opening (8) extends between said first and second head surface (7a, 7b). In a 4th aspect according to any one of the two preceding aspects the cylinder (6) comprises:

an inner lateral surface (9a),
a first surface (9b),
a second surface (9c) opposite to the first surface (9b) with respect to the inner lateral surface (9a).

[0011] In a 5th aspect according to the preceding aspect the inner lateral surface (9a), together with the first and second surface (9b, 9c), defines an internal volume of the cylinder where the piston (7) is housed. In a 6th aspect according to any one of the two preceding aspects the first head surface (7a) delimits, in cooperation with part of the inner lateral surface (9a) and the first surface (9b), the first chamber (C1"). In a 7th aspect according to any one of the three preceding aspects the second head surface (7b) delimits, in cooperation with part of the inner lateral surface (9a) and the second surface (9c), the second chamber (C2").

[0012] In an 8th aspect according to any one of the preceding aspects the cylinder (6) extends between a first and a second end (6a, 6b) along an extension direction (D"). In a 9th aspect according to any one of the preceding aspects the cylinder (6) is free of through open-

ings that allow the expulsion of working fluid from the second chamber (C2"). In a 10th aspect according to any one of the preceding aspects the cylinder (6) comprises an inlet (14) configured for allowing the passage of a working fluid in the first chamber (C1") (optionally the inlet of the working fluid in the cylinder and the outlet of said working fluid from the cylinder). In an 11th aspect according to the preceding aspect in combination with the 4th aspect the inlet (14) is defined on the inner lateral surface (9a) or on the first surface (9b) of the cylinder (6). In a 12th aspect according to any one of the two preceding aspects the cylinder (6) has exclusively the inlet (14), which is configured for allowing the passage of a working fluid. In a 13th aspect according to any one of the three preceding aspects in combination with the 8th aspect the inlet (14) is placed at the first end (6a). In a 13bis aspect according to any one of the preceding aspects from the 11th to the 13th the inlet (14) is configured for allowing the input of the working fluid in the cylinder (6) and the outlet of said working fluid from said cylinder (6), wherein said inlet (14) is in direct fluid communication with the first chamber (C1"). In a 13ter aspect according to any one of the preceding aspects from the 11th to the 13th or with the 13bis aspect the inlet (14) is the only passage of the cylinder (6) configured for allowing the working fluid to pass in and out through the cylinder (6). In a 13quater aspect according to any one of the preceding aspects from the 11th to the 13th or with the 13bis or 13ter aspect the second chamber (C2") is in fluid communication exclusively with the first chamber (C1") of the same cylinder (6).

[0013] In a 14th aspect according to any one of the preceding aspects the piston (7) has an outer lateral surface (10), optionally at least partly countershaped to the cylinder (6). In a 15th aspect according to the preceding aspect said outer lateral surface (10) of the piston (7) defines, in cooperation with the cylinder (6), optionally with the inner lateral surface (9a), a gap (11) which puts in fluid communication the first and the second chamber (C1", C2"). In a 16th aspect according to any one of the two preceding aspects the outer lateral surface (10) of the piston (7) connects the first and the second head surface (7a, 7b), optionally said outer lateral surface (10) is interposed between the first and the second head surface (7a, 7b). In a 17th aspect according to any one of the three preceding aspects the outer lateral surface (10) of the piston (7) is entirely countershaped to the inner lateral surface (9a) of the cylinder (6). In a 18th aspect according to any one of the four preceding aspects the at least one through opening (8)

- is spaced from the outer lateral surface (10) of the piston (7), or
- is defined on the outer lateral surface (10), optionally to define at least one recess on said outer lateral surface (10).

[0014] In a 19th aspect according to any one of the four preceding aspects the piston (7) is free of sealing elements, for example a gasket, at the gap (11). In a 20th aspect according to any one of the five preceding aspects the second chamber (C2") of the cylinder (6) is exclusively in fluid communication with the first chamber (C1") through the gap (11) and the through opening (8). In a 21st aspect according to any one of the preceding aspects the piston (7) is movable along a direction parallel to a/the extension direction (D') of the cylinder (6).

[0015] In a 22nd aspect according to any one of the preceding aspects from the 4th to the 21st the piston (7) is movable approaching and moving away with respect to the first and second surface (9b, 9c) of the cylinder (6) to allow a variation in terms of volume of the first and second chamber (C1", C2").

[0016] In a 23rd aspect according to any one of the preceding aspects, wherein the actuator (5) comprises a rod (12) partially housed in the second chamber (C2") and engaged to the piston (7). In a 24th aspect according to the preceding aspect the rod (12) extends from the second head surface (7b) of the piston (7) and protrudes from the inner volume of the cylinder (6), optionally through the second surface (9c). In a 25th aspect according to any one of the two preceding aspects the rod (12) is exclusively housed in the second chamber (C2") of the cylinder (6).

[0017] In a 26th aspect according to any one of the three preceding aspects the rod (12) does not pass through the first chamber (C1").

[0018] In a 27th aspect according to any one of the preceding aspects the through opening (8) has a passage section between 50 mm^2 and 500 mm^2. In a 28th aspect according to the preceding aspect the passage section of the through opening (8) is constant throughout theta thickness of the piston (7). In a 29th aspect according to any one of the preceding aspects the piston (7) has, in cross section, a surface size between 100 mm^2 and 1500 mm^2; wherein the cross section is defined according to a plane orthogonal to a/the extension direction (D") of the cylinder (6). In a 30th aspect according to any one of the two preceding aspects the ratio between the passage section of the at least one through opening (8) and the surface size of the piston (7) is between 0,01 and 0,2. In a 31st aspect according to any one of the three preceding aspects the rod (12) has, according to a section orthogonal to a/the extension direction (D") of the cylinder (6), a surface size between 50 mm^2 and 1000 mm^2. In a 32nd aspect according to the preceding aspect in combination with the 27th aspect the ratio between the passage section of the through opening (8) and the surface size of the rod (12) is between 0,005 and 0,2. In a 33rd aspect according to any one of the aspects from the 29th to the 32nd the ratio between the surface size of the piston (7) and the surface size of the rod (12) is between 1,1 and 3. In a 34th aspect according to any one of the preceding aspects the actuator (5) is of hydraulic or pneumatic type.

[0019] In a 35th aspect a handling system (4) is pro-

vided, the handling system comprising:

a first actuator (22) comprising:

a cylinder (26),
a piston (27) slidingly movable in the cylinder, wherein the piston (27) defines, in cooperation with the cylinder (26), a first and a second chamber (C1', C2'),
an inlet (24) defined on the cylinder (26) and in fluid communication with the first chamber (C1'),
an outlet (25) defined on the cylinder (26) and in fluid communication with the second chamber (C2'),

a second actuator (5) according to any one of the preceding aspects,
a supply circuit comprising:

a primary supply line (20) configured for putting in fluid communication the inlet (24) of the first actuator (22) with a source (S) of a working fluid,
a secondary supply line (21) which puts in fluid communication the outlet (25) of the first actuator (22) with the second actuator, optionally with the inlet (14) of the second actuator (5).

[0020] In a 36th aspect according to the preceding aspect the secondary supply line (21) is exclusively in fluid communication (optionally directly) with the outlet (25) of the second actuator (22). In a 37th aspect according to any one of the three preceding aspects the piston (27) of the first actuator extends in thickness between a first and a second head surface (27a, 27b) respectively delimiting part of the first and second chamber (C1', C2') of the cylinder (26) of the first actuator (22). In a 38th aspect according to any one of the four preceding aspects the cylinder (26) of the first actuator (22) comprises:

an inner lateral surface (29a),
a first surface (29b),
a second surface (29c) opposite to the first surface (29b) with respect to the inner lateral surface (29a).

[0021] In a 39th aspect according to the preceding aspect the inner lateral surface (29a), together with the first and second surface (29b, 29c), defines an internal volume of the cylinder (26) where it is housed the piston (27) of the first actuator (22).

[0022] In a 40th aspect according to any one of the two preceding aspects in combination with the 37th aspect the first head surface (27a) of the piston (27) of the first actuator (22) delimits, in cooperation with part of the inner lateral surface (29a) and the first surface (29b), the first chamber (C1') of the first actuator (22). In a 41st aspect according to any one of the three preceding aspects in combination with the 37th aspect the second head surface (27b) of the piston (27) of the first actuator (22) delimits, in cooperation with part of the inner lateral surface (29a) and the second surface (29c), the second chamber (C2') of the first actuator (22). In a 42nd aspect according to any one of the preceding aspects from the 35th to the 41st the cylinder (6) of the first actuator (22) extends between a first and a second end (26a, 26b) along an extension direction (D'). In a 43rd aspect according to any one of the preceding aspects from the 35th to the 42nd the first chamber (C1') of the cylinder (26) of the first actuator (22) is exclusively in fluid communication with the primary supply line (20) through the inlet (24) of the first actuator (22). In a 44th aspect according to any one of the preceding aspects from the 36th to the 43rd the second chamber (C2') of the cylinder (26) of the first actuator (22) is exclusively in fluid communication with the secondary supply line (21) through the outlet (25) of the first actuator (22).

[0023] In a 45th aspect according to any one of the preceding aspects the piston (27) of the first actuator (22) has an outer lateral surface (30) at least partly countershaped to the cylinder (26) of the first actuator (22). In a 46th aspect according to the preceding aspect the first actuator (22) has at least one sealing element (28) interposed between said outer lateral surface (30) of the piston (27) and the inner lateral surface (29a) of the cylinder (26) of the first actuator (22), said sealing element (28) being configured for preventing a fluid passage between the first and the second chamber (C1', C2') of the cylinder (26) of the first actuator (22). In a 47th aspect according to any one of the preceding aspects from the 35th to the 46th the piston (27) of the first actuator (22) is movable along a direction parallel to a/the extension direction (D') of the cylinder (26) of the first actuator (22). In a 48th aspect according to any one of the preceding aspects from the 38th to the 47th the piston (27) of the first actuator (22) is movable approaching and moving away with respect to the first and second surface (29b, 29c) of the cylinder (26) to allow a variation in terms of volume of the first and second chamber (C1', C2') of the first actuator (22). In a 49th aspect according to any one of the preceding aspects from the 35th to the 48th the first actuator (22) comprises a rod (32) partially housed in the second chamber (C1') and engaged to the piston (27) of the first actuator (22). In a 50th aspect according to the preceding aspect in combination with the 38th aspect the rod (32) of the first actuator (22) extends from the second head surface (27b) of the piston (27) and protrudes from the inner volume of the cylinder (26) through the second surface (29c). In a 51st aspect according to any one of the two preceding aspects the rod (22) is exclusively housed in the second chamber (C2') of the first actuator (22). In a 52th aspect according to any one of the three preceding aspects the rod (22) does not pass through the first chamber (C1') of the first actuator (22).

[0024] In a 53rd aspect according to any one of the preceding aspects from the 35th to the 52th the supply circuit comprises:

a source (S) of a working fluid,
a non-return valve (39) active on the primary supply line (20) and configured for preventing the fluid passage toward the source (S).

[0025] In a 54th aspect according to the preceding aspect the primary supply line (20) comprises:

a first section (13) interposed between the source (S) and the non-return valve (39),
a second section (23) interposed between the non-return valve (39) and the inlet (24) of the first actuator (22).

[0026] In a 55th aspect according to any one of the preceding aspects from the 35th to the 54th the supply circuit comprises a pump (33) active on the primary supply line (20), optionally on the first section (13), and configurable between:

an activation condition wherein the pump is configured for sending working fluid from the source (S) to the inlet (24) of the first actuator (22),
a deactivation condition.

[0027] In a 56th aspect according to the preceding aspect the handling system comprises a control unit (50) operatively connected to the pump (33) and configured for commanding the activation condition and the deactivation condition of the pump (33). In a 57th aspect according to any one of the preceding aspects from the 35th to the 56th the supply circuit comprises a bypass line (34) which puts in fluid communication the primary supply line (20), optionally the second section (23), with the secondary supply line (21).

[0028] In a 58th aspect according to the preceding aspect the supply circuit comprises a balance valve (35) active on the bypass line (34) and configurable between:

a closing position wherein the balance valve (35) is configured for preventing the fluid passage along the bypass line (34),
an opening position wherein the balance valve (35) is configured for allowing the fluid passage along the bypass line (34).

[0029] In a 59th aspect according to the preceding aspect the supply circuit comprises a first pressure sensor (36) connected to the primary supply line (20), optionally to the second section (23), and configured for generating a signal representative of the fluid pressure upstream of the balance valve (35). In a 60th aspect according to any one of the two preceding aspects the supply circuit comprises a second pressure sensor (37) connected to the secondary supply line (21) and configured for generating a signal representative of the fluid pressure downstream of the balance valve (35). In a 61th aspect according to any one of the two preceding aspects theta control unit (50) is operatively connected to the first and second pressure sensor (36, 37) and configured for:

receiving the signal from the first pressure sensor (36),
determining, as a function of the signal emitted by the first sensor, one or more measured values of the pressure of the working fluid in the primary supply line (20),
receiving the signal from the second pressure sensor (37),
determining, as a function of the signal emitted from the second sensor, one or more measured values of the pressure of the working fluid in the secondary supply line (21).

[0030] In a 62th aspect according to the preceding aspect the control unit (50) is configured for:
determining one or more values of a control parameter representative of a difference or a ratio between the measured value of the pressure of the working fluid in the primary supply line (20) and the measured value of the pressure of the working fluid in the secondary supply line (21). In a 63th aspect according to the preceding aspect the control unit (50) is configured for carrying out a balancing procedure comprising the steps of:

comparing one or more values of the control parameter with a threshold value, optionally equal to 0.5 bar,
commanding, as a function of the comparison of one or more values of the control parameter, the opening position or the closing position of the balance valve (35).

[0031] In a 64th aspect according to any one of the two preceding aspects the control parameter is representative of a difference of pressure between the primary supply line (20) and the secondary supply line (21). In a 65th aspect according to any one of the three preceding aspects the control unit (50) is configured for commanding the opening position of the balance valve (35) if one or more pressure values of the control parameter are higher than the threshold value. In a 66th according to any one of the preceding aspects from the 35th to the 65th the supply circuit comprises a parachute valve (44) sensitive to a variation of pressure of the working fluid on the primary supply line (20) upstream of the inlet (24) of the first actuator (22). In a 67th aspect according to the preceding aspect the parachute valve (44) is configurable between:

an opening condition wherein it allows the passage of the working flow through the primary supply line (20); and
a closing condition wherein it prevents the passage of the working flow in the primary supply line (20).

[0032] In a 67bis aspect according to any one of the

two preceding aspects the parachute valve (44) is configured for passing from the opening condition to the closing condition if an increase of the working flow is detected in the primary supply line (20), optionally creating a pressure variation between an upstream and a downstream section of the parachute valve itself higher than a predefined threshold value, for example between 5 bar and 20 bar.

[0033] In a 68th aspect according to any one of the preceding aspects from the 54th to the 67bis aspect the supply circuit comprises a return line (38) which puts in fluid communication the second section (23) of the primary supply line (20) with the source (S). In a 69th aspect according to the preceding aspect the supply circuit comprises a discharge valve (41) active on the return line (38) and configurable between:

- a closing position in which the discharge valve is configured for preventing the fluid passage through the return line (38),
- an opening position in which the discharge valve is configured for allowing the fluid passage through the return line (38), putting in fluid communication the inlet of the first actuator with the source (S).

[0034] In a 70th aspect according to the preceding aspect theta control unit (50) is active on the discharge valve (41) and configured for commanding the closing position and the opening position. In a 71th aspect according to any one of the preceding aspects from the 54th to the 70th the supply circuit comprises a safety line (42) which puts in fluid communication the first section (13) of the primary supply line (20) with the source (S). In a 72th aspect according to the preceding aspect the supply circuit comprises an overpressure valve (43) active on the safety line (42) and configured for allowing selectively the passage of fluid through the safety line (42) as a function of a pressure of the working fluid in the first section (13) of the primary supply line (20). In a 73th aspect according to the preceding aspect theta control unit (50) is operatively connected to the overpressure valve (43) and is configured for:

- detecting and determining one or more measured values of pressure of the working fluid on the first section (13) of the primary supply line (20),
- comparing said one or more measured values of pressure of the working fluid on the first section (13) of the primary supply line (20) with a reference value, optionally between 50 and 300 bar,
- commanding, as a function of said comparison, the overpressure valve (43) during the opening for allowing the passage of fluid in the safety line (42), optionally if said one or more measured values of pressure of the working fluid on the first section (13) are higher than the reference value.

[0035] In a 74th aspect it is provided a vehicle lift (1) comprising:

- at least one column (2),
- at least one carriage (3) slidingly movable along the column (2),
- a handling system (4) configured for handling the carriage (3) along the column (2).

[0036] In a 75th aspect according to the preceding aspect the lift comprises a block (51) configured for locking the carriage (3) with respect to the column (2) in a plurality of operative positions. In a 76th aspect according to the preceding aspect the block (51) comprises:

- a support element (52) fixed to the column (2) and extending along a direction parallel to an extension direction (E) of the column (2), wherein the support element (52) comprises a plurality of stops (53) spaced apart from each other and aligned along the extension direction (E) of the column (2),
- an insert (54) movable at least between:
  - a release position where the insert (54) is spaced apart from the support element (52),
  - a gripping position where the insert (54) engages at least one stop (53) of the support element (52) to lock the carriage (3) with respect to the column (2) in an operative position.

[0037] In a 77th aspect according to the preceding aspect the lift comprises a dragging element (55) connecting the insert (54) to the carriage (3), optionally for moving said insert (54) with respect to the support element (52) during the movement of the carriage (3) along the column (2). In a 78th aspect according to the preceding aspect the dragging element (55) is configurable between:

- a pull condition where the dragging element (55) is configured for holding the insert (54) in the release position,
- a release condition the dragging element (55) is configured for allowing the displacement of the insert (54) in the gripping position.

[0038] In a 79th aspect according to the 77th or 78th aspect the lift comprises a tensioner (56) configured for moving the dragging element (55) for defining the pull and release conditions of said dragging element (55).

[0039] In an 80th aspect according to any one of the aspects from 76th to 79th the support element (52) comprises at least one plate upon which are defined the stops (53). In an 81st aspect according to the preceding aspect the plate of the support element (52) extends in length along a prefixed direction (D1) between a first and a second end (52a, 52b). In an 82nd aspect according to the preceding aspect the prefixed extension direction (D1) of the plate is parallel to the extension direction (E) of the column (2). In an 83rd aspect according to any one of

the aspects from the 80th to the 82nd the plate of the support element (52) comprises a plurality of cavities (52c) spaced apart from each other and aligned along the predetermined extension direction (D1) of the plate. In an 84th aspect according to the preceding aspect two cavities (52c) immediately consecutive are separated by at least one stop (53). In an 85th aspect according to the 83rd or 84th aspect the insert (54), in the gripping position, is at least partly housed in a cavity (52c) of the plate, resting on a stop (53). In an 86th aspect according to any one of the aspects from the 83rd to the 85th the plate of the support element (52) has a number of cavities (52c) greater than 5, optionally a number of cavities between 10 and 30. In an 87th aspect according to any one of the aspects from the 83rd to the 86th each cavity (52c) is delimited by a closed profile. In an 88th aspect according to any one of the aspects from the 83rd to the 87th each cavity (52c) has a square or rectangular shape.

[0040] In an 89th aspect according to any one of the aspects from the 76th to the 88th the support element (52) has a number of stops (53) greater than 5, optionally between 10 and 30. In a 90th aspect according to any one of the aspects from the 76th to the 89th each stop (53) comprises a top surface (53a) suitable for receiving in support the insert (54). In a 91st aspect according to the preceding aspect the top surface (53a) of each stop (53) extends along a plane. In a 92nd aspect according to the preceding aspect the extension plane of the surface (53a) of each stop (53) is orthogonal to the extension direction (E) of the column (2). In a 93rd aspect according to any one of the aspects from the 76th to the 92nd the support element (52) is constituted exclusively by the plate on which are defined the stops (53) and the cavities (52c).

[0041] In a 94th aspect according to any one of the aspects from the 74th to the 93rd the column (2) extends between a base (2a) and a top (2b) along the extension direction (E). In a 95th aspect according to any one of the aspects from the 76th to the 94th the extension direction (E) of the column (2), in use, is vertical. In a 96th aspect according to any one of the aspects from the 74th to the 95th the column (2) comprises:

a base plate (45),
a frame (46) protruding from the base (45).

[0042] In a 97th aspect according to the preceding aspect the frame (46) defines within itself a space (V) in which it is housed at least partly the block (51). In a 98th aspect according to the preceding aspect the support element (52) of the block (51) is entirely housed in the space of the column (2). In a 99th aspect according to any one of the two preceding aspects a preponderant part of the dragging element (55) of the block (51) is housed in the space of the column (2). In a 100th aspect according to any one of the three preceding aspects the dragging element (55) of the block (51) is entirely housed in the space of the column (2). In a 101st aspect according to any one of the four preceding aspects the insert (54) of the block (51) is entirely housed in the space of the column (2).

[0043] In a 102nd aspect according to any one of the aspects from the 76th to the 101st the frame (46) of the column (2) has, along its entire extension, a constant-profile transversal section. In a 103rd aspect according to any one of the aspects from the 76th to the 102nd the frame (46) has, along its entire extension, a transversal section having a substantially "C"-shaped profile.

[0044] In a 104th aspect according to any one of the aspects from the 94th to the 103rd the column (2) comprises, at the top (2b), a top plate (47). In an aspect according to the preceding aspect the top plate (47) is opposed to the base plate (45) with respect to the frame (46).

[0045] In a 105th aspect according to any one of the aspects from the 96th to the 104th the base plate (45) is arranged at the base (2a) of the column (2). In a 106th aspect according to any one of the aspects from the 96th to the 105th the base plate (45) is configured for being fixed to the ground. In a 106th aspect according to any one of the aspects from the 96th to the 105th the frame (46) is fixed to the base plate (45).

[0046] In a 107th aspect according to any one of the aspects from the 94th to the 106th the support element (52) extends from the top (2b) of the column (2) in direction of the base (2a). In a 108th aspect according to any one of the aspects from the 94th to the 107th the support element (52) is spaced apart from the base (2a).

[0047] In a 109th aspect according to any one of the aspects from the 94th to the 108th the column (2) has a length defined by the maximum distance between the base (2a) and the top (2b). In a 110th aspect according to any one of the aspects from the 76th to the 109th the support element (52) has a respective length defined by the maximum distance between the first and the second end (52a, 52b). In a 111th aspect according to the preceding aspect the ratio between the length of the support element (52) and the length of the column (2) is between 0,5 and 0,9, optionally between 0,6 and 0,8.

[0048] In a 112th aspect according to any one of the aspects from the 77th to the 111th the dragging element (55) extends between a first and a second end (55a, 55b) distinct from each other. In a 113th aspect according to any one of the aspects from the 77th to the 112th the dragging element (55) defines an elongated body having an open profile. In a 114th aspect according to any one of the aspects from the 77th to the 113th the dragging element (55) comprises at least one of: a belt, a chain, a rope. In a 115th aspect according to any one of the aspects from the 77th to the 114th the dragging element (55) is constituted by a belt having an open profile.

[0049] In a 116th aspect according to any one of the aspects from the 112th to the 115th the first end (55a) of the dragging element (55) is constrained to the carriage (3). In a 117th aspect according to any one of the aspects from the 112th to the 116th the first end (55a) of the drag-

ging element (55) is fixed to the carriage (3).

[0050] In a 118th aspect according to any one of the aspects from the 112th to the 117th the second end (55b) of the dragging element (55) is constrained to the insert (54) of the block (51). In a 119th aspect according to any one of the aspects from the 112th to the 118th the second end (55b) of the dragging element (55) is hinged to the insert (54) of the block (51).

[0051] In a 120th aspect according to any one of the aspects from the 75th to the 119th the block (51) comprises:

at least one first idle member (57a) carried by the column (2),
at least one second idle member (57b) carried too by the column (2) which is spaced apart from the first idle member (57a).

[0052] In a 121st aspect according to the preceding aspect the first idle member (57a) is arranged at the base (2a) of the column (2). In a 122nd aspect according to the 120th or 121st aspect the first idle member (57a) is constrained to the base plate (45). In a 123rd aspect according to any one of the aspects from the 120th to the 122nd the first idle member (57a) comprises a pulley. In a 124th aspect according to any one of the aspects from the 120th to the 123rd the second idle member (57b) is arranged at the top (2b) of the column (2). In a 125th aspect according to any one of the aspects from the 120th to the 124th the second idle member (57b) is constrained to the top plate (47). In a 126th aspect according to any one of the aspects from the 120th to the 125th the second idle member (57b) comprises a pulley.

[0053] In a 127th aspect according to any one of the aspects from the 120th to the 126th the dragging element (55) is slidingly engaged to the first and second idle member (57a, 57b). In a 128th aspect according to any one of the aspects from the 120th to the 127th the dragging element (55) is wrapped around a part of an outer contact surface of the first idle member (57a), optionally faced to the top (2b) of the column. In a 129th aspect according to any one of the aspects from the 120th to the 128th the dragging element (55) is wrapped around a part of an outer contact surface of the second idle member (57b), optionally faced to the opposite with respect to the base (2a) of the column. In a 130th aspect according to any one of the aspects from the 120th to the 129th at least one of said first and second idle members (57a, 57b) and movable with respect to the other to vary a distance present between said first and second idle members (57a, 57b), optionally to determine the pull and release conditions of the dragging element (55). In a 131st aspect according to any one of the aspects from the 120th to the 130th the first idle member (57a) is fixed to the column. In a 132nd aspect according to any one of the aspects from the 120th to the 131st the first idle member (57a) is fixed (optionally directly) to the base plate (45) of the column (2).

[0054] In a 133rd aspect according to any one of the aspects from the 120th to the 132nd the second idle member (57b) is slidingly movable with respect to the column (2). In a 134th aspect according to any one of the aspects from the 120th to the 133rd the second idle member (57b) is movable with respect to the first idle member. In a 135th aspect according to any one of the aspects from the 120th to the 134th the second idle member (57b) is movable approaching and moving away with respect to the first idle member (57a). In a 136th aspect according to any one of the aspects from the 120th to the 135th the second idle member is movable with respect to the column (2) along a direction substantially parallel to the extension direction (E) of the column itself.

[0055] In a 137th aspect according to any one of the aspects from the 74th to the 136th the at least one carriage (3) comprises at least one lifting arm configured for contacting a vehicle, optionally the body of the vehicle, for allowing its lifting. In a 138th aspect according to the preceding aspect the arm lies substantially along a plane orthogonal to the extension direction (E) of the column (2). In a 139th aspect according to any one of the two preceding aspects the arm is movable by rotation around an axis (Y) parallel to the extension direction (E) of the column (2).

[0056] In a 140th aspect according to any one of the aspects from the 74th to the 139th the at least one carriage (3) comprises two lifting arms (3a, 3b). In a 141st aspect according to the preceding aspect the lifting arms (3a, 3b) lie substantially on a single plane, orthogonal to the extension direction (E) of the column (2). In a 142nd aspect according to any one of the two preceding aspects the lifting arms (3a, 3b) are movable by rotation around respective axes (Y) parallel to the extension direction of the column (2).

[0057] In a 143rd aspect according to any one of the aspects from the 74th to the 142nd the carriage (3) comprises a guide frame (80) engaged (optionally directly) to the frame of the column (2), optionally carrying the at least one arm, even more optionally carrying the first and second arm (3a, 3b). In a 144th aspect according to the preceding aspect the guide frame (80) of the carriage is housed at least partly in the space (V) of the column (2).

[0058] In a 145th aspect according to the 143rd or 144th aspect the guide frame (80) comprises at least one plate extending in length parallel to the extension direction (E) of the column (2). In a 146th aspect according to the preceding aspect the plate of the guide frame (80) has, according to a section orthogonal to the extension direction of the column (2), a substantially "L"-shaped profile. In a 147th aspect according to the 145th or 146th aspect the plate of the guide frame (80) is at least partly countershaped to the frame (46) of the column (2). In a 148th aspect according to any one of the aspects from the 145th to the 147th the ratio between the length of the plate of the guide frame (80) and the column (2) is between 0,1 and 0,5, optionally between 0,2 and 0,4.

[0059] In a 149th aspect according to any one of the

aspects from the 143rd to the 148th the first end (55a) of the dragging element (55) is fixed (optionally directly) to the guide frame (80) of the carriage (3). In a 150th aspect according to any one of the aspects from the 76th to the 149th the insert (54) is hinged (optionally directly) to the carriage (3). In a 151st aspect according to any one of the aspects from the 143rd to the 150th the insert (54) is hinged (optionally directly) to the guide frame (80) of the carriage (3).

[0060] In a 152nd aspect according to any one of the aspects from the 75th to the 151st the block (51) comprises a pusher (58) hinged, on one side, to the carriage (3) and, on the other side, to the insert (54). In a 153rd aspect according to the preceding aspect the pusher (58) is configured for exerting a thrust on the insert (54) suitable for moving said insert (54) in the gripping position. In a 154th aspect according to the 152nd or 153rd the pusher (58) is configured for forcing the gripping position to the insert (54). In a 155th aspect according to any one of the aspects from the 152nd to the 154th the pusher (58) is configured for holding the insert (54) in the gripping position. In a 156th aspect according to any one of the aspects from the 152nd to the 155th the pusher (58), in the release condition of the dragging element (55), is configured for holding the insert (54) in the gripping position.

[0061] In a 157th aspect according to any one of the aspects from the 152nd to the 156th the pusher (58) comprises an elastic return element. In a 158th aspect according to any one of the aspects from the 152nd to the 157th the pusher (58) comprises:

a hollow sustain body (58a) hinged (optionally directly) to the carriage (3),
a rod (59) slidingly engaged in a seat (58b) of the sustain body (58a), the rod (59) protruding from the seat (58b) of the sustain body and being hinged to the insert (54),
an elastic body (60) housed at least partly in the seat of the sustain body (58) and active in thrust on the rod (59) which is active in thrust, in turn, on the insert (54).

[0062] In a 159th aspect according to the preceding aspect the elastic body (60) comprises a spring. In a 160th aspect according to the preceding aspect the spring comprises at least one of: a compression spring, a traction spring, a torsion spring. In a 161st aspect according to any one of the aspects from the 152nd to the 160th the pusher (58), optionally the sustain body (58a), is hinged to the guide frame (80) of the carriage.

[0063] In a 162nd aspect according to any one of the aspects from the 76th to the 161st the insert (54) is constrained to the second end of the dragging element (55) through a hinge-type constraint. In a 163rd aspect according to any one of the aspects from the 76th to the 162nd the insert (54) is constrained (optionally directly) to the carriage (3) through a hinge-type constraint. In a 164th aspect according to any one of the aspects from the 143rd to the 163rd the insert (54) is hinged (optionally directly) to the guide frame (80) of the carriage (3). In a 165th aspect according to any one of the aspects from the 143rd to the 164th the insert (54) is movable with respect to the guide frame (80) exclusively by rotation. In a 166th aspect according to any one of the aspects from the 76th to the 165th the insert (54) is rotatable between the release and gripping position, and vice versa. In a 167th aspect according to any one of the aspects from the 152nd to the 166th the insert (54) is constrained to the pusher (58) through a hinge-type constraint.

[0064] In a 168th aspect according to any one of the aspects from the 76th to the 167th the insert (54), in the release position, is configured for moving by sliding and rotation relatively to the support element (52). In a 169th aspect according to any one of the aspects from the 76th to the 168th the insert (54) comprises:

a head section (54a) which, in the gripping position, is configured for contacting the stops (53) of the support element (52),
a rear section (54b) opposed to the head section (54a), which is hinged (optionally directly) to the dragging element (55), optionally to the second end (55b) of the dragging element (55).

[0065] In a 170th aspect according to the preceding aspect the pusher (58), optionally the rod (59) of the pusher, is hinged (optionally directly) to the insert (54) at the head section (54a). In a 171st aspect according to the 169th or 170th aspect the insert (54) is hinged to the carriage (3), optionally to the guide frame (80) of the carriage (3), at a zone spaced apart with respect to the head section (54a) and to the rear section (54b). In a 172nd aspect according to any one of the aspects from the 169th to the 171 st the insert (54) is hinged (optionally directly) to the guide frame (80) of the carriage (3) at a peripheral zone of the same insert (54) which is placed, optionally in use, above the head section (54a).

[0066] In a 173rd aspect according to any one of the aspects from the 169th to the 172nd the head section (54a) comprises an abutting plane (54a') which, in the gripping position of the insert (54), is substantially parallel to the top surface (53a) of the stops (53). In a 174th aspect according to any one of the aspects from the 169th to the 173rd the insert (54) comprises, optionally at the head section (54a), a front surface (54c), tilted with respect to the abutting plane (54a') of the insert (54) itself. In a 175th aspect according to the preceding aspect the front surface (54c), in the release position, is faced to the plate of the support element (52). In a 176th aspect according to the 174th or 175th aspect the front surface (54c), in the release position of the insert (54), is substantially parallel to a lying plane of the plate of the support element (52). In a 177th aspect according to any one of the aspects from the 174th to the 176th the front surface (54c) of the insert (54), in the release position, is substantially

parallel to the extension direction (E) of the column (2). In 178th aspect according to any one of the aspects from the 174th to the 177th the insert (54) is (optionally directly) hinged to the carriage (3), optionally to the guide frame (80) of the carriage (3), at an intermediate zone of the same insert (54), interposed between the front surface (54c) and the rear section (54b).

[0067] In a 179th aspect according to any one of the aspects from the 75th to the 178th the block (51) comprises an end stop (70) fixed (optionally directly) to the carriage (3), optionally to the guide frame (80). In a 180th aspect according to the preceding aspect the end stop (70) is arranged near the insert (54). In a 181st aspect according to any one of the two preceding aspects the end stop (70) is configured for contacting the rear section (54b) of the insert (54) in the gripping position of said insert (54).

[0068] In a 182nd aspect according to any one of the aspects from the 120th to the 181st the tensioner (56) is active (optionally directly) on at least one of said first and second idle members (57a, 57b) to vary a distance present between said first and second idle members (57a, 57b) and consequently a distance present between the first and the second end (55a, 55b) of the dragging element (55).

[0069] In a 183rd aspect according to any one of the aspects from the 120th to the 182nd the tensioner (56) is active (optionally directly) on the second idle member (57b). In a 184th aspect according to any one of the aspects from the 120th to the 183rd the tensioner (56) is configured for moving the second idle member (57b) relatively to the first idle member (57a), optionally approaching and moving away with respect to said first idle member (57a). In a 185th aspect according to any one of the aspects from the 120th to the 184th the tensioner (56) is configured for moving at least one of said first and second idle members (57a, 57b), optionally the second idle member (57b), at least between:

a first operative position where said first and second idle members (57a, 57b) are arranged at a first distance from each other,
a second operative position where said first and second idle members (57a, 57b) are arranged at a second distance from each other greater than the first distance.

[0070] In a 186th aspect according to the preceding aspect the tensioner (56), in the first operative position of the first and second idle member (57a, 57b), is configured for allowing the pusher (58) to move the insert in the gripping position. In a 187th aspect according to the 185th or 186th aspect the tensioner (56), in the second operative position of the first and second idle member (57a, 57b), is configured for counteracting a force generated by the pusher on the insert (54) to move said insert (54) in the release position.

[0071] In a 188th aspect according to any one of the aspects from the 79th to the 187th the tensioner (56) comprises an actuator. In a 189th aspect according to any one of the aspects from the 79th to the 188th the tensioner (56) comprises at least one of: a pneumatic actuator, a hydraulic actuator, an electric actuator, a magnetic actuator.

[0072] In a 190th aspect according to any one of the aspects from the 120th to the 189th the dragging element (55), in the first operative position of the first and second idle member (57a, 57b), defines the release condition. In a 191st aspect according to any one of the aspects from the 185th to the 190th the dragging element (55), in the second operative position of the first and second idle member (57a, 57b), defines the pull condition.

[0073] In a 192nd aspect according to any one of the aspects from the 79th to the 191st the lift (1) comprises at least one control unit (50) active commanding on the tensioner (56) for defining the pull and release conditions of said dragging element (55). In a 193rd aspect according to the preceding aspect the control unit (50) is active commanding on the tensioner (56) for moving the first and second idle member (57a, 57b) between the first and the second operative position. In a 194th aspect according to the 192nd or 193rd aspect the control unit (50) is active commanding on the handling system (4) for commanding the movement of the carriage (3) along the column (2) and the stop of the carriage (3) with respect to the column (2). In a 195th aspect according to any one of the aspects from the 192nd to the 194th the control unit (50) is configured for commanding the tensioner (56) to define the second operative position of the first and second idle member (57a, 57b), during the stop of the carriage (3) with respect to the column (2).

[0074] In a 196th aspect according to any one of the aspects from the 74th to the 195th the lift (1) comprises at least one sensor (40) configured for generating a signal representative of one of the following parameters relative to the carriage (3):

a position of the carriage (3) along the column (2),
a relative movement between the carriage (3) and the column (2),
a height of the carriage (3) with respect to the ground,
a sliding speed of the carriage (3) along the column (2),
a representative number of ascent/descent cycles of the carriage (3),
a number of reversions, optionally with reduced stroke, of the carriage (3).

[0075] In a 197th aspect according to the preceding aspect the control unit (50) is connected to the sensor (40). In a 198th aspect according to the preceding aspect the control unit (50) is configured for:

receiving the signal emitted by the sensor (40),
determining, as a function of the signal emitted by the sensor, a value of at least one of the following

parameters:

- a position of the carriage (3) along the column (2),
- a relative movement between the carriage (3) and the column (2),
- a height of the carriage (3) with respect to the ground,
- a sliding speed of the carriage (3) along the column (2),
- a representative number of ascent/descent cycles of the carriage (3),
- a number of reversions, optionally with reduced stroke, of the carriage (3).

[0076] In a 199th aspect according to any one of the aspects from the 192nd to the 198th the control unit (50) is configured for carrying out a blocking procedure of the carriage (3) comprising the following steps:

- commanding the stop of the handling system,
- commanding the tensioner (56) to define the second operative position of the first and second idle member (57a, 57b).

[0077] In a 200th aspect according to the preceding aspect the blocking procedure also comprises the following steps:

- after the stop command of the handling system (4), receiving from the sensor a signal representative of a relative movement of the carriage with respect to the column,
- determining the presence of a relative movement between carriage (3) and the column (2),
- if the control unit (50) detects a relative movement between carriage (3) and column, commanding the tensioner (56) to define the second operative position of the first and second idle member (57a, 57b).

[0078] In a 201st aspect according to the 199th or 200th aspect the blocking procedure also comprises the following steps:

- commanding the activation of the handling system (4) for moving the carriage (3) relatively the column (2),
- receiving from the sensor (40) a signal representative of a relative movement of the carriage with respect to the column,
- determining the presence of a relative movement between carriage (3) and the column (2),
- if the control unit (50) detects, following the sending of the activation command of the handling system (4), the absence of a relative movement between carriage (3) and column, commanding the tensioner (56) to define the second operative position of the first and second idle member (57a, 57b).

[0079] In a 202nd aspect according to any one of the aspects from the 196th to the 201st the sensor (40) comprises at least one of: an inductive sensor, a capacitive sensor, a magnetic sensor, an optical sensor, a laser sensor. In a 203rd aspect according to any one of the aspects from the 196th to the 202nd the sensor (40) is directly carried by the column (2).

[0080] In a 204th aspect according to any one of the aspects from the 196th to the 203rd the sensor (40) is arranged near of at least one between the first and second idle member (57a, 57b). In a 205th aspect according to any one of the aspects from the 196th to the 204th the sensor (40) is configured for detecting at least one parameter relative to the rotation, of at least one between the first and second idle member (57a, 57b). In a 206th aspect according to any one of the aspects from the 196th to the 205th the sensor (40) is configured for detecting at least one of the following parameters of at least one between the first and second idle member (57a, 57b):

- a rotational speed,
- an acceleration,
- a number of rotations,
- an angular position,
- a direction of rotation.

[0081] In a 207th aspect according to any one of the aspects from the 192nd to the 206th the control unit (50), as a function of the at least one parameter relative to the rotation of at least one between said first and second idle members (57a, 57b), is configured for determining a value of at least one of the parameters relative to the carriage (3), optionally the value of at least one between:

- a position of the carriage (3) along the column (2),
- a relative movement between the carriage (3) and the column (2),
- a height of the carriage (3) with respect to the ground,
- a sliding speed of the carriage (3) along the column (2),
- a representative number of ascent/descent cycles of the carriage (3),
- a number of reversions, optionally with reduced stroke, of the carriage (3).

[0082] In a 208th aspect according to any one of the aspects from the 74th to the 207th the at least one column comprises a first and a second column (2', 2"). In a 209th aspect according to the preceding aspect the first and the second column (2', 2") are spaced apart and parallel to each other. In a 210th aspect according to the 208th or 209th aspect the first and the second column (2', 2") are substantially equal to each other. In a 211th aspect according to any one of the aspects from the 208th to the 210th the first and the second column are of the type according to any one of the preceding aspects relative to the at least one column (2). In a 212th aspect according to any one of the aspects from the 208th to the 211th the

at least one carriage (3) is slidingly movable along at least one between the first and the second column (2', 2"). In a 213rd aspect according to any one of the aspects from the 208th to the 212th the first column carries a first carriage (3') slidingly movable along said first column (2'). In a 214th aspect according to any one of the aspects from the 208th to the 213rd the second column (2") carries a second carriage (3") slidingly movable along said second column (2"). In a 215th aspect according to any one of the aspects from the 208th to the 214th the lift (1) comprises a block (51) for each column. In a 216th aspect according to any one of the aspects from the 74th to the 215th the handling system (4) is according to any one of the preceding aspects from the 35th to the 73rd. In a 217th aspect according to the preceding aspect the first actuator (22) of the handling system (4) is associated to the first column (2') while the second actuator (5) is associated to the second column (2"). In a 218th aspect according to the 216th or 217th aspect the first and second actuator (22, 5) of the handling system (4) are configured for allowing the movement of said at least one carriage (3) along at least one of said first and second column (2', 2").

[0083] In a 219th aspect according to any one of the aspects from the 208th to the 218th the at least one carriage (3) comprises:

a/the first carriage (3') slidingly movable along the first column (2'),
a/the second carriage (3") slidingly movable along the second column (2").

[0084] In a 220th aspect according to any one of the aspects from the 208th to the 219th the first actuator (22) is housed in the first column (2'). In a 221st aspect according to any one of the aspects from the 208th to the 220th the second actuator (5) is housed in the second column (2"). In a 222nd aspect according to any one of the aspects from the 208th to the 221st the first carriage (3') carried by the first column (2') is engaged to the first actuator (22), optionally to the rod (32) of the first actuator (22). In a 223rd aspect according to any one of the aspects from the 208th to the 222nd the second carriage (3") carried by the second column (2") is engaged to the second actuator (5), optionally to the rod (12) of the second actuator (5).

[0085] In a 224th aspect according to any one of the aspects from the 208th to the 223rd each column extends between a base (2a) and a top (2b). In a 225th aspect according to the preceding aspect the first and the second actuator (22, 15) are respectively placed at the bases (2a) of the first and second column (2', 2"). In a 226th aspect according to any one of the aspects from the 208th to the 225th the first column (2') comprises:

a base plate (45'),
a frame (46') protruding from the base plate (45') and defining within it a space (V') wherein it is housed the first actuator (22).

[0086] In a 227th aspect according to any one of the preceding aspects from the 208th to the 226th the second column (2") comprises:

a base plate (45"),
a frame (46") protruding from the base plate (45") and defining within itself a space (V") where it is housed the second actuator (5).

[0087] In a 228th aspect according to the preceding aspect each frame (46', 46"), of the first and the second column (2', 2"), has, along its entire extension, a constant-profile transversal section, optionally having a substantially "C"-shaped profile. In a 229th aspect according to the 226th or 227th or 228th aspect the frame (46') of the first column (2') comprises:

a first through access (48a) near the base (2a') of the first column (2'), for allowing the access of the primary supply line (20) in the space (V'),
a second through access (48b) near the top (2b') of the first column (2'), for allowing the output of the secondary supply line (21) from the first column (2').

[0088] In a 230th aspect according to any one of the preceding aspects from the 227th to the 229th the frame (46") of the second column (2") comprises a respective access (49) near the top (2b") of the second column (2"), configured for allowing the inlet of the secondary supply line (21) in the space (V") of the second column (2"). In a 231st aspect according to any one of the preceding aspects from the 227th to the 230th the secondary supply line (21) extends at least partly in the spaces (V', V") of frames (46', 46") of the first and the second column (2', 2").

[0089] In a 232nd aspect according to any one of the preceding aspects from the 227th to the 230th the secondary supply line extends at least partly outside the frames (46', 46") of the first and the second column (2', 2"). In a 233rd aspect according to any one of the preceding aspects from the 208th to the 232nd the secondary supply line, in use, extends at least partly above the first and the second column (2', 2").

[0090] In a 234th aspect according to any one of the preceding aspects from the 74th to the 233rd the lift (1) comprises a user interface (UI) usable by an operator, wherein the user interface (UI) is connected to the control unit (50) and configured for sending signals of command to the control unit (50) for the lifting, the lowering and the stop of the at least one carriage (3).

[0091] In a 235th aspect a process of lifting vehicles using a lift (1) according to any one of the aspects from the 74th to the 234th is provided. In a 236th aspect according to the preceding aspect the process comprises the following steps:

arranging the at least one carriage (3) near the ground,
arranging a vehicle above the at least one carriage (3), optionally above the at least one lifting arm of the carriage,
activating the handling system (4) for moving the carriage (3) along the column to lift the vehicle above the ground. In a 237th aspect according to the preceding aspect the step of activating the handling system (4) comprises sending a working fluid to the first and second actuator (22, 5) for moving the at least one carriage along the first and the second column (2', 2"). In a 238th aspect according to the 236th or 237th aspect the step of activating the handling system (4) comprises a step of activating the pump (33) of the supply circuit. In a 239th aspect according to the preceding aspect the step of activating the pump (33) comprises the steps of:

moving a working fluid from the source (S) to the first actuator (22) through the primary supply line (20),
moving working fluid from the first actuator (22) to the second actuator (5) through the secondary supply line (21). In a 240th aspect according to the preceding aspect the step of moving a working fluid from the source (S) to the first actuator (22), provides the sub-steps of moving the working fluid along the first and the second section (13, 23) of the primary supply line (20) accessing the first chamber (C1') of the first actuator (22). In a 241st aspect according to any one of the two preceding aspects the step of moving fluid from the first actuator (22) to the second actuator (5) provides the sub-steps of:
moving the piston (27) of the first actuator (22) approaching the second end (26b) of the cylinder (26) of the first actuator (22),
moving the working fluid accessing the first chamber (C1") of the second actuator (5).

[0092] In a 242nd aspect according to the preceding aspect during the step of moving working fluid accessing the first chamber (C1") of the second actuator (5), part of the working fluid passes from the second to the first chamber (C2", C1") of the cylinder (6) of the second actuator (5). In a 243rd aspect according to the preceding aspect the step of passage of the fluid from the second to the first chamber of the cylinder of the first actuator comprises the sub-step of:

moving the piston (7) of the second actuator (5) approaching the second end (9c) of the cylinder (6) of the second actuator (5),
moving the working fluid from the second to the first chamber of the second actuator (5) through the through opening (8) of the piston (7).

[0093] In a 244th aspect according to any one of the preceding aspects from the 236th to the 243rd the process comprises a step of balancing of the supply circuit which comprises the sub-steps of:

determining one or more measured values of pressure of the working fluid on the second section (23) of the primary supply line (20) through the first sensor (36) connected to said second section of the primary supply line,
determining one or more measured values of pressure of the working fluid on the secondary supply line (21) through the sensor (37) connected to said secondary supply line,
determining one or more values of a control parameter representative of a difference or a ratio between the measured value of the pressure of the working fluid on the second section (23) and the measured value of the pressure of the working fluid on the secondary supply line (21),
comparing one or more values of the control parameter with a threshold value,
commanding, as a function of the comparison of one or more values of the control parameter, the opening position or the closing position of the balance valve (35).

[0094] In a 245th aspect according to the preceding aspect the step of balancing provides for commanding the opening position of the balance valve (35) if one or more pressure values of the control parameter are higher than the threshold value, optionally equal to 0.5 bar. In a 246th aspect according to any one of the preceding aspects from the 236th to the 245th the process comprising a safety procedure comprising a step of moving fluid along the safety line (42) as a function of a value of pressure of the fluid in the first section (13) of the primary supply line (20). In a 247th aspect according to the preceding aspect the step of moving fluid along the safety line (42), comprises the sub-steps of:

determining one or more measured values of pressure of the working fluid on the first section (13) of the primary supply line (20),
comparing said one or more measured values of pressure of the working fluid on the first section (13) of the primary supply line (20) with a reference value,
commanding, as a function of said comparison, the overpressure valve (43) opening for allowing the passage of fluid in the safety line (42), optionally if said one or more measured values of pressure of the working fluid on the first section (13) are, in module, higher to a predetermined threshold, optionally between 50 and 300 bar.

[0095] In a 248th aspect according to any one of the aspects from the 236th to the 247th the process furthermore comprises the steps of:

commanding the stop of the handling system (4) for stopping the lifting of the vehicle,
after the stop of the handling system (4), determining the gripping position of the insert (54) of the block (51).

[0096] In a 249th aspect according to any one of the aspects from the 236th to the 248th the insert (54), during the activation of the handling system (4), is arranged in the release position. In a 250th aspect according to any one of the aspects from the 236th to the 249th the step of determining the gripping position of the insert (54) comprises a step of activation of the tensioner (56). In a 251st aspect according to the preceding aspect the activation of the tensioner (56) comprises the stop commanding the activation of the actuator active on at least one of said first and second idle members (57a, 57b) for displacing said first and second idle members (57a, 57b) in the second operative position. In a 252nd aspect according to any one of the aspects from the 236th to the 251st the process also comprises the following steps:

detecting, during the activation of the handling system (4), a parameter representative of a movement of the carriage (3) along the column (2),
comparing one or more values of said parameter with a desired threshold parameter value,
determining, following the step of comparison, if the carriage (3) moves along the column (2) according to a predetermined movement,
if it is determined the stop of the carriage or a movement not corresponding to the predetermined movement, determining the gripping position of the insert (54) of the block (51).

[0097] In a 253rd aspect it is provided a process of lowering vehicles using a lift (1) according to any one of the preceding aspects from the 74th to the 234th. In a 254th aspect according to the preceding aspect the process comprises the steps of:

arranging the at least one carriage (3) spaced apart from the ground,
arranging the discharge valve (41) of the supply circuit in opening position for moving said carriage (3) along said first and second column (2', 2") approaching the ground.

[0098] In a 255th aspect according to the preceding aspect the arranging of the discharge valve in the opening position allows the working fluid to:

pass from the second actuator (5) to the first actuator (22) through the secondary supply line (21),
pass from the first actuator (22) to the source (S) along the second section (23) of the primary supply line (20) and the return line (38).

[0099] In a 256th aspect according to the preceding aspect during the passage of the working fluid from the second actuator (5) to the first actuator (22) through the secondary supply line (21) the working fluid also passes from the first to the second chamber (C1", C2") of the second actuator (5) through the through opening (18) of the piston (7), optionally through the gap (11) of the second actuator (5). In a 257th aspect according to the preceding aspect during the passage of the working fluid from the first to the second chamber of the second actuator (5):

the piston (7) of the second actuator (5) moves approaching the first end (9b) of the cylinder (6) of the second actuator (5)
the working fluid passes from the second chamber (C2") of the second actuator (5) toward the first chamber (C1") of the first actuator (22).

[0100] In a 258th aspect according to any one of the three preceding aspects during the passage of the working fluid from the first actuator (22) to the source (S):

the piston (27) of the first actuator (22) moves approaching the first end (29b) of the cylinder (26) of the first actuator (22),
the working fluid passes through the second section (23) of the primary supply line (20) exiting from the first chamber (C1') of the first actuator (22),
the working fluid passes through the return line (38) and moves towards the source (S).

[0101] In a 259th aspect according to any one of the aspects from the 253rd to the 258th the process of lowering comprises the following steps:

moving the insert (54) from the gripping position to the release one,
commanding the handling system (4) for allowing the lowering of the vehicle with respect to the ground.

[0102] In a 260th aspect according to any one of the aspects from the 253rd to the 259th the insert (54), during the command of the handling system for the lowering of the vehicle, it is arranged in the release position. In a 261 st aspect according to any one of the aspects from the 253rd to the 260th the process of lowering also comprises the following steps:

detecting, during the command of the handling system (4) to lower the vehicle, a parameter representative of a movement of the carriage (3) along the column (2),
comparing one or more values of said parameter with a desired threshold parameter value,
determining, following the step of comparison, if the carriage (3) moves along the column (2) according to a predetermined movement,

if it is determined a movement not corresponding to the predetermined movement, determining the gripping position of the insert (54) of the block (51).

[0103] In a 262nd aspect according to any one of the aspects from the 235th to the 261st the working fluid comprises hydraulic oil. In a 263rd aspect it is provided a use of a lift (1) according to any one of the aspects from the 74th to the 234th for the lifting and/or maintenance of vehicles.

BRIEF DESCRIPTION OF FIGURES

[0104] Some embodiments and aspects of the invention will be described herein with reference to the attached exemplificative, and therefore not limiting, figures wherein:

figure 1 is a perspective view of a lift according to the present invention;
figure 2 is a schematic lateral view of a lift according to the present invention;
figure 3 is a schematic view of a first and second actuator of a lift according to the present invention;
figures 4 and 5 are respective schematic views of a supply circuit for the first and second actuator of figure 3.
figures 6 and 7 are flow diagrams relative to a lifting and lowering process that may be performed by a lift according to the present invention;
figure 8 is a sectional schematic view of a lift according to the present invention;
figure 9 is a detail view of a lift according to the present invention;
figures from 10 to 12 are detail views of components of a lift according to the present invention;
figure 13 is a further perspective view showing a variant embodiment of a lift according to the present invention;
figure 14 is a further perspective view of a lift according to the present invention;
figure 15 is a detail view of a block of a lift according to the present invention arranged in a gripping position;
figures from 16 to 18 show, in sequence, the passage of the block of the lift according to the present invention from a release position to the gripping position.

DEFINITIONS AND CONVENTIONS

[0105] In the present description, corresponding parts shown in the various figures are indicated with the same numerical references. Figures may show the object of the invention by means of non-scaled representations; therefore, parts and components shown in the figures relative to the object of the invention may relate exclusively to schematic representations.

[0106] The terms *"vertical" and "horizontal"* used in relation to components of the lift, refer to a condition of its use during which the lift carries out, or is usable for, a lifting/lowering procedure of a vehicle with respect to the ground.

[0107] The handling system and/or the lift described and claimed below may comprise/use at least one control unit in charge of the control of the operating conditions put in place by the lift itself and/or to the control of the steps of the process of lifting of a vehicle. The control unit may be a single unit or be formed by a plurality of distinct control units depending on design choices and operational requirements. With control unit it is intended an electronic type component which may comprise at least one among: a digital processor (CPU), an analogue type circuit, or a combination of one or more digital processors with one or more analogue type circuits. The control unit may be "*configured*" or "*programmed*" to perform certain steps: this may be realized in practice with any means that allow to configure or program the control unit. For example, in case of a control unit comprising one or more CPUs and one or more memories, one or more programs may be stored in appropriate memory banks connected to the CPU or CPUs; the program or programs contain instructions which, when performed by the CPU or CPUs, program or configure the control unit to perform the operations described in relation to the control unit. Alternatively, if the control unit is or comprises analogue type circuitry, the circuit of the control unit may be then designed to include circuitry configured, in use, for processing electrical signals so as to perform the steps relative to the control unit.

[0108] Parts of the described process may be realized by means of a data processing unit or control unit, technically replaceable with one or more computers designed to carry out a portion of a software program or firmware loaded onto a storage medium. This software program may be written in any known programming language. The electronic processors, if equal to two or more in number, may be connected to each other by means of a data connection such that their computing powers are shared in any way whatsoever; the same electronic processors may thus be installed in even geographically different locations, realizing through the above-mentioned data connection a distributed computing environment.

[0109] The data processing unit, or control unit, may be a general-purpose processor configured for carrying out one or more parts of the process identified in the present disclosure through the software or firmware program, or be an ASIC or dedicated processor or FPGA, specifically programmed to carry out at least part of the operations of the process described herein.

[0110] The storage medium may be non-transitory and may be internal or external to the processor, or control unit, or data processing unit, and may - specifically - be a memory geographically located remote with respect to the electronic processor. The storage medium may also be physically divided into multiple portions, or in the form of a cloud, and the software or firmware program may

physically provide for portions stored on geographically divided portions of memory between them.

DETAILED DESCRIPTION

Actuator

[0111] With the reference 5 it has been indicated an actuator, for example usable for vehicle lifts. The actuator 5 may be of pneumatic type using as working fluid a gas, for example air, or of hydraulic type, using a hydraulic oil.

[0112] As shown in figure 3, the actuator 5 has a cylinder 6 comprising a hollow body extending longitudinally along an extension direction D" between a first and a second end 6a, 6b. In detail, the cylinder 6 comprises an inner lateral surface 9a which connects a first surface 9b - defining, in use, an inner base surface of the actuator 5 - with a second surface 9c opposite to the first surface 9b, defining, in use, an inner top surface of the cylinder 6. The inner lateral surface 9a, together with the first and to the second surface 9b, 9c, delimit the space of the cylinder 6 having a predetermined inner volume.

[0113] The inner lateral surface 9a has, according to a section orthogonal to the extension direction D", a circular shape; consequently, the first and the second surface 9b, 9c, placed at the end of the inner lateral surface 9a, have a circular shape. In terms of size, the inner lateral surface 9a defines a passage section between 100 mm^2 and 1500 mm^2, optionally between 100 mm^2 and 1400 mm^2; this passage section is measured according to a plane orthogonal to the extension direction D" of the cylinder 6. Furthermore, the inner lateral wall 9a has a length, measured along the extension direction D" higher than 150 mm, optionally between 500 mm and 3000 mm. Actually, the length of the inner lateral surface 9a is defined by the distance present between the first and the second surface 9b, 9c which substantially coincides with the length of the cylinder 6.

[0114] As it will be better described below, in the space of the cylinder 6 is housed a piston 7 slidingly movable along the extension direction D" approaching and moving away with respect to the first and second surface 9b, 9c.

[0115] The cylinder 6 may comprise an inlet 14 defined on the inner lateral surface 9a at the first end 6a, or on the first surface 9b, for allowing the passage of the working fluid from or to the inner volume of the cylinder 6: the inlet 14 defines the only opening of the cylinder 6 that allows the passage of the working fluid: the cylinder 6 is free of additional openings or accesses defined on the inner lateral surface 9a or on the first or second surface 9b, 9c, which allow the passage of the working fluid.

[0116] The cylinder 6 has however an auxiliary opening, optionally with a circular section, defined on the second surface 9b of the cylinder 6, which allows exclusively the passage of a rod 12 of the piston 7. The cylinder 6 comprises furthermore a gasket, for example an O-ring, engaged at the auxiliary opening of the cylinder 6; the gasket is countershaped to the rod 12 of the piston 7 and configured for allowing the sliding of said rod 12 with respect to the gasket itself, avoiding substantially the passage of the working fluid, avoiding so the leakage of said working fluid from the space of the cylinder 6. Excluding the inlet 14, the cylinder 6 is therefore free of additional openings that allow the passage of fluid through the cylinder 6.

[0117] As mentioned, the actuator 5 comprises a piston 7. The piston 7 divides the inner volume of the cylinder 6 in a first and a second chamber C1", C2", which show a variable volume, as a function of the position of the piston 7 in relation to the cylinder 6. The piston 7 is delimited in thickness by a first and a second head surface 7a, 7b, respectively faced to the first and the second end 6a, 6b of the cylinder 6 and delimiting at least partly, the first and the second chamber C1", C2". In detail, the first head surface 7a delimits, in cooperation with part of the inner lateral surface 9a and the first surface 9b of the cylinder 6, the first chamber C1", while the second head surface 7b delimits, in cooperation with part of the inner lateral surface 9a and the second surface 9c of the cylinder 6, the second chamber C2". From the dimensional point of view, the piston 7 has, in cross section, a surface size between 100 mm^2 and 1500 mm^2; wherein the cross section is defined according to a plane orthogonal to the extension direction D" of the cylinder 6. The thickness of the piston 7 is defined by the maximum distance present between said first and second head surface 7a, 7b; in terms of size, the ratio between the thickness of the piston 7 and the length of the inner lateral surface 9a of the cylinder 6 is between 0,01 and 0,3, optionally between 0,01 and 0,1.

[0118] The piston 7 has also an outer lateral surface 10 interposed between the first and the second head surface 7a, 7b and delimiting perimetrically the piston itself. In fact, the outer lateral surface 10 of the piston 7 connects the first and second head surface 7a, 7b and defines the surface size of the piston 7. The outer lateral surface 10 is at least partly, optionally entirely, countershaped to the inner lateral surface of the cylinder 6. For example, the outer lateral surface 10 of the piston 7 may have an outer perimeter having a substantially circular shape, entirely countershaped to the inner lateral surface 9a. In terms of size, the outer lateral surface 10 of the piston has, in section, a smaller size with respect to the passage section defined by the inner lateral wall 9a of the cylinder; in detail, the smaller size of the outer lateral surface 10 with respect to the inner lateral surface 9a of the cylinder allows to define, between said surfaces, a gap 11 which allows to put in fluid communication the first and the second chamber C1", C2". In detail, the piston 7 is free of sealing elements, for example gaskets, housed in the gap 11 to prevent an exchange of working fluid between the first and the second chamber C1", C2".

[0119] As shown in figures 2 and 3, the piston 7 has also at least one through opening 8 which extends between the first and the second head surface 7a, 7b: the

through opening 8 extends thus for the whole thickness of the piston 7 and is configured for putting in fluid communication the first and the second chamber C1", C2". In the attached figures has been shown, in a non-limiting way, only one through opening 8; the possibility of providing two or more through openings 8 is not excluded. The at least one through opening 8 may be defined at a radially inner zone of the piston spaced from the outer lateral surface 10, optionally interposed between the outer lateral surface 10 and the rod 12; in this condition, the through opening 8 is delimited by a closed perimeter, for example having circular shape. Of course, the possibility of providing one or more through openings 8 defined on the outer lateral surface 10 of the piston 7 is not excluded; in this condition, the through opening 8 would have an open type perimeter, for example having an arcuate shape, essentially defining, on the outer lateral surface 10 of the piston 7, one or more recesses. The possibility of one two or more of said through openings 8 spaced from the outer lateral surface 10 of the piston 7 and one or more of said through openings 8 defined on the outer lateral surface (i.e. to define recesses of the outer lateral surface 10) is not excluded. In particular, the at least one through opening 8 may have a constant passage section, between 50 mm^2 and 500 mm^2. With passage section it is intended the section defined by the at least one passage opening 8; if there are two or more through openings 8, this passage section is intended as the sum of the passage sections of all the through openings 8. Of course, the possibility of realizing one through opening 8 having a passage section having different shape and/or a passage section having a variable size along the thickness of the piston 7 is not excluded.

[0120] Still in terms of size, the surface size of the piston 7 is higher than the passage section of the through opening 8; in detail, the ratio between the passage section of the through opening 8 and the surface size of the piston 7 the surface size of the piston and the passage section of the through opening 8 may be between 0,01 and 0,2; with surface size of the piston 7 it is intended the maximum area defined by the outer lateral surface 10 of the piston 7. The through opening 8 and the gap 11 define thus respective passages which put in fluid communication the first and the second chamber C1", C2" for allowing, during the handling of the rod 12 in the cylinder 6 the passage of the working fluid from the first to the second chamber C1", C2".

[0121] As mentioned, the actuator 5 comprises a rod 12 partially housed in the second chamber C2" and engaged to the piston 7. As shown in figure 2, the rod 12 extends from the second head surface 7b of the piston 7, externally to the cylinder 6 passing through the auxiliary opening defined on the second end 6b of the cylinder 6. Therefore, the rod 12 is exclusively housed in the second chamber C2", without passing through the first chamber C1". From the dimensional point of view, the rod 12 has an elongated body, optionally of cylindrical shape, which, according to a section orthogonal to the extension direction D" of the cylinder 6, has a surface size between 50 mm^2 and 1000 mm^2. The surface size of the piston 7 is higher than the surface size of the rod 12; in greater detail, the dimensional ratio between the surface size of the piston 7 (maximum area defined by the outer lateral surface 10) and the surface size of the rod 12 is between 1,1 and 10. Furthermore, the ratio between the passage section of the through opening 8 (optionally the passage section defined by all of the through openings 8 present on the piston 7) and the surface size of the rod 12 may be between 0,005 and 0,2.

[0122] Precisely because of the presence of the rod 12, the second head surface 7b has a surface extension (i.e. the area defined by the surface 7b) smaller than the surface extension of the first head surface 7a. In fact, the sum of the surface extension of the second head surface 7b and the surface size of the rod 12 define substantially the same surface extension of the first head surface 7a. In terms of size, the ratio between the surface extension of the first head surface and the surface extension of the second head surface may be between 1,05 and 1,25. Thanks to the difference between the surface extensions (areas) of said first and second head surface 7a, 7b of the piston 7, the actuator 5 allows the input of the working fluid in the first chamber C1" (input which may occur exclusively through the inlet 14, unique opening of passage for the working fluid entering and exiting the actuator 5) and the consequent displacement of the piston 7 approaching to the second surface 9c of the cylinder 6; during the input of the working fluid in the first chamber C1", the through opening 8 (or the plurality of openings 8) puts in fluid communication the first chamber C1" and the second chamber C": the through opening 8 ensures thus that the working fluid present in said first and second chamber C1", C2" has substantially the same pressure. It is thus thanks to the difference of surface extension between the first and second head surface of the piston 7 that said piston, in the step of input the working fluid in the first chamber C1", may be displaced toward the second end 6b of the cylinder; the first head surface 7a, precisely because of its greater surface extension with respect to the second head surface, allows to generate (at equal pressure of the working fluid present in the first and second chamber C1", C2") a thrust on the piston 7 greater than the one generable by the second head surface 7b. In this condition, the working fluid, during the handling of the piston 7 approaching to the second end 6b, may flow through the at least one through opening 8 for passing from the second chamber C2" to the first chamber C1". Acting instead in thrust on the rod 12 to force the displacement of the piston 7 toward the first end 6a it is possible to generate the passage of fluid from the first chamber C1" to the second chamber C2".

Handling system

[0123] It is object of the present invention a handling system 4, for example for lifts of vehicles, comprising a

first actuator 22 and a second actuator 5 according to the above-described actuator 5. The first actuator 22 may be a double-effect pneumatic or hydraulic actuator. The first actuator 22 comprises a cylinder 26 whose structure is similar to the one of the above-described cylinder 6 for the actuator 5, i.e. the second actuator 5.

[0124] The cylinder 26 of the first actuator is hollow and longitudinally extending along an extension direction D' between a first and a second end 26a, 26b. In detail, the cylinder 26 of the first actuator comprises an inner lateral surface 29a that connects a first surface 29b - defining, in use, an inner base surface of the first actuator 22 - with a second surface 29c opposite to the first surface 29b, defining, in use, an inner top surface of the cylinder 26. The inner lateral surface 29a, together with the first and to the second surface 29b, 29c, delimit the space of the cylinder 26 having a predetermined inner volume.

[0125] The inner lateral surface 29a has, according to a section orthogonal to the extension direction D', a circular shape; consequently, the first and the second surface 29b, 29c, placed at the end of the inner lateral surface 29a, have a circular shape. In terms of size, the inner lateral surface 29a defines a passage section which may be between 100 mm^2 and 1500 mm^2; this passage section is measured according to a plane orthogonal to the extension direction D' of the cylinder 26 of the first actuator. Furthermore, the inner lateral wall 29a has a length, measured along the extension direction D' higher than 150 mm, optionally between 500 mm and 3000 mm. In fact, the length of the inner lateral surface 29a is defined by the distance present between the first and the second surface 29b, 29c which substantially coincides with the length of the cylinder 26 of the first actuator 22.

[0126] Actually, the cylinder 26 of the first actuator 22 may be substantially identical in shape and in size to the cylinder 6 of the second actuator 5. Also in the space of the cylinder 26 of the first actuator 22 it is housed a piston 27 slidingly movable along the extension direction D' of the cylinder 26 approaching and moving away with respect to the first and second surface 29b, 29c.

[0127] The cylinder 26 may comprise an inlet 24 defined on the inner lateral surface 29a at the first end 26a, or on the first surface 29b, for allowing the passage of the working fluid from or toward the inner volume of the cylinder 26: the inlet 24 defines an opening of the cylinder 26 which allows the passage of the working fluid. The cylinder 26 of the first actuator 22 may furthermore comprise an outlet 25, spaced from the inlet 24 and defined on the inner lateral surface 29a, at the second end 26b, or on the second surface 29c; the outlet 25 defines too one through opening configured for allowing the passage of the working fluid from or toward the inner volume of the cylinder. The cylinder 26 has also an auxiliary opening, optionally with circular section, defined on the second surface 29b of the cylinder 26, which allows exclusively the passage of a rod 32 of the piston 27. The cylinder 26 of the first actuator 22 comprises furthermore a gasket, for example an O-ring, engaged at the auxiliary opening of the cylinder 26; the gasket is countershaped to the rod 32 of the piston 27 and configured for allowing the sliding of said rod 32 with respect to the gasket itself, substantially preventing the passage of the working fluid, thus avoiding the leakage of said working fluid from the space of the cylinder 26.

[0128] Actually, unlike the cylinder 6 of the second actuator 5, the cylinder 26 of the first actuator 22 comprises two through openings (the inlet 24 and the outlet 25) which allow the passage of the working fluid for the input and leakage of the working fluid from the cylinder 26.

[0129] As mentioned, the first actuator 22 comprises a piston 27. The piston 27 divides the inner volume of the cylinder 26 of the first actuator 22 in a respective first and second chamber C1', C2', which have a variable volume, as a function of position of the piston 27 relative to the cylinder 26.

[0130] The piston 27 of the first actuator 22 is delimited in thickness a first and a second head surface 27a, 27b, respectively faced to the first and to the second end 26a, 26b of the cylinder 26 of the first actuator 22 and delimiting at least partly, the first and the second chamber C1', C2'. In detail, the first head surface 27a delimits, in cooperation with part of the inner lateral surface 29a and the first surface 29b of the cylinder 26, the first chamber C1', while the second head surface 27b delimits, in cooperation with part of the inner lateral surface 29a and the second surface 29c of the cylinder 26, the second chamber C2'. From the dimensional point of view, the piston 27 has, according to a section orthogonal to the extension direction D' of the cylinder 26, a surface size between 100 mm^2 and 1000 mm^2.

[0131] The thickness of the piston 27 is defined by the maximum distance present between said first and second head surface 27a, 27b; in terms of size, the ratio between the thickness of the piston 27 and the length of the inner lateral surface 29a of the cylinder 6 is between 0,01 and 0,3, optionally between 0,01 and 0,1.

[0132] The piston 27 has also an outer lateral surface 30 which extends between the first and the second head surface 27a, 27b, perimetrally delimiting the piston itself. In fact, the outer lateral surface 30 of the piston 27 connects the first and second head surface 27a, 27b and defines the surface size of the piston 27. The outer lateral surface 30 is at least partly, optionally entirely, countershaped to the inner lateral surface of the cylinder 26. For example, the outer lateral surface 30 of the piston 27 may have an outer perimeter having substantially circular shape, entirely countershaped to the inner lateral surface 29a. In terms of size, the outer lateral surface 30 of the piston has, in cross section, a lower size with respect to the passage section defined by the inner lateral wall 29a of the cylinder; in detail, the smaller size of the outer lateral surface 30 with respect to the inner lateral surface 29a of the cylinder allows to define, between said surfaces, a gap 11 in which it is housed at least one sealing element 28: the sealing element 28 is interposed between the outer lateral surface 30 of the piston 27 and

the inner lateral surface 29a of the cylinder 26 of the first actuator 22, in such a way as to prevent a passage of fluid between the first and the second chamber C1', C2' of the cylinder 26 of the first actuator 22. Unlike what has been previously described about the second actuator 5, the first and the second chamber C1', C2' of the first actuator 22 are between them isolated, resulting exclusively in fluid communication respectively with the inlet 24 and the outlet 25 of the cylinder 26 of the first actuator 22.

[0133] Unlike the piston 7 of the second actuator, the piston 27 of the first actuator 22 is free of through openings capable of putting in fluid communication the first and the second chamber C1', C2' of the cylinder 26.

[0134] The first actuator 22 also comprises a rod 32 partially housed in the second chamber C2' and engaged to the piston 27. As shown in figure 3, the rod 32 extending from the second head surface 27b of the piston 27, externally to the cylinder 26 passing through the auxiliary opening defined on the second end 26b of the cylinder 26. Therefore, the rod 32 is exclusively housed in the second chamber C2' of the cylinder 26 of the first actuator 22, without passing through the first chamber C1'. From the dimensional point of view, the rod 32 has an elongated body, optionally of cylindrical shape, which, according to a section orthogonal to a/the extension direction D' of the cylinder 26, has a surface size between 50 mm^2 and 1000 mm^2.

[0135] Passing now to a dimensional comparison between the components of the above described first actuator 22, it should be noted how the surface size of the piston 27 is higher to the surface size of the rod 32, wherein the dimensional ratio between said values is between 1,1 and 3.

[0136] The first and second actuator may be identical in terms of size, i.e. have an internal volume of the cylinder, a size of the piston and of the rod having the same size. As it may be seen from the above-mentioned description, the first and second actuator differ in that:

- the cylinder 6 of the second actuator 5 has exclusively the inlet 14 (unique through opening of the cylinder suitable for allowing the passage of working fluid) while the cylinder 26 of the first actuator 22 has both the inlet 24 and the outlet 25; also
- the piston 7 of the second actuator 5 has the at least one through opening 8 which puts in fluid communication the first and the second chamber C1", C2" of the cylinder 26 while the piston 27 of the first actuator 22 is free of through openings.

[0137] The handling system 4 may comprise a supply circuit for the first and second actuator 22, 5. In detail, the supply circuit comprises a primary supply line 20 configured for putting in fluid communication the inlet 24 of the first actuator 22 with a source S of a working fluid, for example defined by a tank configured for containing a predetermined quantity of working fluid, as well as a secondary supply line 21 which puts in fluid communication the outlet 25 of the first actuator 22 with the inlet 14 of the second actuator 5.

[0138] Passing now to describe the active components on the primary and secondary supply lines 20, 21 with reference to the figures 4 and 5, the handling system 4 may comprise a non-return valve 39 active on the primary supply line 20, configured for preventing the passage of fluid toward the source S. The non-return valve 39 defines a first section 13 of the primary supply line 20 interposed between the source S and the non-return valve 39 and a second section 23 of the primary supply line 20, interposed between the non-return valve 39 and the inlet 24 of the first actuator 22. The supply circuit may comprise a pump 33 active on the first section 13 of the primary supply line, configurable between an active condition wherein it moves the working fluid accessing to the first actuator 22 and a deactivated condition wherein it does not act on the working fluid. In detail, during the active condition, the pump 33 is configured for moving the working fluid from the source S, through the non-return valve 39, accessing to the cylinder 26 of the first actuator through the inlet 24. As it will be described later, the pump 33 is in the active condition if there is a need to lift a vehicle through the lift 1, vice versa, the pump 33 is in the deactivated condition in case of lowering of the vehicle.

[0139] The handling system 4 may comprise a control unit 50 operatively connected to the pump 33 and configured for commanding the activation and deactivation conditions of the pump 33 on the base of commands inserted by a user through a subsequently described UI user interface.

[0140] The supply circuit may comprise a parachute valve 44 active on the second section 23 of the primary supply line 20 and sensitive to a pressure variation and/or flow rate of the working fluid in the second section 23, i.e. upstream of the inlet 24 of the first actuator 22. In detail, the parachute valve 44, if it is detected an undesirable increase of pressure and/or of flow rate of the working fluid in the second section 23 is configured for passing from an opening condition (condition of normal operation of the handling system) to a closing condition in which the valve 44 prevents the passage of working fluid. In other words, the parachute valve 44 allows to prevent the uncontrolled descent of the first and of the second actuator 22, 5 in case of breakage of the primary supply line 20 or of the secondary supply line 21, providing the passage of working fluid in the second section 23 of the primary supply line 20. It should be noted that the described parachute valve 44 is a purely mechanical valve, capable of operating without the aid of electronic devices. However, the possibility of using an electronically controlled valve, for example an electromechanical valve of known type, appropriately controlled from the control unit 50 as a function of a measurement of a value of pressure and/or flow rate of the working fluid sampled by a sensor active on the primary supply line 20 is not

excluded.

[0141] The supply circuit may comprise a bypass line 34 which puts in fluid communication the second section 23 of the primary supply line 20 with the secondary supply line 21, as well as a balance valve 35 active on the same bypass line, which is configured for compensating an eventual pressure difference between the primary and secondary supply line 20, 21. The balance valve 25 is thus configurable between opening and closing conditions, wherein respectively allows and prevents the passage of working fluid on the bypass line 34, as a function of a pressure gap. The handling system 4 may comprise a first and a second pressure sensor 36, 37 respectively active on the second section 23 of the primary supply line 20 and on the secondary supply line 21, configured for generating signals representative of the pressure of the working fluid present in the respective supply lines. The control unit 50 is operatively connected to the first and to the second pressure sensor 36, 37, configured for receiving the pressure signals emitted by each sensor and determining one or more measured values of pressure of the working fluid, respectively in the second section 23 of the primary supply line 20 and in the secondary supply line 21. The control unit 50 is then configured for commanding the balance valve 35 as a function of one or more values of a control parameter. In detail, the control unit 50 is configured for:

determining one or more values of the control parameter representative of a difference or a ratio between the measured value of the pressure of the working fluid in the second section 23 of the primary supply line 20 and the measured value of the pressure of the working fluid in the secondary supply line 21,
comparing one or more values of the control parameter with a threshold value, and finally
commanding the opening position or the closing position of the balance valve 35 if one or more pressure values of the control parameter are higher than the threshold value.

[0142] The supply circuit may furthermore comprise a discharge line 38 which puts in fluid communication the second section 23 of the primary supply line 20 with the source S, as well as a discharge valve 41 active on the same discharge line 38, for allowing the passage of fluid toward the source S as a function of a command entered by a user. The discharge valve 41 is thus configurable between respective opening and closing conditions wherein respectively allows and prevents the passage of working fluid along the discharge line 38. The control unit 50 is operatively connected to the discharge valve 41 and is configured for commanding it during the opening or closing as a function of a command entered by a user through the user interface UI. Unlike what is described for the pump 33, the discharge valve 41 is in the opening condition if there is a need to lower a vehicle through the lift 1 (figure 5), while it is in the closing condition in case of lifting of the vehicle (figure 4). The control unit 50 is thus configured for commanding in an asynchronous way the discharge valve 41 and the pump 33, in such a way that to the activation condition of the pump 33 corresponds the closing condition of the discharge valve 41 and, vice versa, to the deactivation condition of the pump 33 corresponds the opening condition of the discharge valve 41.

[0143] The supply circuit may also comprise a filter 14 active on the discharge line 38 for filtering the working fluid accessing the source S.

[0144] The supply circuit may furthermore comprise a safety line 42 which puts in fluid communication the first section 13 of the primary supply line 20 with the source S, as well as an overpressure valve 43 active on the same safety line 42, for allowing the passage of fluid toward the source S if the pressure of the working fluid in the first section 13 is higher than a predetermined reference value. The overpressure valve 43 may be of a fully mechanical type, capable of passing from a closing condition to an opening condition if it detects and determines pressure values of the working fluid in the first section 13 higher than the reference value. Alternatively the overpressure valve 43 may be opportunely connected and commanded by the control unit 50, which would be configured for:

detecting and determining one or more measured values of pressure of the working fluid on the first section 13 of the primary supply line 20,
comparing said one or more measured values of pressure of the working fluid on the first section 13 of the primary supply line 20 with a reference value,
commanding, as a function of said comparison, the overpressure valve 43 during the opening for allowing the passage of fluid in the safety line 42, optionally if said one or more measured values of pressure of the working fluid on the first section 13 are higher to the reference value.

[0145] It should be noted how, during the active condition of the pump 33, it sends a predetermined quantity of working fluid to the first actuator 22; the handling of the piston 27 of the first actuator 22 determines the handling of the working fluid present in the second chamber C2' of the cylinder 26 and of the working fluid present in the secondary supply line 21, toward the cylinder 6 of the second actuator and in particular the input of working fluid in the first chamber C1" of the second actuator 5 through the inlet 14. The inlet of the working fluid in the first chamber C1" allows to displace the piston 7 toward the second surface 9c of the cylinder 6.

[0146] As above specified, precisely thanks to the dimensional difference of the first and second head surface 7a, 7b of the piston 7, the second actuator 5 allows the input of the working fluid in the first chamber C1" (input that exclusively occurs through the inlet 14) and the sub-

sequent displacement of the piston 7 approaching to the second surface 9c of the cylinder 6; during the input of the working fluid in the first chamber C1", the through opening 8 puts in fluid communication the first chamber C1" and the second chamber C": the through opening 8 ensures thus that the working fluid present in said first and second chamber C1", C2" have substantially the same pressure. It is thus thanks to the dimensional difference (surface extension) between the first and second head surface of the piston 7 that the piston 7, in the step of input the working fluid in the first chamber C1", may be displaced toward the second end 6b of the cylinder; the first head surface 7a, precisely thanks to its surface extension greater with respect to the second head surface, allows to generate (at equal pressure of the working fluid present in the first and second chamber C1", C2") a thrust on the piston 7 greater than the one that may be generated from the second head surface 7b. In this condition, the working fluid, during the handling of the piston 7 approaching to the second end 6b, may flow through the at least one through opening 8 for passing from the second chamber C2" to the first chamber C1". While instead the pump 33 is in the deactivated condition and the discharge valve 41 is in the opening condition, it is obtained the handling of the working fluid toward the source; in particular,
the working fluid present on the secondary supply line 21, moves from the cylinder 6 of the second actuator 5 toward the cylinder 26 of the first actuator 22, accessing the second chamber C2' through the outlet 25,
the working fluid present on the primary supply line 20 moves from the cylinder 26 of the first actuator 22, exiting from the inlet 24 and along the discharge line 38, toward the source S.

Lift

[0147] With 1 it has been overall indicated a lift of vehicles, for example usable in the automotive sector for the maintenance of various typologies of vehicles, including cars, trucks and agricultural vehicles.

[0148] As shown by the attached figures, the lift 1 comprises at least one column 2 extending between a base 2a and a top 2b (see for example figure 8) along an extension direction E which, in use, is vertical. The column 2 defines the vertical support element of the lift 1, configured for supporting a hanging vehicle with respect to the ground; the column 2 is fixable to the ground, for example by means of screw-bolt systems. The column 2 may comprise a base plate 45, optionally in metallic material, configured for being fixed to the ground and from which protrudes, for the entire extension of the first column 2, a frame 46, optionally in metallic material too. The base plate 45 may comprise a plurality of holes configured for receiving a fastening screw suitable for allowing the block of the base plate 45, consequently of the entire column 2, to the ground. The frame 46 is joined to the base plate 45 and defines within it a space V (figure 8) configured for housing one or more components of the lift 1 better described below; the frame 46 may be joined in a single piece to the base plate 45 by means of welding or may be fixed to said base plate 45 by means of screw-bolt systems.

[0149] The frame 46 may have, along its entire extension, a constant profile transversal section, optionally having a substantially "C" or substantially "V" shape. For example, the frame 46 is realized through one or more layers of sheet metal in metallic material. Actually, the frame 46 has, along its entire length, an open profile section; in other words, the frame 46 has a lateral through opening 46a (see figures 8 and 14) that extends along the entire length of the column and configured for putting the space V in communication with the external environment.

[0150] As shown for example in figures 8, 9, 13 and 14, the column 2 may also comprise, optionally at the top 2b, a top plate 47: the top plate 47 is opposed to the base plate 45 with respect to the frame 46 and defines essentially an upper closing end element of the column 2. The column 2 has a length defined by the maximum distance present between the base 2a and the top 2b, optionally by the maximum distance present between the base plate 45 and the top plate 47. The length of the column 2 defines substantially the maximum height to which the vehicle may be carried. From the dimensional point of view, the column 2 may have a length greater than 1 meter, optionally between 1,5 meters and 3 meters.

[0151] The lift 1 may comprise only one column 2 (see for example figure 8) or may comprise a plurality of distinct columns. In figure 1 it has been shown a lift 1 comprising a first column 2' and a second column 2" spaced apart from each other to allow the positioning between them of at least one vehicle. The first and the second column 2', 2" extend along respective extension directions parallel to each other and, in use, vertical.

[0152] The first and the second column 2', 2" may be according to the above for the at least one column 2. The first and the second column 2', 2" may be identical to each other, optionally identical in shape and size.

[0153] In detail, the first column 2' may comprise a base plate 45', optionally in metallic material, configured for being fixed to the ground and from which protrudes, for the entire extension of the first column, a frame 46'. As visible in figure 1, the base plate 45' of the first column 2' may comprise a plurality of holes configured for receiving a screw to fix the base plate 45' and consequently the entire first column 2', to the ground. The frame 46' of the first column 2' is engaged to the base plate 45' and has, along its entire extension, a "C" or "V" shaped constant profile transversal section defining within it a space V'. For example, the frame 46 is realized through one or more layers of sheet metal in metallic material. In fact, the frame 46' has, along its entire length, an open profile section; in other words, the frame 46' has a lateral through opening (see figures 8 and 14) which extends along the entire length of the column and configured for putting the

space V in communication with the external environment.

[0154] The first column 2' has also a top plate 47', opposed to the base plate 45' with respect to the frame 46', which vertically delimits the first column 2'.

[0155] As it can be seen for example from figure 2, the frame 46' of the first column 2' may also comprise a first through access 48a defined near the base 2a' and a second through access 48b, for example, defined on the top plate 47' or on the frame 46' at the top 2b'; as it will be better described below, these passages may be used to allow the passage of pipes or cables useful for a handling system of the column.

[0156] The second column 2" has a structure structurally identical to the first column 2'. In detail, the second column 2" comprises a base plate 45" configured for being fixed to the ground and from which protrudes a frame 46". The base plate 45" of the second column 2", comprises a plurality of holes configured for receiving a screw for fixing the base plate 45" and consequently the entire second column 2", to the ground. The frame 46" of the second column 2" is engaged to the base plate 45" and has, along its entire extension, a "C" or "V" shaped constant profile transversal section defining within it a space V". For example, the frame 46" is realized through one or more layers of sheet metal in metallic material. In fact, the frame 46" has, along its entire length, an open profile section; in other words, the frame 46' has a lateral through opening (see figures 8 and 14) which extends along the entire length of the column and configured for putting the space V" in communication with the external environment.

[0157] The second column 2" has a top plate 47' too, opposed to the base plate 45" with respect to the frame 46" which vertically delimits the second column 2".

[0158] As it can be seen for example from figure 2, the frame 46" of the second column 2" may also comprise a respective through access 49 defined on the frame 46", at the top 2b" of the second column, or on the top plate 47"; as it will be better described below, this access may be used to allow the passage of pipes or cables useful for a handling system of the column.

[0159] The lift 1 comprises at least one carriage 3 (figure 14) slidingly movable along the at least one column 2. The carriage 3 defines the movable element of the lift 1 suitable for contacting the vehicle to move it (in particular lifting and lowering it) with respect to the ground, for example for allowing an operator to intervene on the vehicle. In fact, the carriage 3 is movable along the column 2 approaching and moving away with respect to the base 2a and with respect to the top 2b.

[0160] The lift 1 may comprise a single carriage 3 (figure 8 and 14) if the lift 1 has only one column 2. Alternatively, if the lift has a first and a second column 2, 2", the lift may be provided with a first carriage 3' carried from the first column 2' and a second carriage 3" carried by the second column 2" (see for example figures 1 and 2).

[0161] In the attached figures it has been shown, in a non-limiting way, a column type lift 1 i.e. configured for being fixed or leaned to the ground and completely protruding with respect to the ground: in the column-type lift each column slidingly carries a carriage. The possibility of realizing a lift 1 according to the present invention wherein the at least one column is housed at least partly in a hole drilled in the ground to define a lift of the underground or suspended type is not excluded. Underground or hanging lifts may comprise too a first and a second column and one or more carriages (a single carriage for each column or a single carriage carried by both the first and the second column).

[0162] In the following description it will be made reference, in a non-limiting way, to the column type lift 1 shown in figures 1, 2 and 8; it is understood that the aspects of the invention described below are not limited to the column type lift but are applicable to lifts of the suspended or underground type (not shown).

[0163] The carriage 3 (optionally each one of said first and second carriages 3', 3") comprises at least one lifting arm configured for contacting a vehicle, optionally the body of the vehicle, for allowing its lifting; the arm of the carriage lies substantially along a plane orthogonal to an extension direction of the column 2. The arm may be of swiveling type, i.e. movable by rotation around an axis Y parallel to the extension direction of the column: this axis Y may be placed outside the support frame 46 as, for example, shown in figure 8 (or if the lift of figure 1, placed outside the frames 46' and 46"). In addition or alternatively, the arm may be of the extendable type, i.e. configured for varying its length.

[0164] In detail, the carriage 3 (optionally each one of said first and second carriage 3', 3") may comprise a first and a second lifting arm 3a, 3b (figure 1 and 2) both configured for contacting a vehicle, optionally the body of the vehicle, for allowing its lifting. The lifting arms 3a, 3b lie substantially on a single plane orthogonal to the extension direction of the column. At least one of said lifting arms may be of swiveling type, i.e. movable by rotation around a respective axis Y parallel to an extension direction of the column. As it can be seen from figures 1 and 2, each lifting arm 3a, 3b may carry at its end a support foot configured for directly contacting the body of the vehicle; in particular, the first and second arm 3a, 3b carry respective height-adjustable feet at their end.

[0165] The lift also comprises a handling system 4 associated to the at least one column 2 (optionally the first and the second column 2', 2") and configured for moving the carriage 3 (optionally the first and second carriage 3', 3") along said column.

[0166] The handling system 4 may comprise a mechanical screw-female screw and/or chain-pinion system that may be associated to an electric motor or the handling system may comprise one or more cylinders (hydraulic or pneumatic) that may be associated to the at least one carriage.

[0167] In figures from 1 to 5 it has been shown, in a non-limiting way, a handling system 4 according to the above description, i.e. comprising a first and second ac-

tuator 22, 5 connected to a supply circuit.

[0168] In this configuration, the first actuator 22 is housed in the space V' of the first column 2'. In particular, the first actuator 22 is fixed to the frame 46' and/or to the base plate 45' of the first column 2', at the base 2a'. In particular, the first end 26a of the cylinder 26 of the first actuator 22 is placed near the base 2a' of the first column; the piston 27, along with the rod 32 of the first actuator 22 are configured for moving approaching and moving away with respect to the top 2b'. In greater detail still, the part of the rod 32 of the first actuator protruding from the cylinder 26 results faced to the top 2b', spaced apart from the base 2a' (see for example the scheme of figure 2). The primary supply line 20 of the supply circuit enters the space V' of the first column through the first through access 48a (figure 2) to connect to the inlet 24 of the first actuator 22; the second through access 48b allows instead the passage of the secondary supply line 21 in the space V' of the first column 2', connected with the second chamber C2' of the first actuator 22. In fact, the second through access 48b allows to the secondary supply line 21 to connect to the outlet 25 of the cylinder 26 of the first actuator 22 and to exit from the space V' of the first column 2' for reaching the second column 2". In the figure 2 it has been shown, in a non-limiting way, a secondary supply line placed, at least for a section, above the columns 2', 2"; in this it is possible to avoid the positioning of the secondary supply line 21 at the ground where it could be more subject to damages causable by the passage of the vehicle and thus to breakage of the entire lift. However, the possibility of providing a passage of this secondary supply line 21 at the ground, for example arranging a subsection for such a line that connects at the base of the two columns is not excluded.

[0169] The through access 49 of the second column 2" is configured for allowing the access of the secondary supply line 21 in the space V" of the second column 2" for engaging to the inlet 14 of the second actuator 5, housed in the respective space V" of the second column 2". It should be noted how the secondary supply line 21 is housed, partly outside the frames 46', 46" of the first and the second column 2, 2" and partly inside the spaces V', V" of respective frames 46', 46" of the first column and second column 2', 2".

[0170] In fact, as shown in figures 1 and 2, the first and a second carriage 3', 3" of the lift 1 are respectively moved from the first and second actuator 22, 5 of the handling system 4 according to the above detailed description. In particular, as it can be seen from figure 2, the first carriage 3' may be engaged to the rod 32 of the first actuator 22 (the first carriage 3' may however be engaged to the cylinder 26), while the second carriage 3" may engaged to the rod 12 of the second actuator 5 (the second carriage 3" may however be engaged to the cylinder 6); the movement of respective pistons 27, 7 of the first and of the second actuator 22, 5 allow the displacement of rods 32, 12 which, consequently, move the carriages 3', 3" along the respective columns.

[0171] In detail, the connection between piston and carriage (for example of the piston 27 of the first actuator 22 with the first carriage 3' and the piston 7 of the second actuator 5 con the second carriage 3") is allowed thanks to the presence of the lateral opening of the frame (optionally of the respective frames of the first and the second column); in greater detail, the at least one carriage comprises a guide frame 80 which is housed at least partly the space of the column: part of the guide frame protrudes from the lateral through opening of the frame for engaging the at least one lifting arm which results entirely arranged outside the space of the column. The guide frame 80 is engaged by sliding to the frame of the column: the guide frame 80 is in fact configured for sliding in the space between the base 2a and the top 2b of the column.

[0172] In more detail, the guide frame 80 comprises at least one plate extending in length parallel to the extension direction E of the column 2; for example, the plate of the guide frame 80 may have, according to a section orthogonal to the extension direction of the column 2, a substantially "L"-shaped profile optionally at least partly countershaped to the frame of the column. From a dimensional point of view, the ratio between the length of the plate of the guide frame 80 and the column is between 0,1 and 0,5, optionally between 0,2 and 0,4.

[0173] Obviously, if the lift 1 comprises a first and a second column 2', 2", each one of said first and second carriage 3', 3" may comprise a respective guide frame 80 placed in the space of the respective column.

[0174] The lift 1 also comprises a block 51 configured for locking the carriage 3 with respect to the column 2. If there is only one column, the lift 1 may comprise only one block 51; if there is a first and a second column 2', 2', the lift 1 may comprise un solo block 51 or a block 51 associated to each column. In the following description, reference will be made to, in a non-limiting way, ad a block 51 associated to only one column 2 to lock the carriage 3 with respect to said column 2; obviously, the application of the block 51 to a first and second column 2', 2" to respectively lock the first and second carriage 3', 3" with respect to said first and second column is not excluded.

[0175] The block 51 comprises a support element 52 fixed to the column 2 and extending along a direction parallel to an extension direction E of the column 2. For example, the support element 52 may comprise a plate extending in length along a prefixed direction D1 between a first and a second end 52a, 52b (figure 8), the distance thereof defines the length of the support element 52: as it may be seen from figure 8, he prefixed extension direction D1 of the plate of the support element 52 is parallel to the extension direction E of the column 2.

[0176] The support element 52, optionally the plate of the support element 52, comprises a plurality of stops 53 spaced apart from each other and aligned along the extension direction E of the column 2; in detail, the plate of the support element 52 comprises a plurality of cavities

52c spaced apart from each other and aligned along the prefixed extension direction D1 of the plate: two cavities 52c immediately consecutive are separated by at least one stop 53, which, as better described below, is configured for engaging an insert 54 of the block 51. The plate of the support element 52 may have a number of cavities 52c greater than 5, optionally a number of cavities between 10 and 30; each cavity 52c may be delimited, in a non-limiting way, by a closed profile having a substantially square or rectangular shape. Consequently, the support element 52 may have a number of stops (53) greater than 5, optionally between 10 and 30; each stop 53 comprises a top surface 53a suitable for receiving in support the insert 54 (described below) which extends along a plane, optionally orthogonal to the extension direction E of the column 2. In fact, as it can be seen from figure 8, the support element 52 may be exclusively constituted by the plate upon which are defined the stops 53 and the cavities 52c. From a material point of view, the support element may be realized at least partly in metallic and/or plastic material; for example, the plate of the support element 52 may be realized entirely in metallic material, optionally in steel.

[0177] For example, as shown in figure 8, the support plate 52 may be arranged entirely in the space V of the column 2, fixed to the frame 46. For example, the support element 52 may be arranged near the top 2b of the column, spaced apart from the base 2a; in particular, the second end 52b of the support element may be arranged at the top 2b of the column 2 (as shown in figure 8 the support element extends from the top 2b of the column) while the first end 52a of the support element 52 may be spaced apart from the base 2a. Actually, the support element 52 has a length lower than the length of the column; for example, the ratio between the length of the support element 52 and the length of the column 2 may be between 0,5 and 0,9, optionally between 0,6 and 0,8. The possibility of providing a support element 52 arranged outside the space V of the column 2, for example from the opposite side of the carriage 3, is not excluded.

[0178] The block 51 also comprises a dragging element 55 which connects the insert 54 to the carriage 3 for moving said insert 54 with respect to the support element 52 during the movement of the carriage 3 along the column 2. As it can be seen for example from figure 8, the dragging element 55 extends between a first and a second end 55a, 55b distinct from each other; in fact, the ends of the dragging element 55 are spaced apart to define elongated body having an open profile. The dragging element 55 may comprise at least one of: a belt, a chain, a rope. In the attached figures it has been shown a dragging element 55 constituted, in a non-limiting way, by a belt having an open profile.

[0179] The dragging element 55 lies on a plane which results parallel to the extension direction E of the column 2, and orthogonal to an extension plan of the plate of the support element 52.

[0180] The first end 55a of the dragging element 55 is constrained to the carriage 3, in particular is fixed to the guide frame 80 of the carriage 3; the second end 55b of the dragging element 55 is instead hinged to the insert 54 of the block 51.

[0181] The dragging element 55 may be entirely housed in the space V of the column 2 as shown in figure 8 or may be arranged only at least partly in the space V as for example schematized in figure 13 where it is shown a condition wherein a part of the dragging element protrudes from the top plate 47. Obviously, the possibility of realizing a block 51 wherein the dragging element 55 results arranged entirely outside the space V of the column 2 is not excluded.

[0182] The dragging element 55 further than being constrained to the insert 54 to the carriage 3 results wrapped around a first and second idle member 57a, 57b (figure 8) both carried by the column 2. The first idle member 57a is arranged at the base 2a of the column 2, for example, constrained to the base plate 45.

[0183] From a structural point of view, the first idle member 57a may comprise a pulley, optionally a toothed pulley. The structure of the first idle member 57a may vary as a function of the structure of the dragging element. For example, if it is used a rope as dragging element, the first idle member 57a may comprise a plain single-seat pulley or a friction wheel. If it is used a chain as dragging element 55, the first idle member 57a, in addition to the toothed pulley, may comprise a toothed wheel or a crown wheel.

[0184] The first idle member 57a is configured for rotating around an axis orthogonal to the extension direction E of the column 2, orthogonal to the lying plane of the dragging element 55 (the rotation axis of the first idle member 57a is substantially parallel to the lying plane of the plate of the support element 52).

[0185] The second idle member 57b is instead arranged at the top 2a of the column 2, for example, constrained to the top plate 47.

[0186] From a structural point of view, the second idle member 57b may comprise a pulley, optionally a toothed pulley. The structure of the second idle member 57b, as for the first idle member 57a, may vary as a function of the structure of the dragging element. For example, if it is used a rope as dragging element, the second idle member 57b may comprise a plain single-seat pulley or a friction wheel. If it is used a chain as dragging element 55, the second idle member 57b, in addition to the toothed pulley, may comprise a toothed wheel or a crown wheel.

[0187] The second idle member 57b is configured for rotating around an axis orthogonal to the extension direction E of the column 2, orthogonal to the lying plane of the dragging element 55 (the rotation axis of the second idle member 57b is substantially parallel to the lying plane of the plate of the support element 52). In other words, the first and second idle member may rotate around respective axes parallel to each other.

[0188] The dragging element 55 is slidingly engaged to the first and second idle member 57a, 57b: the drag-

ging element 55 is wrapped around a part of an outer contact surface of the first idle member 57a, optionally faced to the top 2b of the column, and wrapped around a part of an outer contact surface of the second idle member 57b, optionally faced to the opposite way with respect the base 2a of the column 2. In fact, the dragging element 55 is slidingly movable around said first and second idle members 57a, 57b in such a way that the first and the second end 55a, 55b of the dragging element 55 result always faced to the support element 52 (see for example figure 8).

[0189] Therefore, as a function of the position of the first and second idle member 57a, 57a with respect to the space V of the column 2 it is possible to have the arrangement of the dragging element. In fact, the first and second idle member 57a, 57b may be both arranged in the space V; in this condition, also the dragging element 55 will result entirely arranged in the space V of the column 2. Alternatively, the first and second idle member 57a, 57b may be both arranged outside the space V of the column 2; in this condition, the dragging element may be arranged too outside said space V. Also, the first idle member 57a may be housed in the space V while the second idle member 57b may be housed outside the space V; in this condition, the dragging element 55 is arranged partly in the space V and partly outside the space V.

[0190] At least one between the first and second idle member 57a, 57b is movable with respect to the other to vary a distance present between said first and second idle member 57a, 57b so as to be able to vary a tension of the dragging element 55 wrapped around said members. For example, the first idle member 57a may be fixed to the column, optionally to the base plate 45, in such a way that said first member is exclusively movable by rotation with respect to the column 2: the first idle member 57a, in this condition, cannot change its position with respect to the column 2. The second idle member 57b may then be slidingly movable with respect to the column 2 and with respect to the first idle member: the second idle member 57b is movable approaching and moving away with respect to the first idle member 57a, along a direction substantially parallel to the extension direction E of the column itself. In this way, the position of the second idle member 57b with respect to the first idle member 57a determines a certain tension of the dragging element 55.

[0191] The possibility of providing a first and second idle member 57a, 57b both movable approaching and moving away the one with respect to the other idle member 57b fixed to the top plate 47 and a first idle member 57a movable approaching with respect to the second idle member is not excluded.

[0192] The relative movement between the first and second idle member (then the tension of the dragging element 55) may be managed through a tensioner 56. The tensioner 56 is active on at least one of said first and second idle member 57a, 57b (optionally exclusively on the second idle member 57b as shown in figures 8, 9, 13 and 14) to vary a distance present between said first and second idle members 57a, 57b) and consequently a distance present between the first and the second end 55a, 55b of the dragging element 55. In other words, the tensioner 56 is configured for displacing at least one of said first and second idle members 57a, 57b, optionally the second idle member (57b), at least between:

- a first operative position where said first and second idle members 57a, 57b are arranged at a first distance from each other,
- a second operative position where said first and second idle members 57a, 57b are arranged at a second distance from each other greater than the first distance.

[0193] From a structural point of view, the tensioner 56 may comprise an actuator 56a for example at least one of: a pneumatic actuator, a hydraulic actuator, an electric actuator.

[0194] As mentioned above, the block 51 comprises at least one insert 54; the insert 54 is configured for cooperating with the support element to lock the carriage 3 with respect to the column. In detail, the insert 54 is hinged to the carriage 3 (optionally directly hinged to the guide frame 80) and, at the same time, constrained to the first and second end 55a, 55b of the dragging element 55. The insert 54 may then be arranged in the space V (see the attached figures) or may be arranged outside the space V. The insert 54 represents the component of the block 51 suitable for cooperating directly with the support element 52; in fact, in any operative position of the lift, the insert 54 is configured for remaining faced to the plate of the support element 52. In particular, the insert 54 is movable at least between:

- a release position where the insert 54 is spaced apart from the support element 52,
- a gripping position where the insert 54 engages at least one stop 53 of the support element 52 to lock the carriage 3 with respect to the column 2 in an operative position. In the gripping position, the insert 54 results at least partly arranged in a cavity 52c of the plate of the support element 52, optionally in direct engagement with the top surface 53a of a stop 53.

[0195] The movement of the insert 54 between the release position and the gripping one, and vice versa, is guided by the dragging element 55 engaged directly to the insert 54. In fact, as mentioned above, the second end 55b of the dragging element 55 is hinged to the insert 54 while the first end 55a is fixed to the guide frame 80 of the carriage 3; the dragging element 55 is configurable between:

- a pull condition where the dragging element 55 is configured for holding the insert 54 in the release

position,

a release condition where the dragging element 55 is configured for allowing the displacement of the insert 54 in the gripping position.

[0196] These pull and release conditions are determined by the tensioner 56 acting on at least one between the first and second idle member 57a, 57b. In other words, when the tensioner 56 acts on the first and/or second idle member 57a, 57b for holding the latter in the second operative position (position where said members are at the maximum distance from each other), the tensioner 56 allows to move (then to tension) the dragging element 55 configuring it in the pull condition where there is the dragging element 55 itself to hold the insert in the release position. Vice versa, when the tensioner 56 arranges the first and second idle member 57a, 57b in the first operative position, the tensioner 56 itself determines the release condition of the dragging element (in the release condition the tensioning of the dragging element 55 is lower with respect to the tensioning of the same dragging element 55 when in the pull position) where the same tensioning element 55 allows the displacement of the insert 54 in the gripping position.

[0197] The displacement of the insert 54 is generated by a pusher 58 of the block 51, in cooperation with the dragging element 55; the pusher 58, on one side, is hinged to the carriage 3 and, on the other side, is hinged to the insert 54. The pusher 58 is configured for exerting a thrust on the insert 54 which, only in the release condition of the dragging element 55, is suitable for holding the insert 54 in the gripping position. In fact, the pusher 58 is configured for forcing the gripping position to the insert 54 and holding said insert 54 in said gripping position until the tensioner 56 moves relatively the first and second idle member 57a, 57b to determine the pull condition of the dragging element 55 during which said dragging element 55 is configured for winning the thrust of the pusher 58 for moving the insert 54 from the gripping position to the release one.

[0198] From a structural point of view, the pusher 58 comprises:

a hollow sustain body 58a hinged to the carriage 3, optionally hinged directly to the guide frame 80,

a rod 59 engaged slidingly in a seat 58b of the sustain body 58a, the rod 59 protruding from the seat 58b of the sustain body and being hinged directly to the insert 54,

an elastic body 60 housed at least partly in the seat of the sustain body 58 and active in thrust on the rod 59 which is active in thrust, in its turn, on the insert 54.

[0199] The elastic body 60 may comprise a spring, for example at least one of: a compression spring, a traction spring, a torsion spring.

[0200] In greater detail, the insert 54 is constrained to the second end of the dragging element 55 through a hinge-type constraint and constrained to the carriage 3, in particular to the guide frame 80, still through a hinge-type constraint: the insert 54 is movable with respect to the guide frame 80 exclusively by rotation. In other words, the displacement of the insert from the release position to the gripping position, and vice versa, occurs by relative rotation of the insert with respect to the guide frame 80. As shown in figures 8, 15-18, the insert 54 is also constrained to the pusher 58 through a hinge-type constraint.

[0201] The position of hinges that constrain the insert 54 to the other components of the block 51 allows its rotation between the release position and the gripping one, and vice versa, during the release condition of the dragging element 55. As it can be seen in figures 15-18, the insert 54 comprises:

a head section 54a which, in the gripping position, is configured for contacting the stops 53 of the support element 52,

a rear section 54b opposed to the head section 54a, which is hinged to the dragging element 55, optionally to the second end 55b of the dragging element 55.

[0202] As it can be seen, the pusher 58, optionally the rod 59 of the pusher, is hinged to the insert 54 at the head section 54a; at a distance from the head section 54a and from the rear section 54b, the insert 45 is hinged to the guide frame 80 of the carriage 3: in particular, the insert 54 is hinged to the guide frame at a peripheral area which is placed, in use, above head section 54a (figure 8).

[0203] In figures 15 and 17 it is shown the insert 54 in the gripping position; in the condition of figure 15, at least the head section 54a of the insert is housed in a cavity 52c of the support element. In this condition, the dragging element 55, by action of the tensioner 56, is in the release condition; in this condition, the pusher 58 acts in thrust on the head section 54a of the insert 54: thanks to the backward position of the two hinges that constrain the insert to the second end 55b of the dragging element 55 and to the frame of the carriage, the pusher 58 forces the gripping position of the insert 54.

[0204] As it can be seen from figures 15 and 17, the insert 54 is held in a position wherein the head section results faced to the cavity 52 of the support element 52 thanks to the presence of an end stop 70 fixed to the carriage 3, optionally to the guide frame 80 which is arranged near the insert 54: the end stop 70 is configured for contacting the rear section 54b of the insert 54 in the gripping position of said insert 54 for holding the head section 54a of said insert 54 in a position wherein it may cooperate with a stop 53 of the support element 52.

[0205] As shown in figure 17, the head section 54a of the insert 54 comprises an abutting plane 54a' which, in the gripping position of the insert 54, is substantially parallel to the top surface 53a of the stops 53. The abutting plane represents the portion of the insert 54 suitable for directly contacting the top surface of the stops to lock the

position of the carriage with respect to the column. Figure 18 shows the insert 54 in the gripping position, during the contact with a stop 53 of the support element 52. In this condition, the abutting plane 54a' is in contact with the top surface 53a of a stop 53 preventing the carriage from sliding along the extension direction E, at least toward the base 2a of the column.

[0206] Still at the head section, the insert 54 also comprises a front surface 54c, tilted with respect to the abutting plane 54a' of the insert 54 itself; the front surface 54c, in the release position, is faced to the plate of the support element 52 and substantially parallel to a lying plane of the plate of the support element 52 (optionally substantially parallel to the extension direction E of the column 2). As it can be seen for example from figure 17, the insert 54 is hinged to the carriage 3, optionally to the guide frame 80 of the carriage 3, at an intermediate zone of the same insert 54, interposed between the front surface 54c and the rear section 54b.

[0207] Figures from 15 to 18 show the passage of the insert 54 from an initial gripping position, to the release position, and then return in a gripping position wherein the insert 54 is in contact with a stop 53 of the support element 52. Below there are the steps shown in figures 15-18 wherein there is the movement of the insert 54.

[0208] In figure 15 the insert 54 is initially placed in the gripping position. In this condition, the tensioner 56 acts on at least one of said idle members 57a, 57b for arranging them in the first operative position wherein said members 57a, 57b are arranged in the closest position. In this condition, the first and the second end 55a, 55b are too in a position of maximum proximity wherein the dragging element 55 has a prefixed tensioning. The tensioning of the dragging element 55 is such as to allow the pusher 58, acting on the head section 54a of the insert 54 to force the gripping position of said insert 54.

[0209] It is useful to notice that in this condition (figure 15) the carriage 3 may still be moved toward the top of the column 2 while a movement toward the base 2a of the carriage 3 would carry the abutting plane 54a' of the insert 54 to contact a stop 53 of the support element 52 with consequent block of the carriage 3. Vice versa, a movement of the carriage 3 toward the top 2b would carry the front surface 54c of the insert to hit against a lower portion of the stop 53; this condition would allow the stop 53 to resist and win the thrust force of the pusher 58 and thus put in rotation the insert 54.

[0210] From the position of the insert of figure 15, it is possible to act through the tensioner 56 for moving said idle members 57a, 57b in the second operative position (position of maximum distance) so as to carry, consequently, the dragging element 55 in the pull condition. In the pull condition, the dragging element 55 is tensioned (the tensioning of the dragging element 55 placed in the pull condition is greater with respect to the tensioning of the same dragging element 55 placed in the release condition) in such a way that it may, acting through the second end 55b, pull the insert 54 from the rear section 54b to put in rotation said insert 54, by moving it from the gripping position to the release one (figure 16). This displacement is allowed because the pulling action by the tensioning element 55 allows to win the thrust force generable by the pusher 58, acting on the head section 54a.

[0211] As above described, in the release position the entire insert 54 is spaced apart from the support element 52 and in particular result entirely arranged outside the cavities 52c of the support element 52. In this condition, the carriage 3 may be freely moved along the column 2, toward the top 2b and toward the base 2a.

[0212] When placed in the release position, the insert 54 may be furthermore carried in the gripping position by action of the tensioner 56 which, acting on the first and/or second idle member 57a, 57b (action suitable for managing the distance between the two members), may determine the release condition of the dragging element 55 and then the possibility of the pusher 58 to win the force generable by the dragging element 55: in this condition the pusher 58, acting on the head section, may determine the rotation of the insert from the release position to the gripping one (figure 17). When the insert 54 is placed in the gripping position, if a movement of the carriage 3 should occur towards the base 2a of the column 2, the abutting plane 54a' is configured for contacting the top surface 53a of a stop 53 to lock this movement (figure 18).

[0213] As it can be seen from the attached figures, at least the support element 52, the insert 54 and the pusher 58 may be housed entirely in the space V of the column; also, as above mentioned, at least one of said idle members 57a, 57b may be housed entirely in the space V of the column 2. If both the idle members 57a, 57b were arranged entirely in the space V of the column, the dragging element would also be entirely housed in the space V of the column. As shown instead in figure 13, at least one of said idle members (in case of figure 13, the second idle member 57b) may be arranged outside the column: in this configuration, a part of the dragging element results arranged in the space V of the column 2 while a part would protrude from the column (figure 13). Also the tensioner 56 may be arranged, as a function of the position of the idle members, at least partly in the column 2. The possibility of realizing a tensioner 56 placed entirely outside the column 2 is not excluded.

[0214] The lift 1 may also comprise a control unit 50 (for example the control unit 50 may be the one above described of the handling system 4) which is operatively connected to the handling system 4 (for example to the pump 33) for commanding the movement of the carriage 3 along the column 2. For example, as above mentioned, the control unit 50 may be configured for commanding the activation and deactivation conditions of the pump 33, as well as controlling the various active components on the supply circuit of the handling system 4, on the base of commands entered by a user through a user interface UI.

[0215] The control unit 50 may also be active commanding on the tensioner 56 for defining the pull and

release conditions of said dragging element 55. In detail, the control unit 50 is active commanding on the tensioner 56 for moving the first and second idle member 57a, 57b between the first and the second operative position so as to control the release and gripping position of the insert 54.

[0216] For example, the control unit 50 may be configured for commanding the release position of the insert 54 as soon as the operator acts commanding on the user interface for the displacement of the carriage along the column 2; as soon as the operator commands, still through the user interface, the stop of the carriage 3, the control unit may be configured for commanding the tensioner 56 to displace the first and second idle member 57a, 57b in the second operative position so that the insert may arrange itself in the gripping position.

[0217] As above mentioned, the control unit 50 may be also connected to various components (for example, sensors, electro valves, parachute valve, etc.) of the handling system to determine possible malfunction conditions of the lift 1 (for example pressure loss or undesired increase in the flow rate of the working fluid in a branch of the supply circuit) and eventually command the tensioner 56 to displace the insert 54 in the gripping position. In detail, the control unit 50 is configured for carrying out a blocking procedure of the carriage 3 comprising the following steps:

commanding the stop of the handling system 4,
commanding the tensioner 56 to define the second operative position of the first and second idle member 57a, 57b.

[0218] The lift 1 may also comprise at least one sensor 40 (figures 9, 10, 12, 13, 14, 16-18) connected to the control unit 50, for example comprising at least one of: an inductive sensor, a capacitive sensor, a magnetic sensor, an optical sensor, a laser sensor. The sensor 40 may be directly carried by the column 2. In the attached figures it has been shown, in a non-limiting way, a sensor 40, arranged near at least one between the first and second idle member 57a, 57b. The sensor 40 is configured for generating a signal representative of one of the following parameters relative to the carriage 3:

a position of the carriage 3 along the column 2,
a relative movement between the carriage 3 and the column 2,
a height of the carriage 3 with respect to the ground,
a sliding speed of the carriage 3 along the column 2,
a representative number of ascent/descent cycles of the carriage 3,
a number of reversions, optionally with reduced stroke, of the carriage 3.

[0219] The control unit 50, connected to the sensor 40, may be then configured for:

receiving the signal emitted by the sensor 40,
determining, as a function of the signal emitted by the sensor, a value of at least one of the following parameters:

a position of the carriage 3 along the column 2,
a relative movement between the carriage 3 and the column 2,
a height of the carriage 3 with respect to the ground,
a sliding speed of the carriage 3 along the column 2,
a representative number of ascent/descent cycles of the carriage 3,
a number of reversions, optionally with reduced stroke, of the carriage 3.

[0220] The information that is given to the control unit 50 through the sensor 40 may be used by the control unit for the blocking of the carriage 3. In particular, the blocking procedure carried by the control unit 50 may also comprise the following steps:

after the stop command of the handling system 4, receiving from the sensor 40 a signal representative of a relative movement of the carriage 3 with respect to the column,
determining the presence of a relative movement between carriage 3 and the column 2,
if the control unit 50 detects a relative movement between carriage 3 and column 2, commanding the tensioner 56 to define the second operative position of the first and second idle member 57a, 57b.

[0221] The blocking procedure carried out by the control unit 50 may also comprise the following steps:

commanding the activation of the handling system 4 for moving the carriage 3 relatively the column 2,
receiving from the sensor 40 a signal representative of a relative movement of the carriage with respect to the column,
determining the presence of a relative movement between carriage 3 and the column 2,
if the control unit 50 detects, following the sending of the activation command of the handling system 4, the absence of a relative movement between carriage 3 and column, commanding the tensioner 56 to define the second operative position of the first and second idle member 57a, 57b.

[0222] As above mentioned, the sensor 40 may be directly carried by the column 2 and, for example, be arranged near at least one between the first and second idle member 57a, 57b. In this condition, the sensor 40 is configured for detecting at least one parameter relative to the rotation, of at least one between the first and second idle member 57a, 57b; in particular, the sensor 40

is configured for detecting at least one of the following parameters of at least one between the first and second idle member 57a, 57b:

a rotational speed,
an acceleration,
a number of rotations,
an angular position,
a direction of rotation.

[0223] The control unit 50, as a function of the at least one parameter relative to the rotation of at least one between said first and second idle members 57a, 57b, is configured for determining a value of at least one of the parameters relative to the carriage 3, optionally the value of at least one between:

a position of the carriage 3 along the column 2,
a relative movement between the carriage 3 and the column 2,
a height of the carriage 3 with respect to the ground,
a sliding speed of the carriage 3 along the column 2,
a representative number of ascent/descent cycles of the carriage 3,
a number of reversions, optionally with reduced stroke, of the carriage 3.

[0224] One or more of the detected values may be compared to a value of a threshold parameter; the control unit 50, as a function of the result of this comparison may be configured for carrying out the above-described blocking procedure to determine the stop of the carriage with respect to the column 2.

[0225] In figures 6 and 7 are indicated the flow diagrams related to a process of lifting (figure 6) and lowering (figure 7) of the carriage 3, manageable by the control unit 50.

[0226] With reference to figure 6, the lifting process begins with the positioning of the carriage 3 at the ground (reference 200 of figure 6). The control unit 50 may be in charge of receiving a signal from the sensor 40 to determine the position of the carriage 3 (if there are two carriages, the position of the first carriage 3' and of the second carriage 3" with respect to the relative first and second column 2', 2"). See the reference 201 of the diagram of figure 6.

[0227] Afterwards, the operator may, through the user interface, send a command signal to the control unit 50 for the lifting of the carriage 3 (reference 202 of figure 6). After the sending of the signal by the user interface, the control unit 50 may be configured for commanding the handling system 4 for the displacement of the carriage 3 (optionally of the carriages) along the column, toward the top 2b. For example, this command may provide the activation of the pump 33 (reference 203 of figure 6).

[0228] After the command by the control unit 50, it may be configured for receiving from the sensor 40 a signal representative of the movement of the carriage 3 along the column. The control unit 50 is then configured for processing the signal and determining the effective movement of the carriage 3 (reference 204 of figure 6).

[0229] Should the control unit 50 determine the stop of the carriage 3 after the movement command, the control unit 50 is configured for commanding the block of the handling system 4, for example through the stop of the pump (reference 209 of figure 6) and then commanding the tensioner 56 for moving the first and second idle member 57a, 57b in the second operative position for moving the insert 54 in the gripping position (reference 210 of figure 6), blocking thus the carriage with respect to the lift (reference 211 of figure 6).

[0230] If instead should the control unit 50 determine the movement of the carriage 3 after the movement command, the control unit 50 is configured for commanding the tensioner 56 for moving the insert in the release position (reference 205 of figure 6). Afterwards, the control unit 50 is configured for receiving from the sensor 40 a signal relative to the movement of the carriage 3 (reference 206 of figure 6), optionally of the first and second carriage. Afterwards, the control unit 50 is configured for processing the signal of the sensor 40 and comparing it with a value of a control parameter to determine if the movement of the carriage 3 (optionally of the first and second carriage 3', 3") is the intended one (reference 207 of figure 6); for example, if the first and second carriage 3', 3" are present, the control unit 50 is configured for processing the signal and determining the relative position of the first carriage 3' with respect to the first column 2' and determining the relative position of the second carriage 3" with respect to the second column 2"; if the control unit determines, as a function of the relative positions of the carriages, a relative position difference (for example carriages placed at different heights) higher than a predefined threshold, the control unit 50 is configured for commanding the block of the handling system 4, for example through the stop of the pump (reference 209 of figure 6) and then commanding the tensioner 56 for moving the first and second idle member 57a, 57b in the second operative position for moving the insert 54 in the gripping position (reference 210 of figure 6), by locking thus the carriage with respect to the lift (reference 211 of figure 6).

[0231] Vice versa, if the displacement of the carriage 3 falls within the parameters of the intended movement, the control unit 50 is subsequently configured for receiving from the sensor 40 a further signal representative of the position in height of the carriage with respect to the column 2 (reference 208 of figure 6); if the control unit 50 determines the reaching of the carriage at the desired height, the control unit 50 is programmed for commanding the block of the handling system 4, for example through the stop of the pump (reference 209 of figure 6) and afterwards commanding the tensioner 56 for moving the first and second idle member 57a, 57b in the second operative position for moving the insert 54 in the gripping position (reference 210 of figure 6), locking then the car-

riage with respect to the lift (reference 211 of figure 6).

[0232] With regard to figure 7, the lowering process begins with the carriage 3 arranged at a distance from the ground, i.e. in lifted vehicle condition (reference 300 of figure 7). The control unit 50 may be in charge of receiving a signal from the sensor 40 for determining the position of the carriage 3 (if there are two carriages, the position of the first carriage 3' and of the second carriage 3" with respect to the relative first and second column 2', 2"). See the reference 301 of the diagram of figure 7.

[0233] Afterwards, the operator may, through the user interface, send a command signal to the control unit 50 for the lowering of the carriage 3 (reference 302 of figure 7). After the sending of the signal by the user interface, the control unit 50 may be configured for commanding the handling system 4 for the displacement of the carriage 3 (optionally of the carriages) along the column, toward the base 2a. For example, this command may provide the deactivation of the pump 33 and the displacement of the discharge valve 41 in the opening condition (reference 303 of figure 7).

[0234] After the command by the control unit 50, it may be configured for receiving from the sensor 40 a signal representative of the movement of the carriage 3 along the column. The control unit 50 is then configured for processing the signal and determining the effective movement of the carriage 3 (reference 304 of figure 7).

[0235] Should the control unit 50 determine the stop of the carriage 3 after the movement command, the control unit 50 is configured for commanding the block of the handling system 4, for example by means of the displacement of the discharge valve in the closing condition and afterwards commanding the tensioner 56 for moving the first and second idle member 57a, 57b in the second operative position for moving the insert 54 in the gripping position (reference 309 of figure 7), blocking then the carriage with respect to the lift (reference 310 of figure 7).

[0236] Should instead the control unit 50 determine the movement of the carriage 3 after the movement command, the control unit 50 is configured for commanding the tensioner 56 for moving the insert in the release position (reference 305 of figure 7). Afterwards, the control unit 50 is configured for receiving from the sensor 40 a signal relative to the movement of the carriage 3 (reference 306 of figure 7), optionally of the first and second carriage. Afterwards the control unit 50 is configured for processing the signal of the sensor 40 and comparing it with a value of a control parameter to determine if the movement of the carriage 3 (optionally of the first and second carriage 3', 3") is the intended one (reference 307 of figure 7); for example, if the first and second carriage 3', 3" are present, the control unit 50 is configured for processing the signal and determining the relative position of the first carriage 3' with respect to the first column 2' and determining the relative position of the second carriage 3" with respect to the second column 2"; if the control unit determines, as a function of the relative positions of the carriages, a position difference (for example carriages placed at different heights) higher than a predefined threshold, the control unit 50 is configured for commanding the block of the handling system 4, for example by means of the displacement of the discharge valve 41 in the closing condition and afterwards commanding the tensioner 56 for moving the first and second idle member 57a, 57b in the second operative position for moving the insert 54 in the gripping position (reference 309 of figure 7), blocking then the carriage with respect to the lift (reference 310 of figure 7).

[0237] Vice versa, if the displacement of the carriage 3 falls within the intended movement parameters, the control unit 50 is subsequently configured for receiving from the sensor 40 an additional signal representative of the position in height of the carriage with respect to the column 2 (reference 308 of figure 6); if the control unit 50 determines the reaching of the carriage to the desired height, the control unit 50 is programmed for commanding the block of the handling system 4, for example by means of the displacement of the discharge valve 41 in the closing condition and after commanding the tensioner 56 to displace the first and second idle member 57a, 57b in the second operative position to displace the insert 54 in the gripping position (reference 309 of figure 7), thereby locking the carriage with respect to the lift (reference 310 of figure 7).

Process of lifting

[0238] It is an object of the present invention a process of lifting vehicles using a lift 1 according to the above-mentioned description.

[0239] The process may use the above-described handling system 4, which allows the handling of working fluid (for example hydraulic oil) accessing the first chambers C1', C1", respectively of the first and of the second actuator 22, 5, through the first and the second section 13, 23 of the primary supply line 20 and through the secondary supply line 21.

[0240] In detail, the process provides the steps of:

arranging the at least one carriage (optionally the first and second carriage 3', 3") near the ground,
arranging a vehicle above the at least one lifting arm of the carriage,
activating the pump 33 of the supply circuit for displacing said at least one carriage along the first and second column 2', 2" moving away from the ground.

[0241] During the activation of the pump 33, the process provides moving working fluid from the source S accessing the first chamber C1' of the first actuator 22, through the first and the second section 13, 23 of the primary supply line 20.

[0242] Contextually to the step of actuating of the pump 33, the process provides moving the working fluid exiting from the second chamber C2' of the first actuator 22 and accessing the first chamber C1" of the second actuator

5 subordinately to the handling of the piston 27 of the first actuator 22 approaching to the second end 26b of the cylinder 26 of the first actuator 22.

[0243] At a displacement of the piston 27 of the first actuator 22, corresponds an analogous movement of the piston 7 of the second actuator 5 approaching to the second end 6b of the cylinder 6. The handling of the piston 7 of the second actuator 5 may occur at the same time with the handling of the working fluid accessing the first chamber C1" of the second actuator 5 and subsequently to the passage of the working fluid between the second to the first chamber C2", C1" of the second actuator 5 through the through opening 8 and optionally through the gap 11. It should be noted how the pressure of the working fluid in the first and second chamber C1", C2" of the second actuator 5 is the same and the handling of the piston 7 approaching to the second end 6b of the cylinder, occurs as the working fluid in the first chamber C1" applies a thrust on the first head surface 7a of the piston 7 directed toward the second end 6b of the cylinder, higher with respect to a thrust applied by the working fluid in the second chamber C2" and directed toward the first end 6a. In other words, the lifting of the piston 7 occurs since the working fluid in the first chamber C1" acts on a surface (i.e. the first head surface 7a) higher with respect to the surface upon which the working fluid in the second chamber C2" (i.e. the second head surface 7b) acts.

[0244] It should be also noted that for the entire duration of the process, the exhaust valve 41 is in closing position, preventing the passage of fluid along the return line 38. Contextually to the step of activation of the pump 33, the process provides the displacement of the insert 54 in the release position by means of the displacement of the first and second idle member 57a, 57b in the first operative position.

[0245] The process of lifting may provide the execution of a balancing procedure with the purpose of compensating an eventual pressure difference between the primary and secondary supply line 20, 21, which provides the following steps:

determining one or more measured values of pressure of the working fluid on the second section 23 of the primary supply line 20 through the first sensor 36,
determining one or more measured values of pressure of the working fluid on the secondary supply line 21 through the second sensor 37,
determining one or more values of a control parameter representative of a difference or a ratio between the measured value of the pressure of the working fluid on the second section 23 and the measured value of the pressure of the working fluid on the secondary supply line 21,
comparing one or more values of the control parameter with a threshold value, optionally equal to 0.5 bar,
commanding the opening position of the balance valve 35 if one or more pressure values of the control parameter are higher to the threshold value.

[0246] The lifting process also comprises, in case of use of an overpressure valve 43 electromechanically controllable by the control unit 50, the execution of a safety procedure which provides the discharge of working fluid from the first section 13 of the primary supply line 20 to the source S. In particular, the safety procedure may provide the steps of:

determining one or more measured values of pressure of the working fluid on the first section 13 of the primary supply line 20,
comparing said one or more measured values of pressure of the working fluid on the first section 13 of the primary supply line 20 with a reference value,
commanding, as a function of said comparison, the overpressure valve 43 during the opening for allowing the passage of fluid in the safety line 42 if said one or more measured values of pressure of the working fluid on the first section 13 are higher than a threshold value, for example between 50 and 300 bar.

[0247] Upon reaching the desired height or if the control unit 50 determines an undesired condition (for example the pressure loss in a branch of the supply circuit, the undesired lowering of at least one carriage, the undesired increase of the flow rate in a branch of the supply circuit, etc.), the control unit 50 is in charge of displacing the insert 54 in the gripping position by means of the activation of the tensioner 56 which moves relatively the first and second idle member 57a, 57b in the second operative position, with consequent determination of the release condition of the dragging element 55.

Process of lowering

[0248] It is also object of the present invention a process of lowering vehicles using a lift according to the above indicated description and/or according to the attached claims.

[0249] With reference to figure 5, the process provides the lowering of vehicles using the handling system 4 and, in particular, commanding the handling of working fluid exiting the first chambers C1', C1", respectively of the first and of the second actuator 22, 5, through the secondary supply line 21, the second section 23 of the primary supply line 20 and through the discharge line 38.

[0250] In detail, the process provides the steps of:

arranging the at least one carriage spaced from the ground,
arranging the discharge valve 41 of the supply circuit in opening position for moving said carriage along said first and second column 2', 2" approaching to the ground.

[0251] During the step of arranging the discharge valve 41 in opening position, the working fluid passes from the first chamber C1" of the second actuator 5, toward the second chamber C2' of the first actuator 22, through the secondary supply line 21. During this step, the working fluid passes between the first and the second chamber C1", C2" of the second actuator 5 through the through opening 8 and the gap 11. During the passage of the working fluid from the first to the second chamber of the second actuator 5, the piston 7 of the second actuator 5 moves approaching to the first end 6b of the cylinder 6 of the second actuator 5. At a displacement of the piston 7 of the second actuator 5, corresponds an analogous movement of the piston 27 of the first actuator 22 approaching to the first end 26a of the cylinder 26. Alternatively to this latter step, the working fluid passes from the first chamber C1' of the first actuator 22, to the source S, along the second section 23 of the primary supply line 20 and the return line 38, thus allowing the lowering of each carriage of the lift and consequently the lowering of the vehicle.

[0252] Contextually to the arrangement of the exhaust valve 41 of the supply circuit in the opening position, the process provides the movement of the insert 54 in the release position by means of the displacement of the first and second idle member 57a, 57b in the first operative position.

[0253] Upon reaching the desired height or if the control unit 50 determines an undesirable condition (for example the pressure loss in a branch of the supply circuit, the excessive lowering of at least one carriage, the undesired increase of the flow rate in a branch of the supply circuit, etc.), the control unit 50 is in charge of displacing the insert 54 in the gripping position by means of the activation of the tensioner 56 which moves relatively the first and second idle member 57a, 57b in the second operative position, with consequent determination of the release condition 55 of the dragging element 55.

ADVANTAGES

[0254] The present invention involves, with respect to the background art solutions, considerable advantages. In fact, the presence of an insert 54 movable with the carriage and usable for the block of the carriage 3 itself with respect to the column 2, allows to put in position a lift 1 that is extremely compact in structural terms, suitable for preventing any undesired movement of the carriage with respect to the column 2.

Claims

1. Vehicle lift (1) comprising:

at least one column (2),
at least one carriage (3) slidingly movable along the column (2),
a handling system (4) configured for moving the carriage (3) along the column (2),
a block (51) configured for lock the carriage (3) with respect to the column (2) in a plurality of operative positions,

wherein the block (51) comprises:

a support element (52) fixed to the column (2) and extending along a direction parallel to an extension direction (E) of the column (2), wherein the support element (52) comprises a plurality of stops (53) spaced apart from each other and aligned along the extension direction (E) of the column (2),
an insert (54) movable at least between:

a release position where the insert (54) is spaced apart from the support element (52),
a gripping position where the insert (54) engages at least one stop (53) of the support element (52) to lock the carriage (3) with respect to the column (2) in an operative position,
a dragging element (55) connecting the insert (54) to the carriage (3), wherein the dragging element (55) is configurable between:

a pull condition where the dragging element (55) is configured for holding the insert (54) in the release position,
a release condition where the dragging element (55) is configured for allowing the displacement of the insert (54) to the gripping position,

characterized by the fact that the block (51) comprises:

at least one first idle member (57a) carried by the column (2),
at least one second idle member (57b), carried too by the column (2), spaced apart from the first idle member (57a),

wherein the dragging element (55) is slidingly engaged to the first and second idle member (57a, 57b), wherein at least one of said first and second idle members (57a, 57b) is movable with respect to the other to vary a distance present between said first and second idle members (57a, 57b) to determine the pull and release conditions of the dragging element (55).

2. Lift according to claim 1, wherein the block (51) comprises a tensioner (56) configured for moving the dragging element (55) for defining the pull and re-

lease conditions of said dragging element (55).

3. Lift according to any one of the preceding claims, wherein the support element (52) and the insert (54) are housed at least partly in an inner volume of the column (2), wherein at least part of the dragging element (55) is housed in the inner volume of the column.

4. Lift according to any one of the preceding claims, wherein the dragging element (55) extends between a first and a second end (55a, 55b) distinct from each other to define an elongated body having an open profile, wherein the first end (55a) of the dragging element (55) is fixed to the carriage (3) while the second end (55b) of the dragging element (55) is constrained to the insert (54) of the block (51).

5. Lift according to any one of the preceding claims, wherein the dragging element (55) comprises at least one of: a belt optionally toothed, a chain, a rope.

6. Lift according to any one of the preceding claims, wherein the column (2) extends along the extension direction (E) between a base (2a) and a top (2b), wherein the first idle member (57a) is arranged at the base (2a) while the second idle member (57b) is arranged at the top (2b).

7. Lift according to any one of the preceding claims, wherein the dragging element (55) is wrapped around part of an outer contact surface of said first and second idle members (57a, 57b).

8. Lift according to any one of the preceding claims, wherein the block (51) further comprises a pusher (58) hinged, on one side, to the carriage (3) and, on the other side, to the insert (54),

wherein the pusher (58), in the release condition of the dragging element (55), is configured for exerting a thrust on the insert (54) suitable for moving said insert (54) to the gripping position, optionally wherein the pusher (58) comprises an elastic return element, for example comprises a spring.

9. Lift according to any one of the preceding claims, wherein the insert (54) comprises:

a head section (54a) which, in the gripping position, is configured for contacting the stops (53) of the support element (52),
a rear section (54b) opposed to the head section (54a), which is hinged to the dragging element (55), optionally to the second end (55b) of the dragging element (55).

10. Lift according to the preceding claim, wherein the pusher (58) is hinged to the insert (54) at the head section (54a), wherein the insert (54) is hinged to the carriage at a zone spaced apart with respect to the head section (54a) and to the rear section (54b).

11. Lift according to claim 9 or 10, wherein the head section (54a) comprises an abutting plane (54a') which, in the gripping position of the insert (54), is substantially parallel to a top surface (53a) of the stops (53), wherein the insert (54) comprises a front surface (54c), tilted with respect to the abutting plane (54a') of the same insert (54), wherein said front surface (54c), in the release position, is faced to the support element (52), optionally substantially parallel to a lying plane of the support element (52).

12. Lift according to any one of the preceding claims from 2 to 11, wherein the tensioner (56) is active on at least one of said first and second idle members (57a, 57b) to vary a distance present between said first and second idle members (57a, 57b) and consequently a distance between the first and the second end (55a, 55b) of the dragging element (55).

13. Lift according to any one of the preceding claims from 2 to 12, wherein the tensioner (56) is configured for moving at least one of said first and second idle members (57a, 57b), optionally the second idle member (57b), at least between:

a first operative position where said first and second idle members (57a, 57b) are arranged at a first distance from each other,
a second operative position where said first and second idle members (57a, 57b) are arranged at a second distance from each other greater than the first distance,

wherein the tensioner (56), in the first operative position of the first and second idle member (57a, 57b), is configured for allowing the pusher (58) to move the insert in the gripping position.

14. Lift according to any one of the preceding claims, wherein the tensioner (56) comprises at least one actuator carried by the column (2) and directly active in thrust on the second idle member (57b), optionally the actuator comprises at least one of: a pneumatic actuator, a hydraulic actuator, an electric actuator.

15. Process of lifting vehicles using a lift (1) according to any one of the preceding claims, wherein the lifting process comprises the following steps:

arranging at least one carriage (3) near the ground,
arranging a vehicle above the at least one car-

riage (3),
activating the handling system (4) for moving the carriage (3) along the column for raising the vehicle with respect to the ground,
commanding the stop of the handling system (4), optionally for stopping the lifting of the vehicle,
after the stopping of the handling system (4), determining the gripping position of the insert (54) of the block (51).

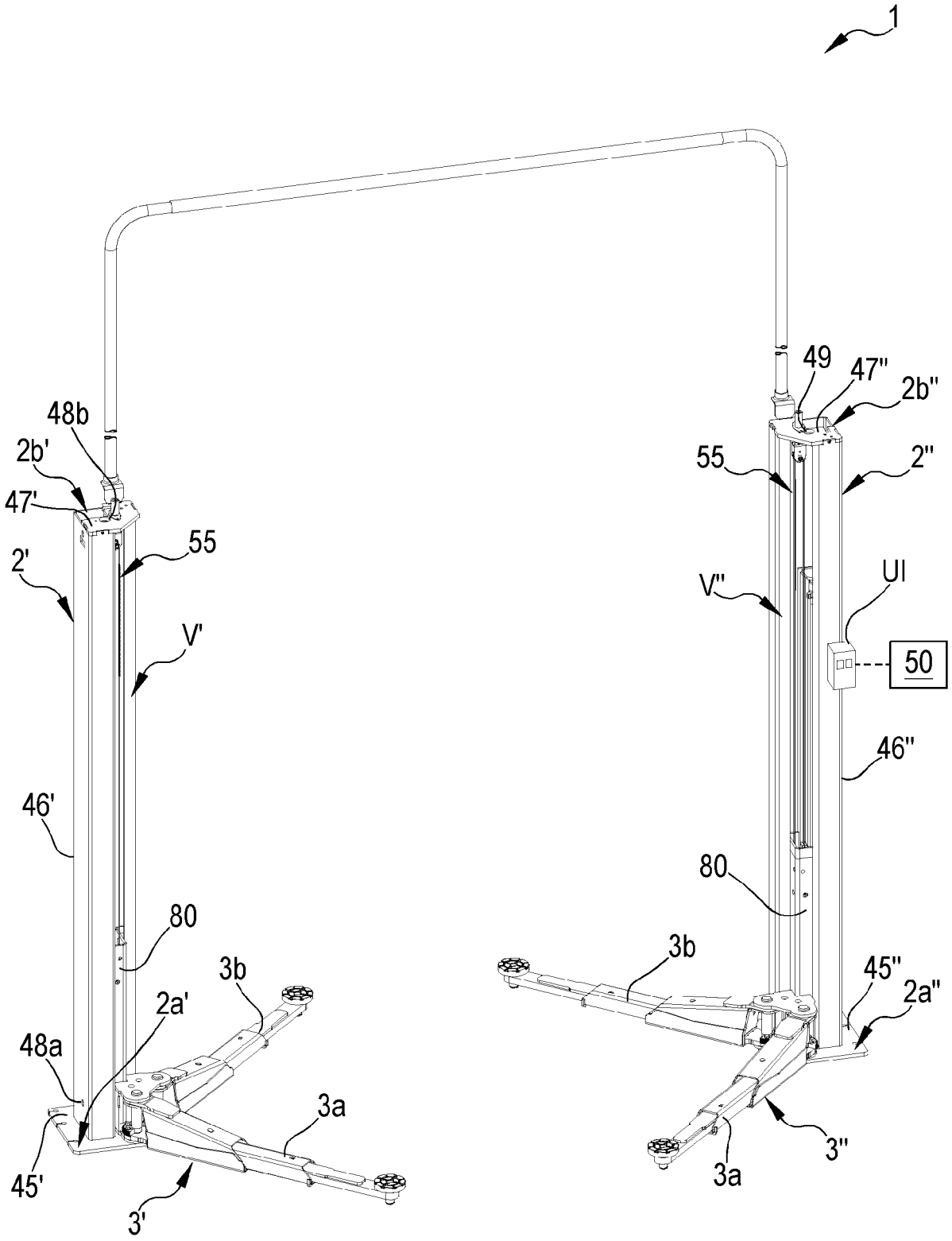

1
48b
2b'
47'
2'
55
V'
46'
80
3b
2a'
48a
3a
45'
3'
49
47"
2b"
55
2"
V"
UI
50
46"
80
3b
45"
2a"
3"
3a

FIG.1

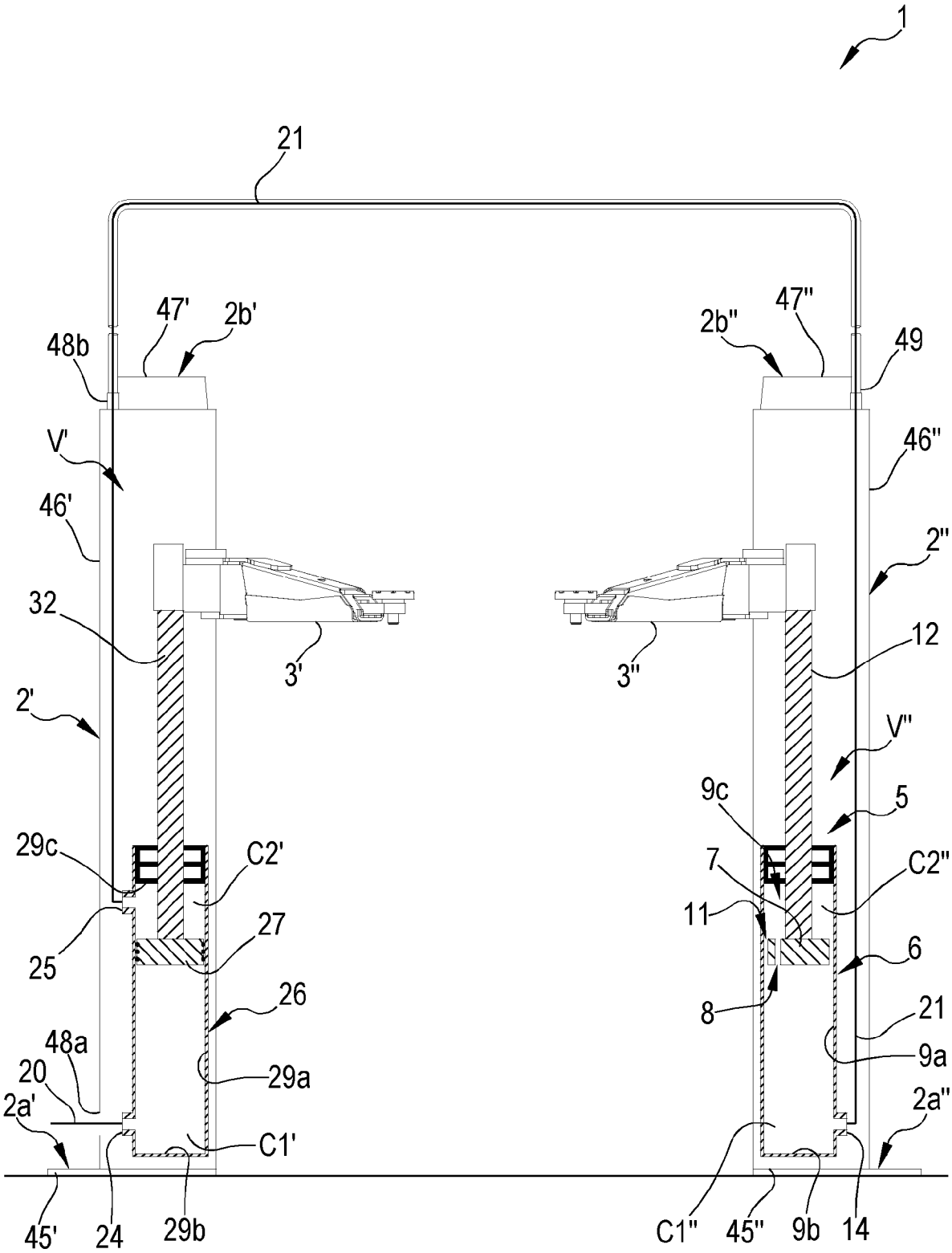
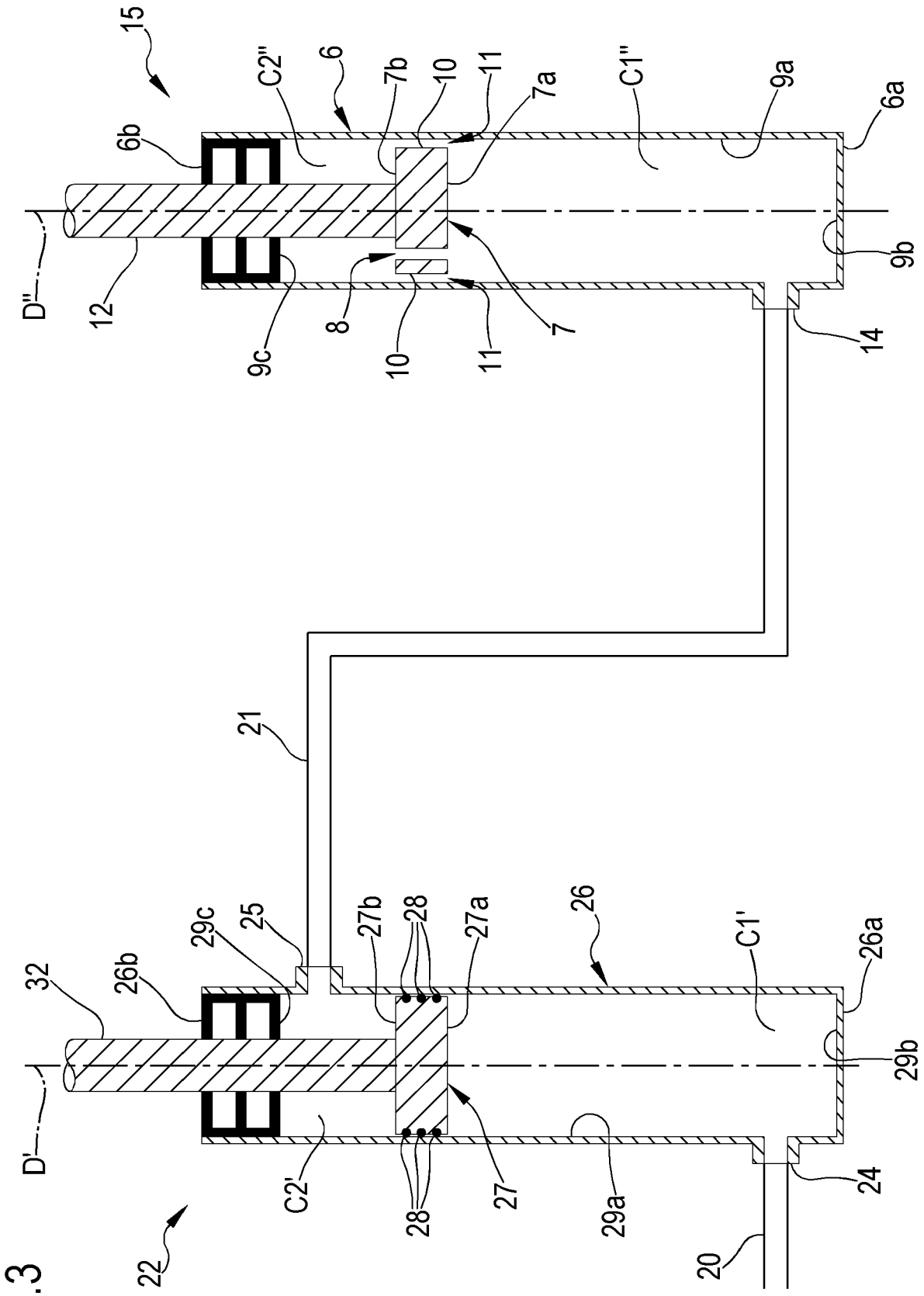

1
21
47'
2b'
48b
V'
46'
32
3'
2'
29c
C2'
25
27
26
48a
20
29a
2a'
C1'
45'
24
29b
47"
2b"
49
46"
2"
12
3"
V"
9c
5
7
C2"
11
6
8
21
9a
2a"
C1"
45"
9b
14

FIG.2


15
C2"
6
7b
10
11
7a
C1"
9a
6a
6b
D"
12
8
9c
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11
7
14
9b
21
29c
25
27b
28
27a
26
C1'
26a
32
26b
29b
D'
C2'
28
27
29a
24
22
20

FIG.3

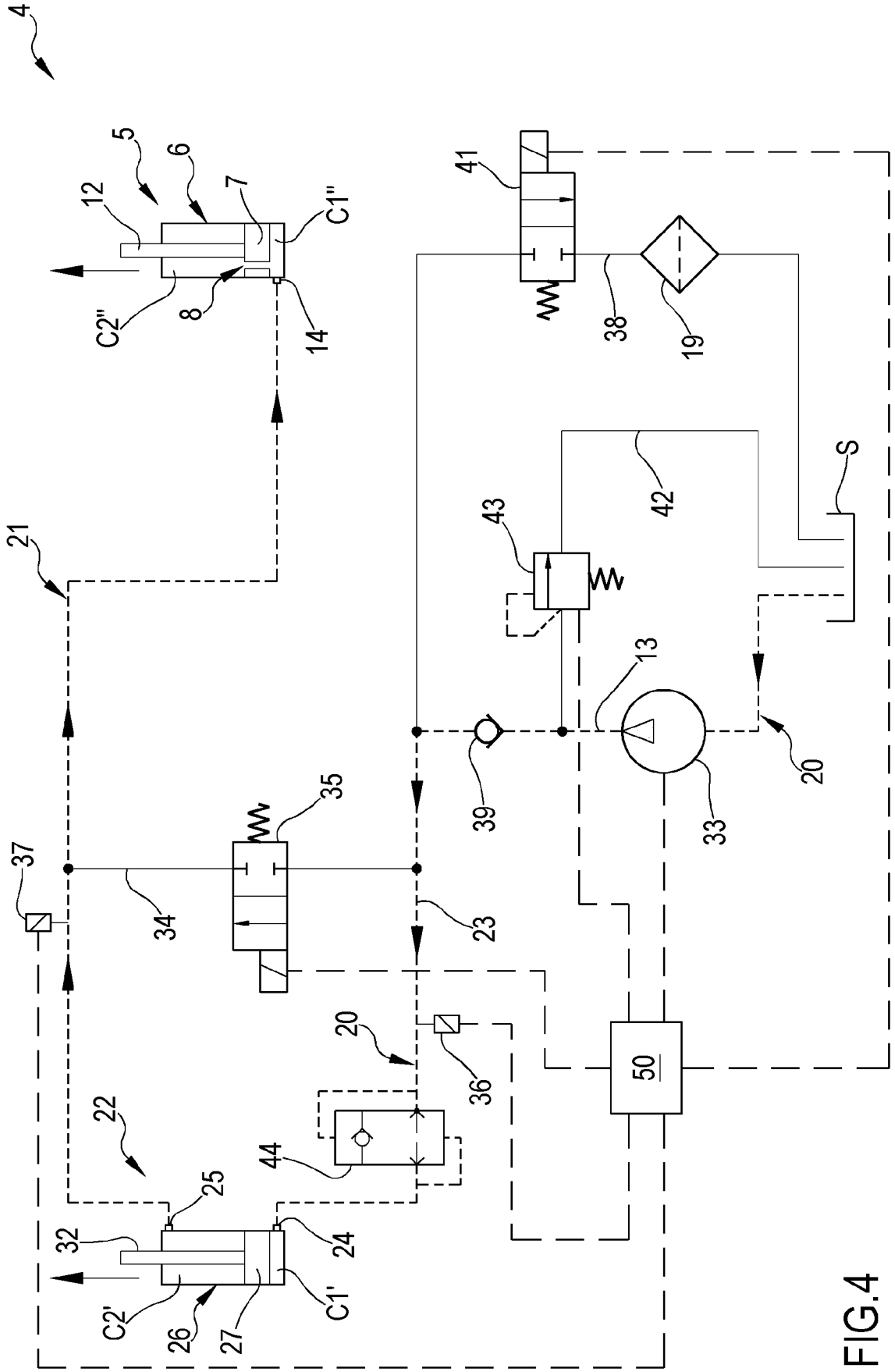

4
5
6
7
12
C1"
C2"
8
14
41
38
19
S
42
43
21
13
39
20
33
35
37
34
23
20
36
50
22
44
25
24
32
C2'
26
27
C1'

FIG.4

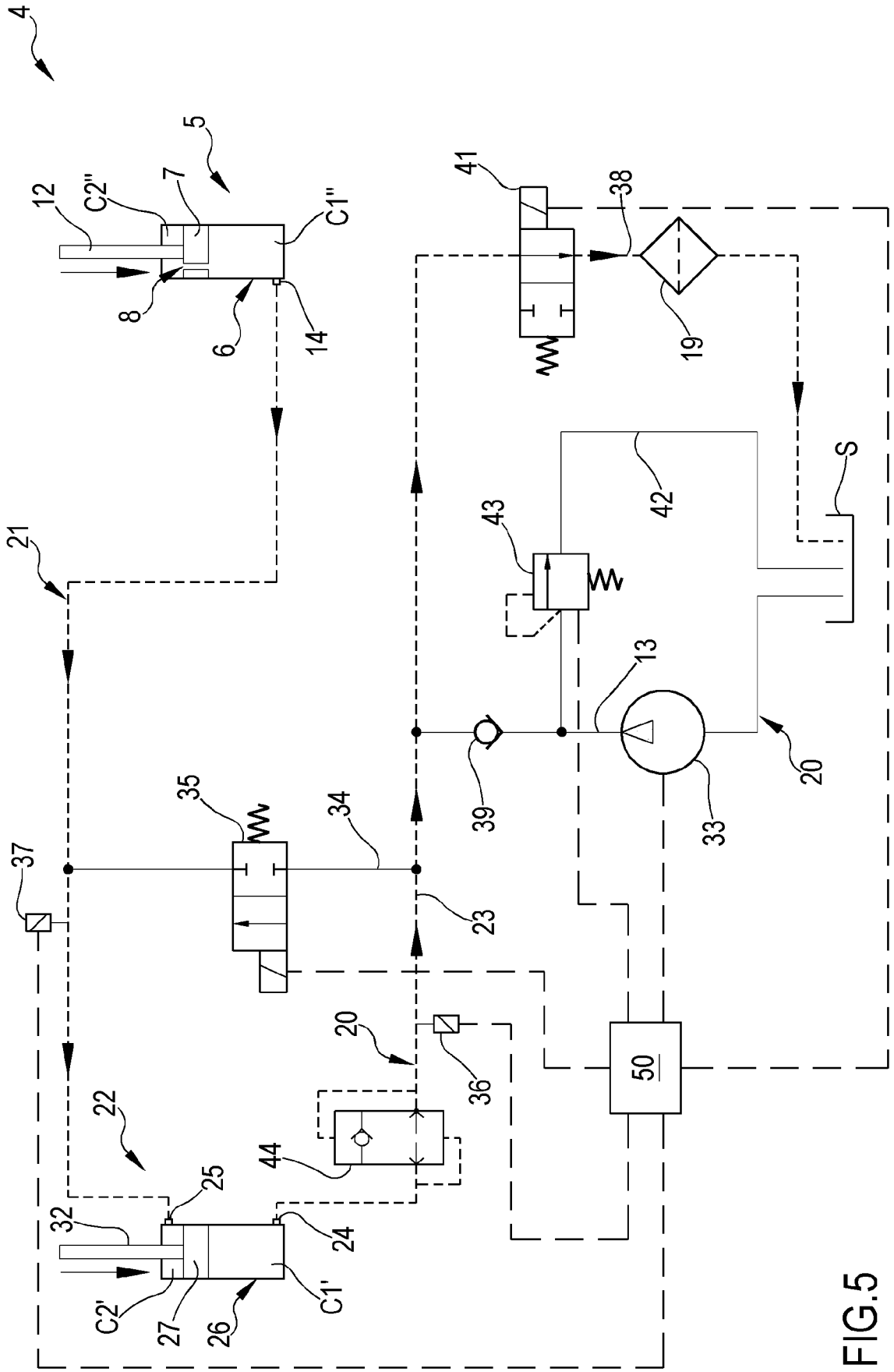

4
5
12
C2"
7
C1"
8
6
14
41
38
19
21
42
S
43
13
39
20
33
35
34
37
23
20
36
50
22
44
25
32
24
C2'
27
26
C1'

FIG.5

FIG.6

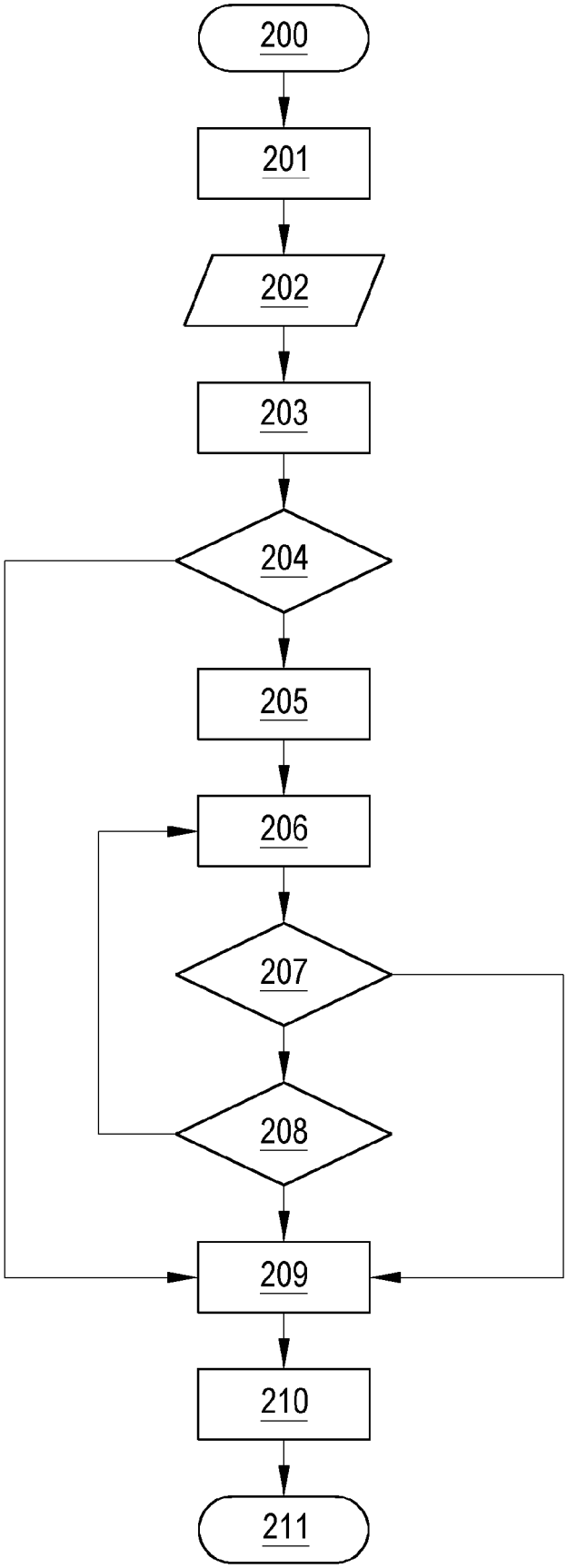


FIG.7

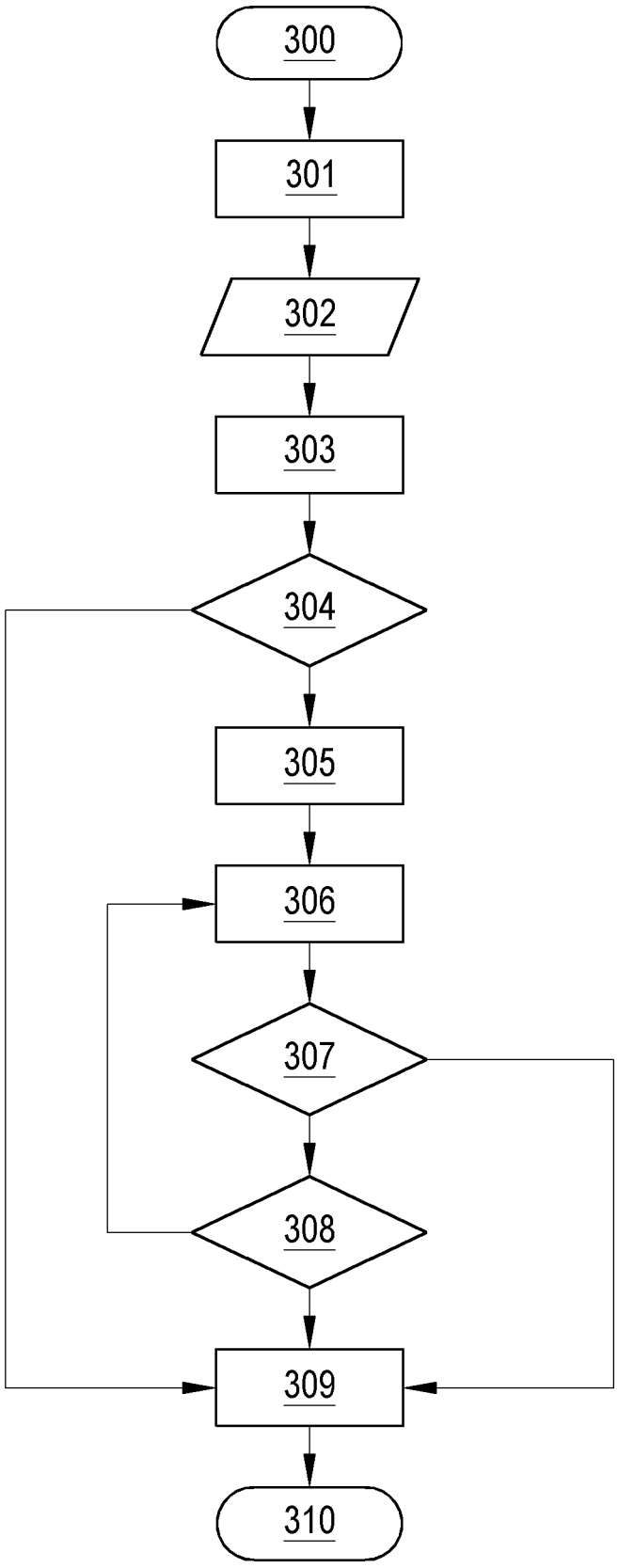
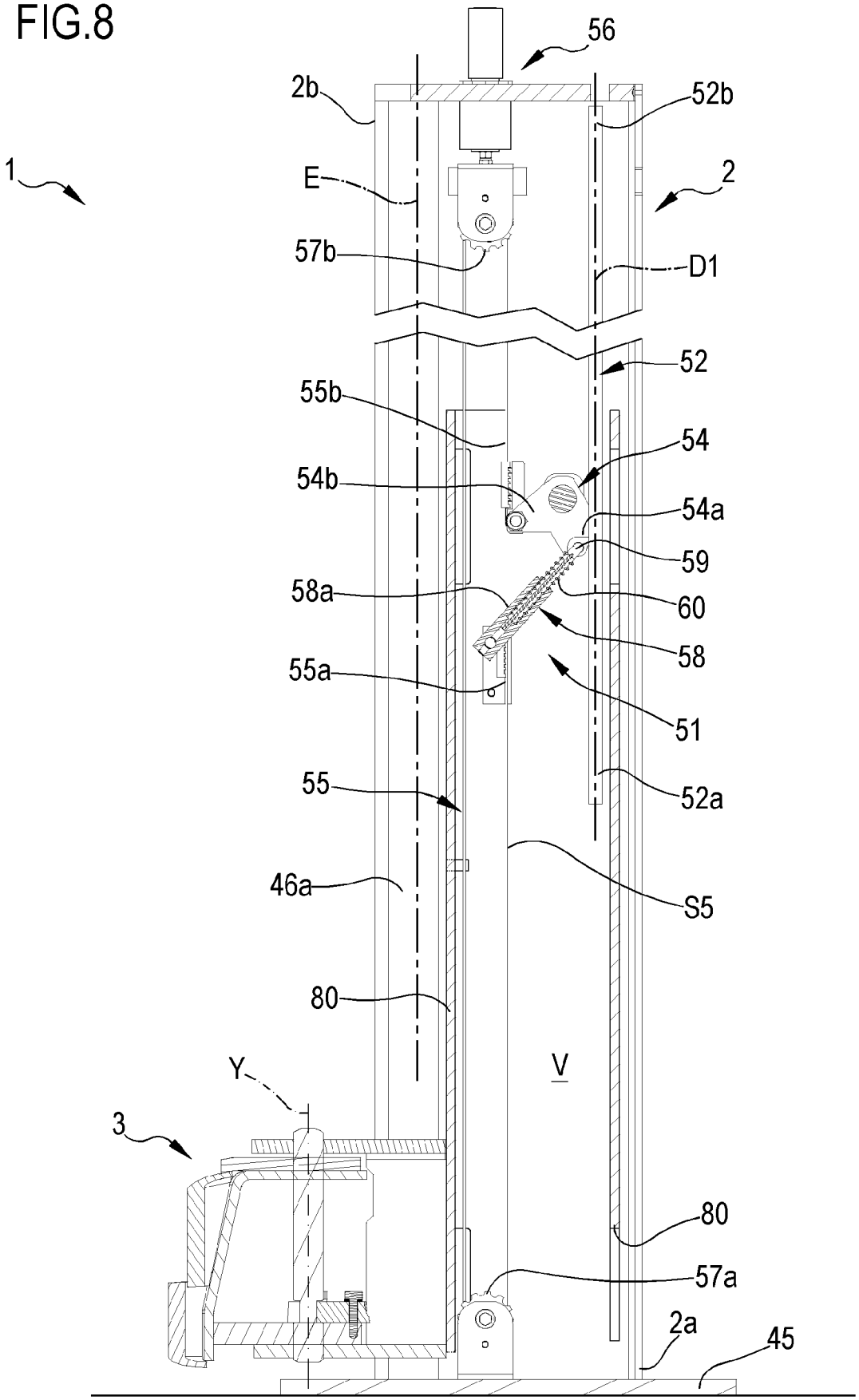


FIG.8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54
54b
54a
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S5
80
Y
V
3
80
57a
2a
45

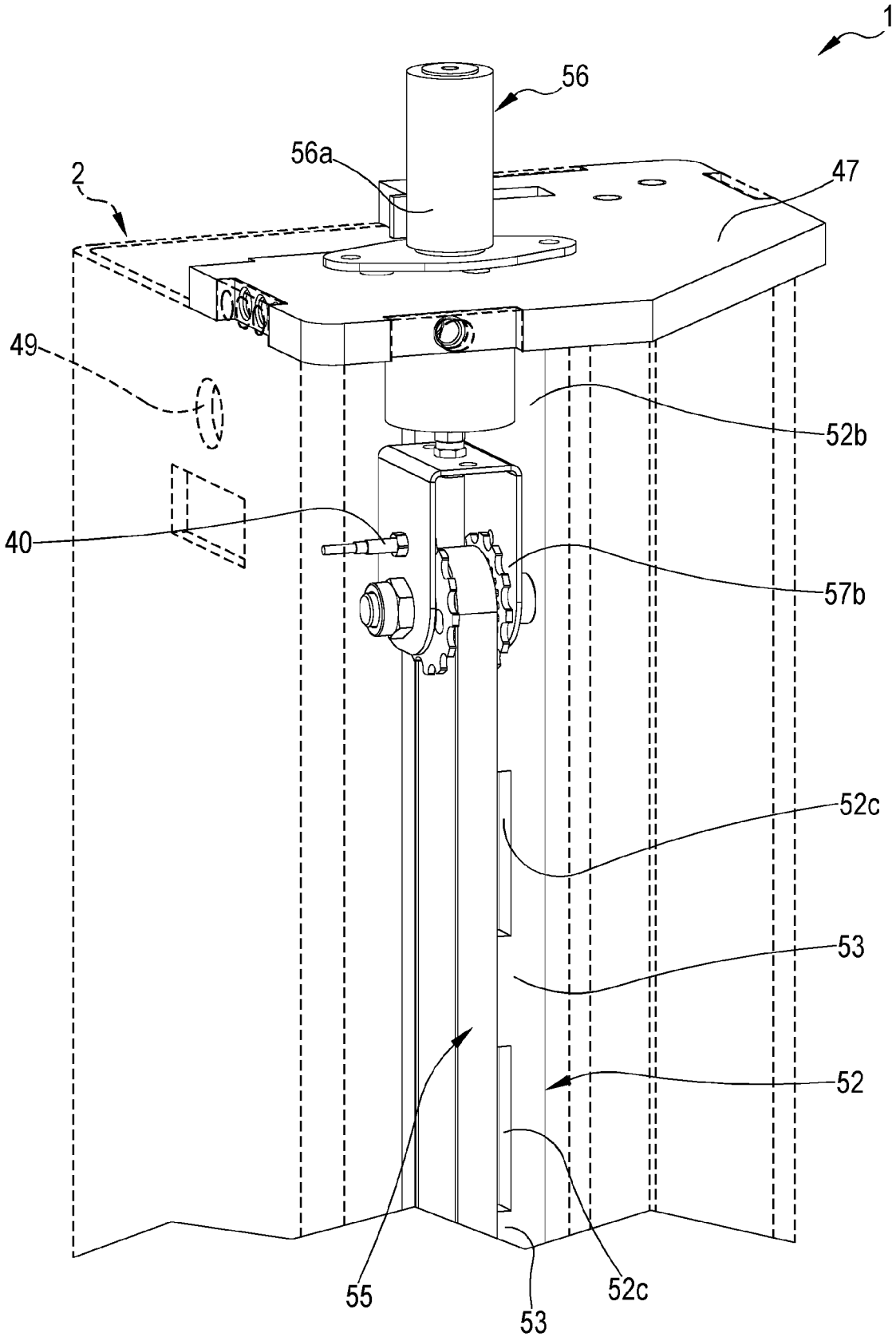


FIG.9

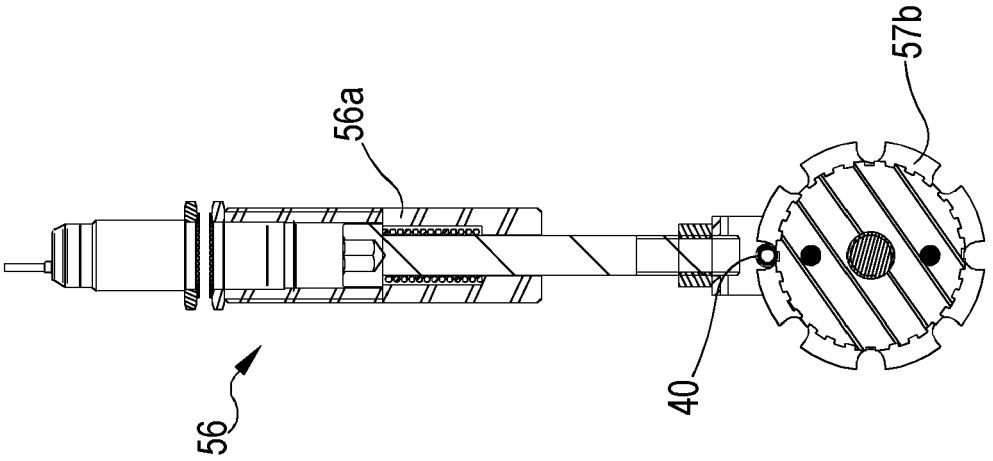


FIG.12

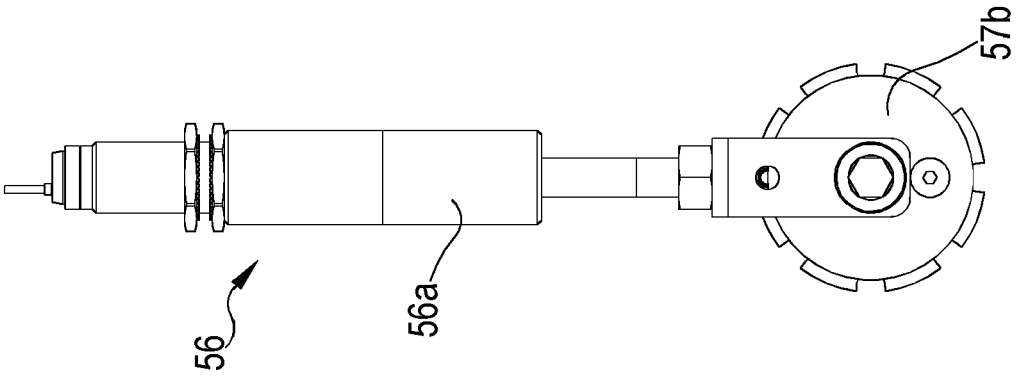


FIG.11

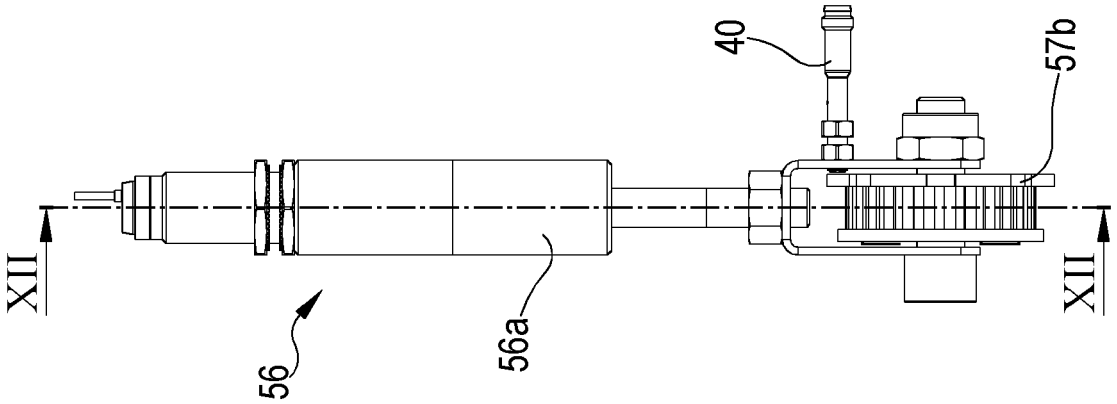


FIG.10

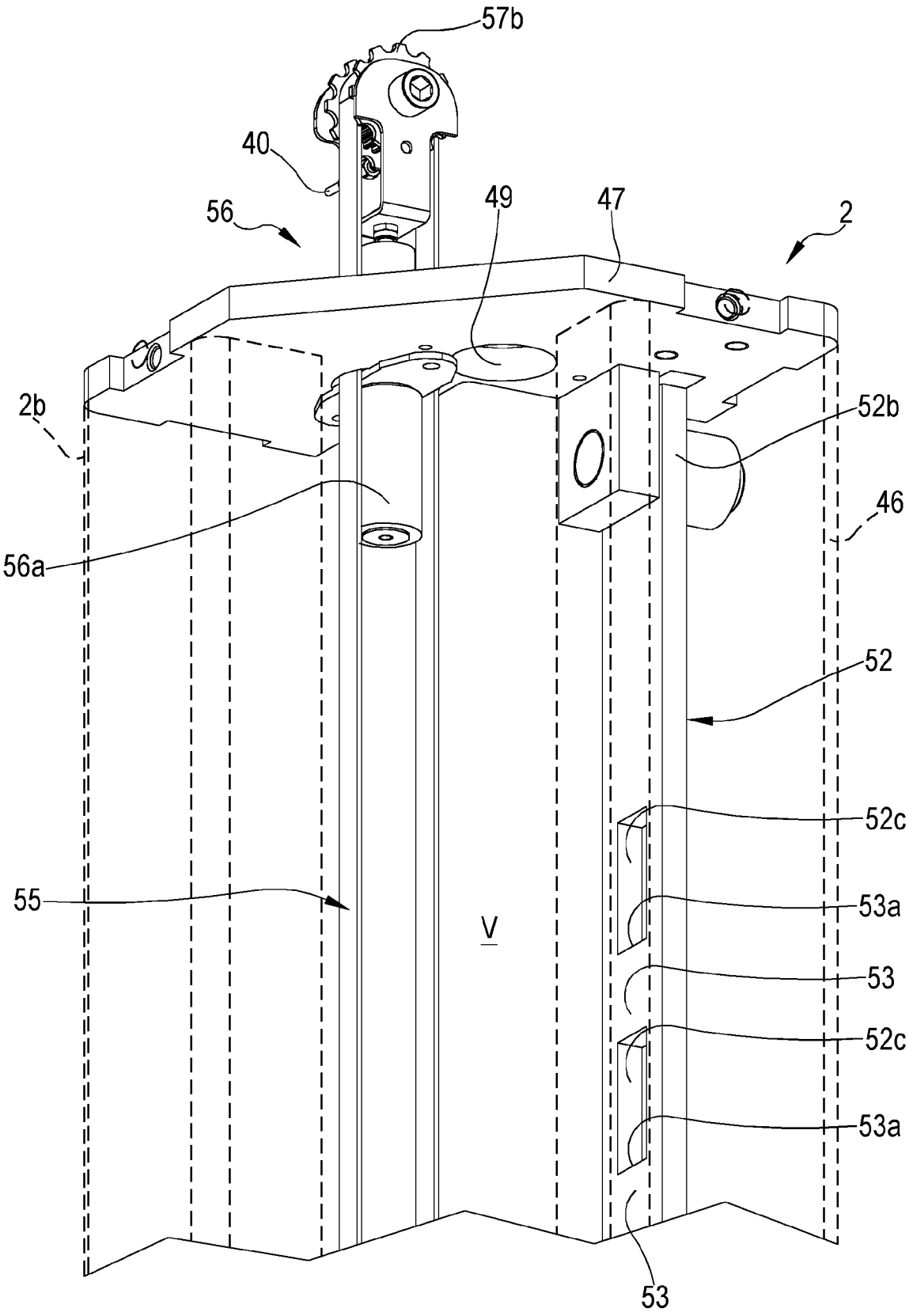


FIG.13

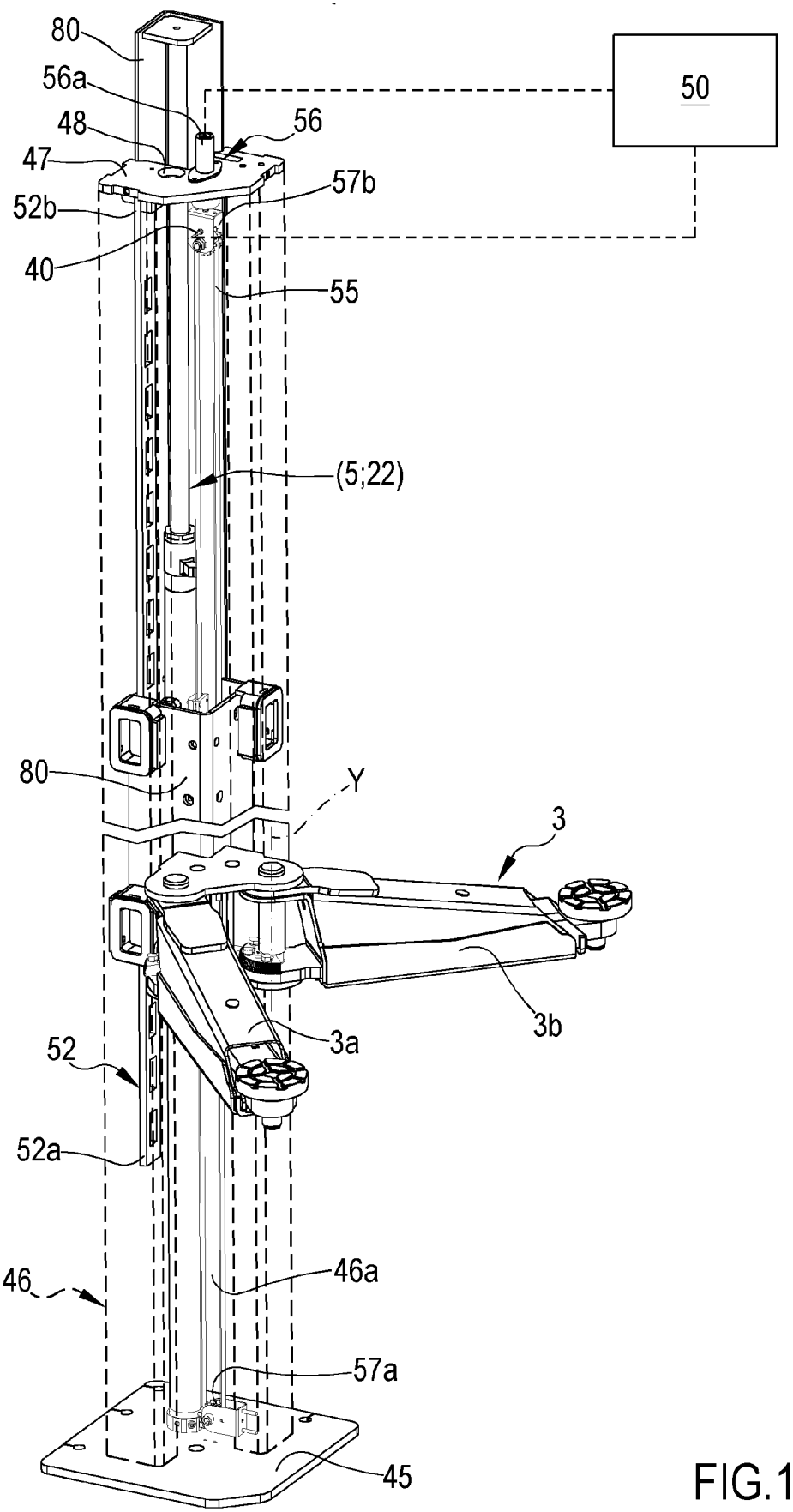


FIG.14

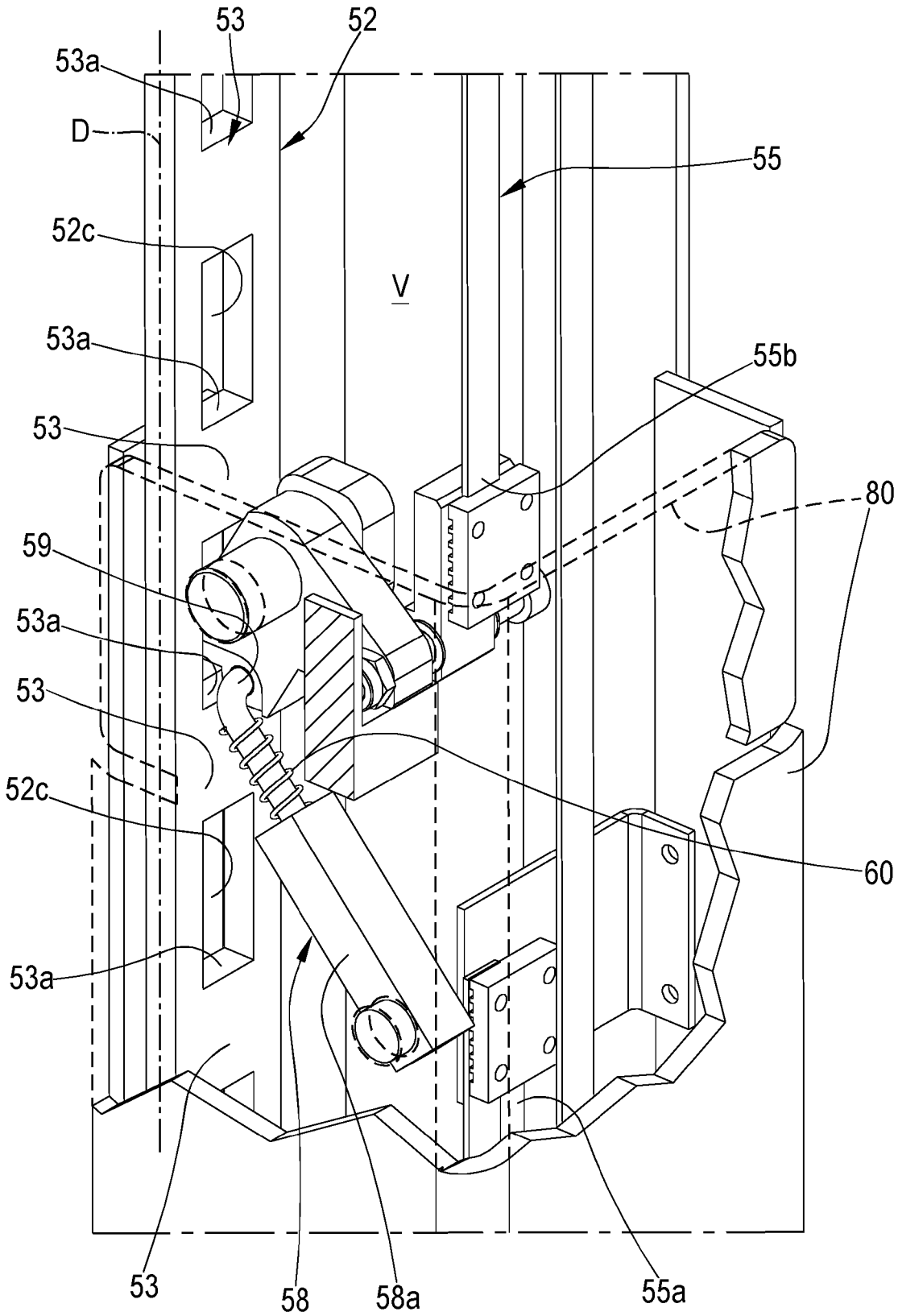
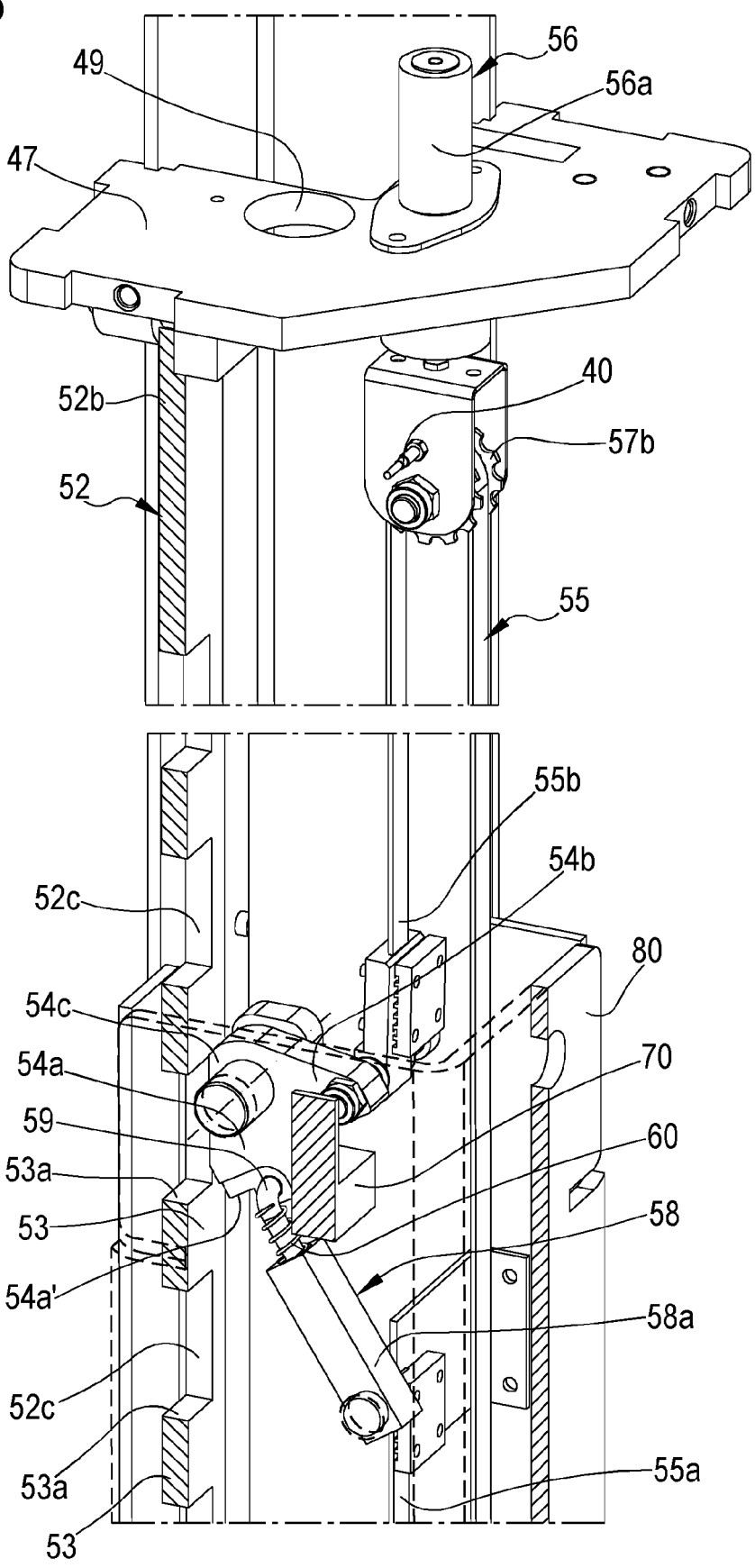


FIG.15

FIG.16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49
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52b
57b
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55
55b
54b
52c
80
54c
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54a
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60
53a
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54a'
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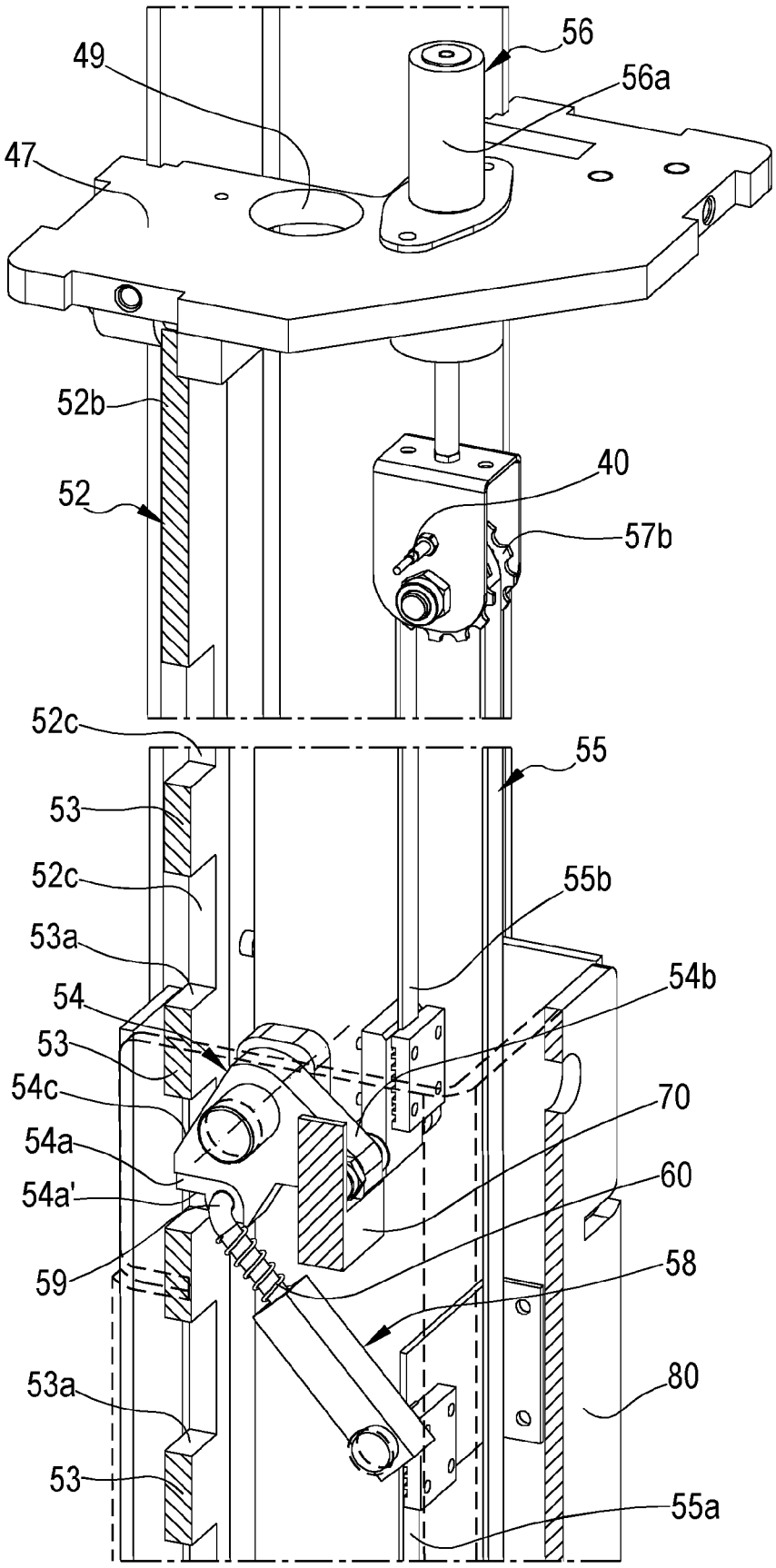
52c
53a
55a
53

FIG.17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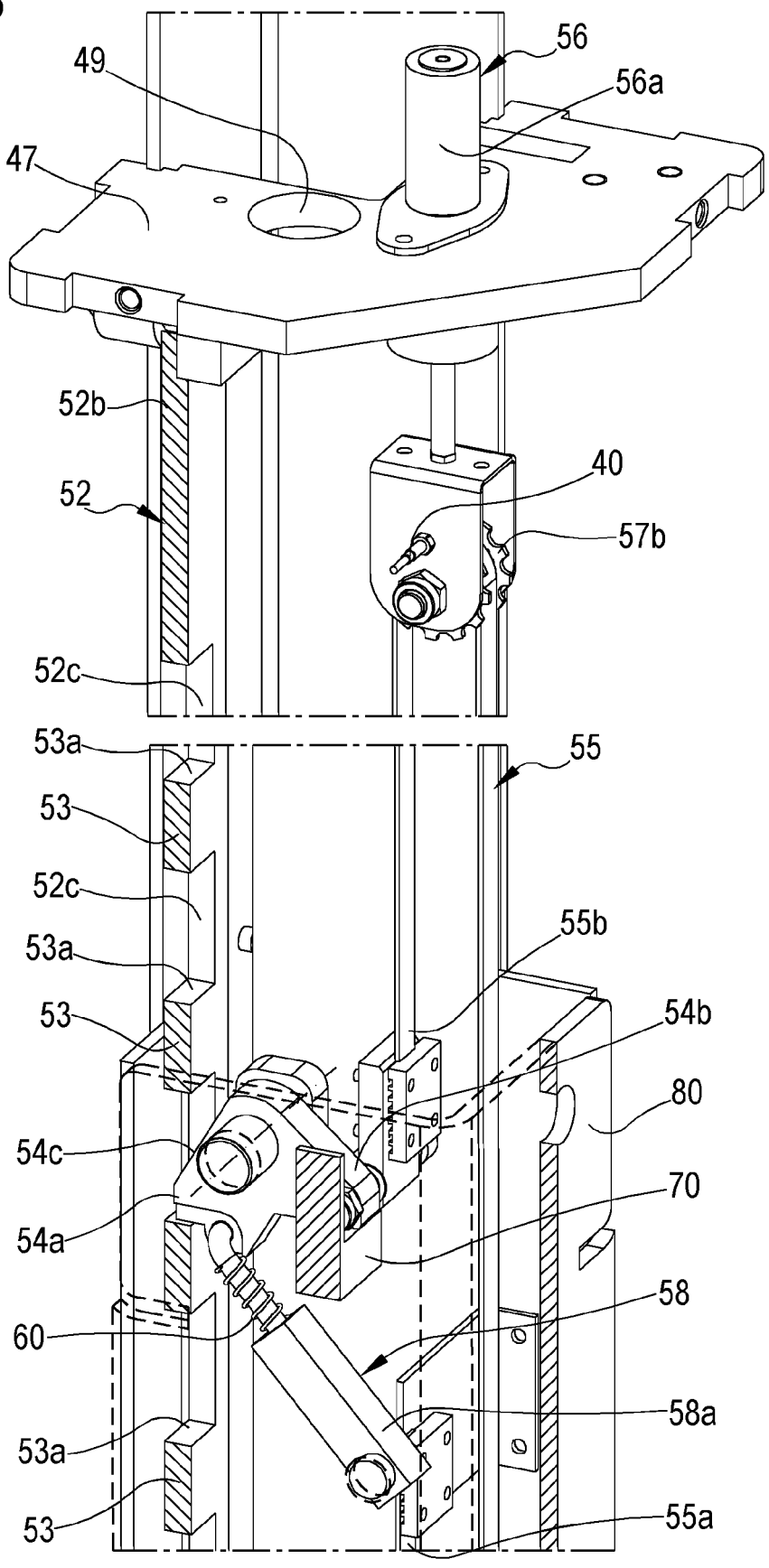
53
55a

FIG.18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54b
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54c
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54a
58
60
58a
53a
55a
53

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EUROPEAN SEARCH REPORT

Application Number
EP 24 16 0673

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	DE 27 59 085 A1 (FOGAUTOLUBE SA) 13 July 1978 (1978-07-13) * page 5 - page 8 * * page 11 * * figures 1-3 * -----	1-15	INV. B66F7/16 B66F7/02 B66F7/20 B66F7/04 B66F7/28
A	DE 36 00 316 C2 (FOGAUTOLUBE SA [FR]) 24 November 1994 (1994-11-24) * column 1, line 45 - line 46 * * column 1, line 64 - column 2, line 4 * * column 2, line 29 - line 34 * * figures 1,2 * -----	1-15	
A	US 2011/210298 A1 (BONACINI MAURIZIO [IT]) 1 September 2011 (2011-09-01) * paragraph [0001] - paragraph [0002] * * paragraph [0075] * * paragraph [0085] * * paragraph [0106] * * figures 1,5,6,7 * -----	1-15	
			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	2 July 2024	Serafeim, Athanasios

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
DE 2759085 A1	13-07-1978	BE 862172 A	14-04-1978
		DE 2759085 A1	13-07-1978
		DK 564477 A	12-07-1978
		FR 2376816 A1	04-08-1978
		GB 1587361 A	01-04-1981
		IT 1089738 B	18-06-1985
DE 3600316 C2	24-11-1994	DE 3600316 A1	24-07-1986
		DE 8600290 U1	19-06-1986
		FR 2576298 A1	25-07-1986
		NL 8600104 A	18-08-1986
US 2011210298 A1	01-09-2011	CN 102190262 A	21-09-2011
		EP 2361871 A1	31-08-2011
		IT 1398963 B1	28-03-2013
		JP 2011178386 A	15-09-2011
		US 2011210298 A1	01-09-2011

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Patent documents cited in the description

- US 2011210298 A1 **[0003]**
- DE 2759085 A1 **[0004]**
- DE 3600316 C2 **[0004]**