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(54) A STABILISING UNIT FOR A MOTOR VEHICLE

(57) The invention relates to a stabilising unit (1) for a motor vehicle (100), for example a motor crane, comprising: a stabiliser foot (2); a first hydraulic cylinder (11) which bears the stabiliser foot (2); a second hydraulic cylinder (12) which can be borne by a motor vehicle (100), which comprises a fixed part (7), and which comprises a movable part (8) which bears the first hydraulic cylinder (11); a first telescopic pipeline (31) which at a first end (41) is solidly constrained to the fixed part (7) of the second hydraulic cylinder (12) and which at a second end (42) is solidly constrained to the movable part (8) of the second hydraulic cylinder (12); a second telescopic pipeline which at a third end is solidly constrained to the fixed part (7) of the second hydraulic cylinder (12) and which at a fourth end is solidly constrained to the movable part (8) of the second hydraulic cylinder (12); a plurality of piloted check valves (51, 52, 53, 54) and a plurality of hydraulic lines (61, 62, 63, 64). The stabilising unit can comprise hydraulic directional control valves (121, 122).

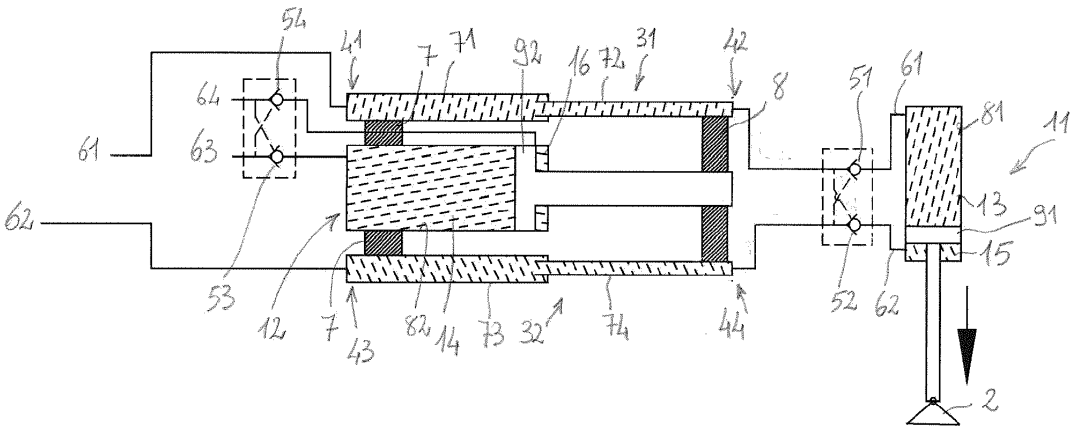

FIG5A

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Description

[0001] The present invention relates to the technical sector concerning the stabilising of a motor vehicle, for example a motor crane. In particular, the invention relates to a stabilising unit for a motor vehicle.

[0002] Figure 1 generically illustrates a motor crane (100) of known type, which comprises four stabilising units (102), two per side. Figure 2 is a partial rear view of the motor crane (100) of figure 1. These stabilising units (102) are necessary when the telescopic arms (103) of the motor crane (100) are extended and are moving a load in cantilever fashion with respect to the profile of the motor crane (100): in this case the drive of the stabilising unit (102) raises the wheels (101) of the motor crane (100), which stabilises the motor crane (100).

[0003] In particular, each stabilising unit (102) comprises: a stabiliser foot (2); a first hydraulic cylinder (11) and a second hydraulic cylinder (12).

[0004] The first hydraulic cylinder (11) comprises a first jacket (81) and a first piston (91), is vertically orientated and bears, via the first piston (91), the stabiliser foot (2) in order to move the foot (2) from a raised position (not illustrated), so that it is raised from a ground surface (6), and a lowered position (L) (figures 1 and 2), so that it is in contact with the ground surface (6).

[0005] The second hydraulic cylinder (12) is horizontally orientated, and comprises a second jacket (82) which is solidly constrained to the frame (5) of the motor crane (100) and a second piston (92) which in turn: can move between a retracted position (not illustrated) and an extended position (E) (figure 2); and is solidly constrained to the first jacket (81) of the first hydraulic cylinder (11). The second piston (92) can be stably blocked in intermediate positions (not illustrated) between the retracted position and the extended position (E).

[0006] Both the first hydraulic cylinder (11) and the second hydraulic cylinder (12) are double-acting. Therefore, the stabilising unit (102) comprises a first hydraulic line (61) which is connected to a first thrust chamber (13) of the first hydraulic cylinder (11) and a second hydraulic line (62) which is connected to a first pull chamber of the first hydraulic cylinder (11).

[0007] The first hydraulic line (61) and the second hydraulic line (62) flow through flexible tubes (not illustrated) which are free (not illustrated) or constrained to an overhead tract (105) (figure 2) or wound about spring-loaded hydraulic tube reels (not illustrated).

[0008] When the relative second hydraulic cylinder (12) is activated to retract and extend the relative second piston (92), the flexible tubes are bent. These continuous stresses on the flexible tubes cause rapid wear, which requires periodic maintenance and in any case leads to a limited working life of the flexible tubes.

[0009] Documents DE 9301899 U1 and US 3856152 A relate to stabilising units for motor vehicles, the units comprising a telescopic conduit. The solutions illustrated in these documents do not guarantee correct functioning of the stabilising unit as they do not independently control the two hydraulic cylinders and do not stabilise the two hydraulic cylinders; in these solutions, it is indeed possible for an undesired extraction and/or return of the second hydraulic cylinder to occur. For example, the first embodiment of US 3856152 A necessarily uses only three hydraulic lines which do not offer an independent control of the two hydraulic cylinders and do not prevent the undesired extraction or return of the second hydraulic cylinder. Further, the telescopic conduit can generate undesired displacements of the second hydraulic cylinder when it is subject to the push of the hydraulic oil and the piston of the second hydraulic cylinder is not at full stroke.

[0010] A stabilising unit that is not stable in each condition and/or operating configuration is not working correctly as it does not guarantee the necessary safety, either when being used or when the whole motor vehicle is being used, i.e. when the hydraulic lines are not supplied.

[0011] The aim of the present invention consists in obviating the above-mentioned drawbacks.

[0012] The above aim is attained with a stabilising unit for a motor vehicle, according to claim 1, a stabilising apparatus for a motor vehicle according to claim 8 and a motor vehicle according to claim 10.

[0013] Flexible tubes are advantageously no longer required. Instead, telescopic pipelines are used, which are constrained to the second hydraulic cylinder, as well as check valves that are pilotable to open to guarantee correct functioning of the stabilising unit.

[0014] Specific embodiments of the invention will be described in the following part of the present description, according to what is reported in the claims and with the aid of the appended tables of drawings, in which:

- figures 1 and 2 are respectively a lateral and rear view of a motor crane which comprises a plurality of stabilising units of known type;
- figure 3 is a rear view of a motor crane which incorporates a stabilising unit for a motor vehicle, according to a first embodiment of the present invention, which is in a first operating configuration;
- figure 3A is the hydraulic diagram of the stabilising unit of figure 3 in the first operating configuration;
- figure 4 is a rear view of the motor crane of figure 3, in which the stabilising unit is in a second operating configuration;
- figure 4A is the hydraulic diagram of the stabilising unit of figure 3 in the second operating configuration;
- figure 5 is a rear view of the motor crane of figure 3, in which the stabilising unit is in a third operating configuration;
- figure 5A is the hydraulic diagram of the stabilising unit of figure 3 in the third operating configuration;
- figure 6 is a rear view of the motor crane of figure 3, in which the stabilising unit is in a fourth operating configuration;
- figure 6A is the hydraulic diagram of the stabilising

unit of figure 3 in the fourth operating configuration;

- figure 7 is a rear view of the motor crane of figure 3, in which the stabilising unit is in a fifth operating configuration;
- figure 7A is the hydraulic diagram of the stabilising unit of figure 3 in the fifth operating configuration;
- figure 8 is a rear view of a motor crane which incorporates a stabilising unit for a motor vehicle, according to a second embodiment of the present invention;
- figure 8A is the hydraulic diagram of the stabilising unit of figure 8;
- figure 8B illustrates the larger-scale details of K1, K2, K3 of figure 8;
- figure 9 is the hydraulic diagram of the stabilising unit of figure 3, in which two examples of hydraulic directional control valves are shown.

[0015] With reference to figures from 3 onwards, reference numeral (1) denotes a stabilising unit for a motor vehicle (100), object of the present invention, comprising:

a stabiliser foot (2);

a first hydraulic cylinder (11) which bears the stabiliser foot (2) so as to move the stabiliser foot (2) between a raised position (H), in order to be raised from a ground surface (6), and a lowered position (L), in order to be in contact with the ground surface (6);

a second hydraulic cylinder (12) which can be borne by a motor vehicle (100), which comprises a fixed part (7), and which comprises a movable part (8) which in turn: can move between a retracted position (R) and an extended position (E); and bears the first hydraulic cylinder (11);

a first telescopic pipeline (31) which at a first end (41) is solidly constrained to the fixed part (7) of the second hydraulic cylinder (12) and which at a second end (42) thereof, opposite the first end (41), is solidly constrained to the movable part (8) of the second hydraulic cylinder (12), so that when the second hydraulic cylinder (12) is in the retracted position (R) then also the first telescopic pipeline (31) is retracted and when the second hydraulic cylinder (12) is in the extended position (E) then also the first telescopic pipeline (31) is extended;

a second telescopic pipeline (32) which at a third end (43) is solidly constrained to the fixed part (7) of the second hydraulic cylinder (12) and which at a fourth end (44) thereof, opposite the third end (43), is solidly constrained to the movable part (8) of the second hydraulic cylinder (12), so that when the second hydraulic cylinder (12) is in the retracted position (R) then also the second telescopic pipeline (32) is retracted and when the second hydraulic cylinder (12) is in the extended position (E) then also the second telescopic pipeline (32) is extended;

a first check valve (51) which is pilotable to open;

a second check valve (52) which is pilotable to open;

a first hydraulic line (61) which: passes through the first telescopic pipeline (31); passes through the first check valve (51) and is connected to a first thrust chamber (13) of the first hydraulic cylinder (11), the first check valve (51) being arranged so as to enable passage of liquid towards the first thrust chamber (13) of the first hydraulic cylinder (11);

a second hydraulic line (62) which: passes through the second telescopic pipeline (32); passes through the second check valve (52) and is connected to a first pull chamber (15) of the first hydraulic cylinder (11), the second check valve (52) being arranged so as to enable passage of liquid towards the first pull chamber (15) of the first hydraulic cylinder (11);

a third check valve (53) which is pilotable to open;

a fourth check valve (54) which is pilotable to open;

a third hydraulic line (63) which: passes through the third check valve (53) and which is connected to a second thrust chamber (14) of the second hydraulic cylinder (12), the third check valve (53) being arranged so as to enable passage of liquid towards the second thrust chamber (14) of the second hydraulic cylinder (12);

a fourth hydraulic line (64) which: passes through the fourth check valve (54) and which is connected to a second pull chamber (16) of the second hydraulic cylinder (12), the fourth check valve (54) being arranged so as to enable passage of liquid towards the second pull chamber (16) of the second hydraulic cylinder (12).

[0016] The first hydraulic cylinder (11) is preferably orientated vertically when the second hydraulic cylinder (12) is borne by the motor vehicle (100).

[0017] The first hydraulic cylinder (11) comprises a first jacket (81) and a first piston (91) which slides in the first jacket (81).

[0018] The first hydraulic cylinder (12) is preferably orientated horizontally when the second hydraulic cylinder (12) is borne by the motor vehicle (100).

[0019] The second hydraulic cylinder (12) comprises a second jacket (82) and a second piston (92) which slides in the second jacket (82).

[0020] The motor vehicle (100) can be a motor crane (100).

[0021] The term "fixed part (7)" is taken to mean that it is solidly constrained to the frame (5) of the motor vehicle (100), when the second hydraulic cylinder (12) is borne by the motor vehicle (100). In the illustrated examples, the fixed part (7) comprises the second jacket (82) of the second hydraulic cylinder (12).

[0022] In the illustrated examples, the movable part (8) comprises the second piston (92) of the second hydraulic cylinder (12).

[0023] The first telescopic pipeline (31) preferably comprises a first conduit (71) which is solidly constrained to the fixed part (7) of the second hydraulic cylinder (12), and a second conduit (72) which is solidly constrained to the movable part (8) of the second hydraulic cylinder

(12) and which is telescopically movable along the first conduit (71); the second telescopic pipeline (32) comprises a third conduit (73) is solidly constrained to the fixed part (7) of the second hydraulic cylinder (12), and a fourth conduit (74) which is solidly constrained to the movable part (8) of the second hydraulic cylinder (12) and which is telescopically movable along the third conduit (73).

[0024] The second conduit (72) is preferably movable internally of the first conduit (71) and the fourth conduit (74) is movable internally of the third conduit (73).

[0025] According to a first embodiment, illustrated in figures 3 - 7, 9, the first telescopic pipeline (31) and the second telescopic pipeline (32) are external of the second hydraulic cylinder (12), while according to a second embodiment, illustrated in figure 8, the first telescopic pipeline (31) and the second telescopic pipeline (32) are incorporated in the second hydraulic cylinder (12).

[0026] The first check valve (51) is preferably piloted by the second hydraulic line (62) at a point upstream of the second check valve (52); and the second check valve (52) is piloted by the first hydraulic line (61) at a point upstream of the first check valve (51).

[0027] The third check valve (53) is preferably piloted by the fourth hydraulic line (64) at a point upstream of the fourth check valve (54); and the fourth check valve (54) is piloted by the third hydraulic line (63) at a point upstream of the third check valve (53).

[0028] The embodiments of the stabilising unit (1) described above can be installed on many motor vehicles (100) which already have their own directional control valves, as they do not require the use of specifically-conceived drives; these valves can be appropriately configured on the basis of the teachings that follow.

[0029] The stabilising unit (1) can comprise a first directional control valve (121) which is connectable to the first hydraulic line (61) and to the second hydraulic line (62) on one side, and to a hydraulic oil infeed (P) and to a hydraulic oil discharge (T), on the other side. The stabilising unit (1) can further comprise a second directional control valve (122) which is connected to the third hydraulic line (63) and to the fourth hydraulic line (64) on one side, and to the hydraulic oil infeed (P) and to the hydraulic oil discharge (T), on the other side.

[0030] The first directional control valve (121) comprises a first compartment (131), a second compartment (132) and a third compartment (133). When the first compartment (131) is selected, then the first hydraulic line (61) is connected to the hydraulic oil discharge (T) and the second hydraulic line (62) is connected to the hydraulic oil infeed (P); when the second compartment (132) is selected, then the first hydraulic line (61), the second hydraulic line (62) and the hydraulic oil infeed (P) are connected to the hydraulic oil discharge (T); when the third compartment (133) is selected, then the first hydraulic line (61) is connected to the hydraulic oil infeed (P) and the second hydraulic line (62) is connected to the hydraulic oil discharge (T).

[0031] The second directional control valve (122) comprises a fourth compartment (134), a fifth compartment (135) and a sixth compartment (136). When the fourth compartment (134) is selected, then the third hydraulic line (63) is connected to the hydraulic oil infeed (P) and the fourth hydraulic line (64) is connected to the hydraulic oil discharge (T); when the fifth compartment (135) is selected, then the third hydraulic line (63) and the fourth hydraulic line (64) are connected to the hydraulic oil discharge (T); when the sixth compartment (136) is selected, then the third hydraulic line (63) is connected to the hydraulic oil discharge (T) and the fourth hydraulic line (64) is connected to the hydraulic oil infeed (P).

[0032] The first directional control valve (121) and the second directional control valve (122) are respectively interchangeable or replaceable, so that: it is possible to use only the first directional control valve (121) present in two units so as to connect to the first hydraulic line (61) and the second hydraulic line (62) (first unit, see figure 9) and so as to connect to the third hydraulic line (63) and the fourth hydraulic line (64) (second unit); it is possible to use only the second directional control valve (122) present in two units so as to connect to the first hydraulic line (61) and the second hydraulic line (62) (first unit) and so as to connect to the third hydraulic line (63) and the fourth hydraulic line (64) (second unit, figure 9); it is possible to exchange the first directional control valve (121) and the second directional control valve (122), so that the first directional control valve (121) is connected to the third hydraulic line (63) and the fourth hydraulic line (64) and the second directional control valve (122) is connected to the first hydraulic line (61) and the second hydraulic line (62).

[0033] A further aim of the present invention is a stabilising apparatus (99) for a motor vehicle (100) which comprises a plurality of stabilising units (1) of the above-described type. The motor vehicle (100) can comprise four stabilising units (1); the figures illustrate two stabilising units (1).

[0034] The following is a description of the functioning of the stabilising unit (1), to bring the motor crane (100) from a non-stabilised configuration, figures 3, 3A, to a stabilised configuration, figures 5, 5A, according to the first embodiment.

[0035] With reference to figures 3, 3A, the first hydraulic cylinder (11) is in the raised position and the second hydraulic cylinder (12) is in the retracted position (R).

[0036] The first hydraulic line (61), the second hydraulic line (62), the third hydraulic line (63) and the fourth hydraulic line (64) are connected to the discharge.

[0037] This operating configuration is shown in figure 9: in the first directional control valve (121) the second compartment (132) is selected and in the second directional control valve (122) the fifth compartment (135) is selected.

[0038] Subsequently, figures 4, 4A, in the first directional control valve (121) the second compartment (132) remains selected, and in the second directional control

valve (122) the fourth compartment (134) is selected: the first hydraulic line (61) remains connected to the hydraulic oil discharge (T), the second hydraulic line (62) remains connected to the hydraulic oil discharge (T), the third hydraulic line (63) is connected to the hydraulic oil infeed (P) and the fourth hydraulic line (64) remains connected to the hydraulic oil discharge (T). The hydraulic oil passing through the third hydraulic line (63) pilots the fourth check valve (54), which enables the hydraulic oil present in the second pull chamber (16) to pass through the fourth check valve (54) and to go towards the hydraulic oil discharge (T). Therefore, the second thrust chamber (14) begins to expand while the second pull chamber (16) begins to retract. The second hydraulic cylinder (12) is brought towards the extended position (E).

[0039] During this step it is necessary for the first hydraulic line (61) and the second hydraulic line (62) to be connected to the hydraulic oil discharge (T), in order to prevent the extraction of the second conduit (72) from the first conduit (71) and of the fourth conduit (74) from the third conduit (73) from generating forces that oppose the advancement of the second piston (92) towards the extended position (E), creating depressions such as to compromise, even permanently, the functioning of the stabilising unit (1).

[0040] Once the second hydraulic cylinder (12) has returned into the extended position (E), in the second directional control valve (122) the fifth compartment (135) is selected, in order to connect also the third hydraulic line (63) to the hydraulic oil discharge (T). The third check valve (53) and the fourth check valve (54) respectively prevent the exit of hydraulic oil from the second thrust chamber (14) and from the second pull chamber (16), and this guarantees that the second hydraulic cylinder (12) is maintained stably in the extended position (E). This condition persists, for example, even should the hydraulic oil infeed (P) be interrupted.

[0041] Subsequently, figures 5, 5A, in the first directional control valve (121) the third shutter (133) is selected, and in the second directional control valve (122) the fifth compartment (135) remains selected: the first hydraulic line (61) is connected to the hydraulic oil infeed (P), the second hydraulic line (62) remains connected to the hydraulic oil discharge (T), the third hydraulic line (63) is connected to the hydraulic oil discharge (T) and the fourth hydraulic line (64) remains connected to the hydraulic oil discharge (T).

[0042] The hydraulic oil passing through the first hydraulic line (61) pilots the second check valve (52), which enables the hydraulic oil present in the first pull chamber (15) to pass through the second check valve (52) and to go towards the hydraulic oil discharge (T). Therefore, the first thrust chamber (13) begins to expand while the first pull chamber (15) begins to reduce.

[0043] The first hydraulic cylinder (11) is thus brought into the lowered position (L) until the stabiliser foot (2) contacts the ground surface (6).

[0044] The third check valve (53) and the fourth check valve (54) respectively prevent the exit of hydraulic oil from the second thrust chamber (14) and from the second pull chamber (16), and this guarantees that the second hydraulic cylinder (12) is maintained stably in the extended position (E).

[0045] Once the stabiliser foot (2) has contacted the ground surface (6) and the motor vehicle (100) has been lifted (in figure 5 the tyres are raised from the ground, but this need not necessarily be the case), in the first directional control valve (121) the second compartment (132) is selected, in order to connect also the first hydraulic line (61) to the hydraulic oil discharge (T). The first check valve (51) and the second check valve (52) respectively prevent the exit of hydraulic oil from the first thrust chamber (13) and from the first pull chamber (15), and this guarantees that the first hydraulic cylinder (11) is maintained stably in the lowered position (L).

[0046] In this way the motor crane (100) is stabilised.

[0047] The stabilising unit (1) can be operated to make and maintain the second hydraulic cylinder (12) stable in intermediate positions between the retracted position (R) and the extended position (E).

[0048] The following is a description of the functioning of the stabilising unit (1), to bring the motor crane (100) from a stabilised configuration, figures 5, 5A, to a non-stabilised configuration, figures 7, 7A (equivalent to figures 3, 3A).

[0049] Starting from the operating configuration already described with reference to figures 5, 5A, in which the motor crane (100) is stabilised, the following steps take place (figures 6, 6A).

[0050] In the first directional control valve (121) the first compartment (131) is selected, and in the second directional control valve (122) the fifth compartment (135) remains selected: the first hydraulic line (61) remains connected to the hydraulic oil discharge (T), the second hydraulic line (62) is connected to the hydraulic oil infeed (P), the third hydraulic line (63) remains connected to the hydraulic oil discharge (T) and the fourth hydraulic line (64) remains connected to the hydraulic oil discharge (T).

[0051] The hydraulic oil which flows through the second hydraulic line (62) pilots the first check valve (51), which enables the hydraulic oil present in the first thrust chamber (13) to pass through the first check valve (51) and to go towards the hydraulic oil discharge (T). Therefore, the first thrust chamber (15) begins to expand while the first pull chamber (13) begins to reduce.

[0052] The first hydraulic cylinder (11) is brought towards the raised position, while the second hydraulic cylinder (12) is maintained stably in the extended position (E) for the reasons already explained in the foregoing.

[0053] Once the first hydraulic cylinder (11) is brought into the raised position, in the first directional control valve (121) the second compartment (132) is selected, in order to connect also the second hydraulic line (62) to the hydraulic oil discharge (T).

[0054] Subsequently, figures 7, 7A, in the first directional control valve (121) the second compartment (132)

remains selected, and in the second directional control valve (122) the sixth compartment (136) is selected: the first hydraulic line (61) remains connected to the hydraulic oil discharge (T), the second hydraulic line (62) remains connected to the hydraulic oil discharge (T), the third hydraulic line (63) remains connected to the hydraulic oil discharge (T) and the fourth hydraulic line (64) is connected to the hydraulic oil infeed (P). The hydraulic oil passing through the fourth hydraulic line (64) pilots the third check valve (53), which enables the hydraulic oil present in the second thrust chamber (14) to pass through the third check valve (53) and to go towards the hydraulic oil discharge (T). Therefore the second pull chamber (16) begins to expand while the second thrust chamber (14) begins to retract.

[0055] The second hydraulic cylinder (12) is brought towards the retracted position (E).

[0056] During this step it is necessary for the first hydraulic line (61) and the second hydraulic line (62) to be connected to the hydraulic oil discharge (T), to prevent the telescopic insertion of the second conduit (72) into the first conduit (71) and of the fourth conduit (74) into the third conduit (73) from generating forces that oppose the retraction of the second piston (92) towards the retracted position (R), creating overpressures such as to compromise, even permanently, the functioning of the stabilising unit (1).

[0057] Once the second hydraulic cylinder (12) is brought into the retracted position (R), in the second directional control valve (122) the fifth compartment (135) is selected, in order to connect also the fourth hydraulic line (64) to the hydraulic oil discharge (T).

[0058] The functioning of the stabilising unit (1) according to the second embodiment is alike to the one already described in the foregoing with reference to the first embodiment.

[0059] As is known to the expert in the sector, the term "hydraulic line" indicates an independent entity, i.e. distinct from other hydraulic lines; for example, a hydraulic line connects a single-chamber distributor of a hydraulic cylinder.

[0060] It is understood that the above has been described by way of nonlimiting example and that any technical-functional variants are considered to fall within the protective scope of the present technical solution, as claimed in the following.

Claims

1. A stabilising unit (1) for a motor vehicle (100), comprising:

    a stabiliser foot (2);
    a first hydraulic cylinder (11) which bears the stabiliser foot (2) so as to move the stabiliser foot (2) between a raised position (H), in order to be raised from a ground surface (6), and a lowered position (L), in order to be in contact with the ground surface (6);
    a second hydraulic cylinder (12) which can be borne by a motor vehicle (100), which comprises a fixed part (7), and which comprises a movable part (8) which in turn: can move between a retracted position (R) and an extended position (E); and bears the first hydraulic cylinder (11);
    the stabilising unit (1) being **characterised in that** it comprises:

        a first telescopic pipeline (31) which at a first end (41) is solidly constrained to the fixed part (7) of the second hydraulic cylinder (12) and which at a second end (42) thereof, opposite the first end (41), is solidly constrained to the movable part (8) of the second hydraulic cylinder (12), so that when the second hydraulic cylinder (12) is in the retracted position (R) then also the first telescopic pipeline (31) is retracted and when the second hydraulic cylinder (12) is in the extended position (E) then also the first telescopic pipeline (31) is extended;
        a second telescopic pipeline (32) which at a third end (43) is solidly constrained to the fixed part (7) of the second hydraulic cylinder (12) and which at a fourth end (44) thereof, opposite the third end (43), is solidly constrained to the movable part (8) of the second hydraulic cylinder (12), so that when the second hydraulic cylinder (12) is in the retracted position (R) then also the second telescopic pipeline (32) is retracted and when the second hydraulic cylinder (12) is in the extended position (E) then also the second telescopic pipeline (32) is extended;
        a first check valve (51) which is pilotable to open;
        a second check valve (52) which is pilotable to open;
        a first hydraulic line (61) which: passes through the first telescopic pipeline (31); passes through the first check valve (51) and is connected to a first thrust chamber (13) of the first hydraulic cylinder (11), the first check valve (51) being arranged so as to enable passage of liquid towards the first thrust chamber (13) of the first hydraulic cylinder (11);
        a second hydraulic line (62) which: passes through the second telescopic pipeline (32); passes through the second check valve (52) and is connected to a first pull chamber (15) of the first hydraulic cylinder (11), the second check valve (52) being arranged so as to enable passage of liquid towards the first pull chamber (15) of the first hydraulic cyl-

inder (11);
a third check valve (53) which is pilotable to open;
a fourth check valve (54) which is pilotable to open;
a third hydraulic line (63) which: passes through the third check valve (53) and which is connected to a second thrust chamber (14) of the second hydraulic cylinder (12), the third check valve (53) being arranged so as to enable passage of liquid towards the second thrust chamber (14) of the second hydraulic cylinder (12);
a fourth hydraulic line (64) which: passes through the fourth check valve (54) and which is connected to a second pull chamber (16) of the second hydraulic cylinder (12), the fourth check valve (54) being arranged so as to enable passage of liquid towards the second pull chamber (16) of the second hydraulic cylinder (12).

2. The stabilising unit (1) of the preceding claim, wherein: the first telescopic pipeline (31) comprises a first conduit (71) which is solidly constrained to the fixed part (7) of the second hydraulic cylinder (12), and a second conduit (72) which is solidly constrained to the movable part (8) of the second hydraulic cylinder (12) and which is telescopically movable along the first conduit (71); the second telescopic pipeline (32) comprises a third conduit (73) which is solidly constrained to the fixed part (7) of the second hydraulic cylinder (12), and a fourth conduit (74) which is solidly constrained to the movable part (8) of the second hydraulic cylinder (12) and which is telescopically movable along the third conduit (73).

3. The stabilising unit (1) of the preceding claim, wherein the first telescopic pipeline (31) and the second telescopic pipeline (32) are external of the second hydraulic cylinder (12).

4. The stabilising unit (1) of claim 2, wherein the first telescopic pipeline (31) and the second telescopic pipeline (32) are incorporated in the second hydraulic cylinder (12).

5. The stabilising unit (1) of any one of the preceding claims, wherein:
the first check valve (51) is piloted by the second hydraulic line (62) at a point upstream of the second check valve (52); and the second check valve (52) is piloted by the first hydraulic line (61) at a point upstream of the first check valve (51).

6. The stabilising unit (1) of any one of the preceding claims, wherein the third check valve (53) is piloted by the fourth hydraulic line (64) at a point upstream of the fourth check valve (54); and the fourth check valve (54) is piloted by the third hydraulic line (63) at a point upstream of the third check valve (53).

7. The stabilising unit (1) of any one of the preceding claims, wherein:

it comprises a first directional control valve (121) which is connectable to the first hydraulic line (61) and to the second hydraulic line (62) on one side, and to a hydraulic oil infeed (P) and to a hydraulic oil discharge (T), on the other side;
it comprises a second directional control valve (122) which is connected to the third hydraulic line (63) and to the fourth hydraulic line (64) on one side, and to the hydraulic oil infeed (P) and to the hydraulic oil discharge (T), on the other side;
the first directional control valve (121) comprises a first compartment (131), a second compartment (132) and a third compartment (133) and is configured in such a way that: when the first compartment (131) is selected, then the first hydraulic line (61) is connected to the hydraulic oil discharge (T) and the second hydraulic line (62) is connected to the hydraulic oil infeed (P); when the second compartment (132) is selected, then the first hydraulic line (61) and the second hydraulic line (62) are connected to the hydraulic oil discharge (T); when the third compartment (133) is selected, then the first hydraulic line (61) is connected to the hydraulic oil infeed (P) and the second hydraulic line (62) is connected to the hydraulic oil discharge (T); the second directional control valve (122) comprises a fourth compartment (134), a fifth compartment (135) and a sixth compartment (136) and is configured in such a way that: when the fourth compartment (134) is selected, then the third hydraulic line (63) is connected to the hydraulic oil infeed (P) and the fourth hydraulic line (64) is connected to the hydraulic oil discharge (T); when the fifth compartment (135) is selected, then the third hydraulic line (63) and the fourth hydraulic line (64) are connected to the hydraulic oil discharge (T); when the sixth compartment (136) is selected, then the third hydraulic line (63) is connected to the hydraulic oil discharge (T) and the fourth hydraulic line (64) is connected to the hydraulic oil infeed (P).

8. A stabilising apparatus (99) for a motor vehicle (100), comprising a plurality of stabilising units (1) according to any one of the preceding claims.

9. The stabilising apparatus (99) according to the preceding claim, wherein:

it comprises a first directional control valve (121) comprising a first compartment (131), a second compartment (132) and a third compartment (133);
it comprises a second directional control valve (122) comprising a fourth compartment (134), a fifth compartment (135) and a sixth compartment (136);
wherein the first directional control valve (121) and the second directional control valve (122) are configured to connect to the hydraulic lines (61, 62, 63, 64) of two stabilising units (1) of the plurality of stabilising units (1).

10. A motor vehicle (100), comprising a stabilising apparatus (99) according to the preceding claim.

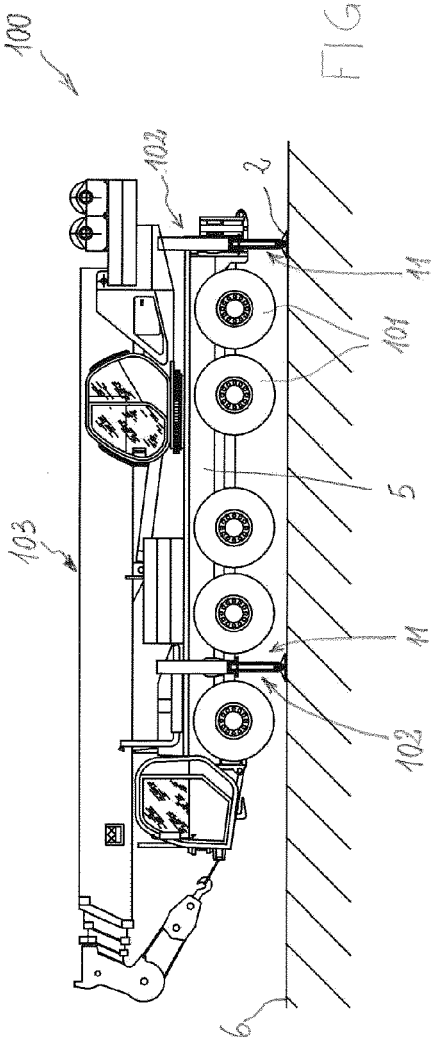

100
103
2
11
101
5
103
11
102
6

FIG 1

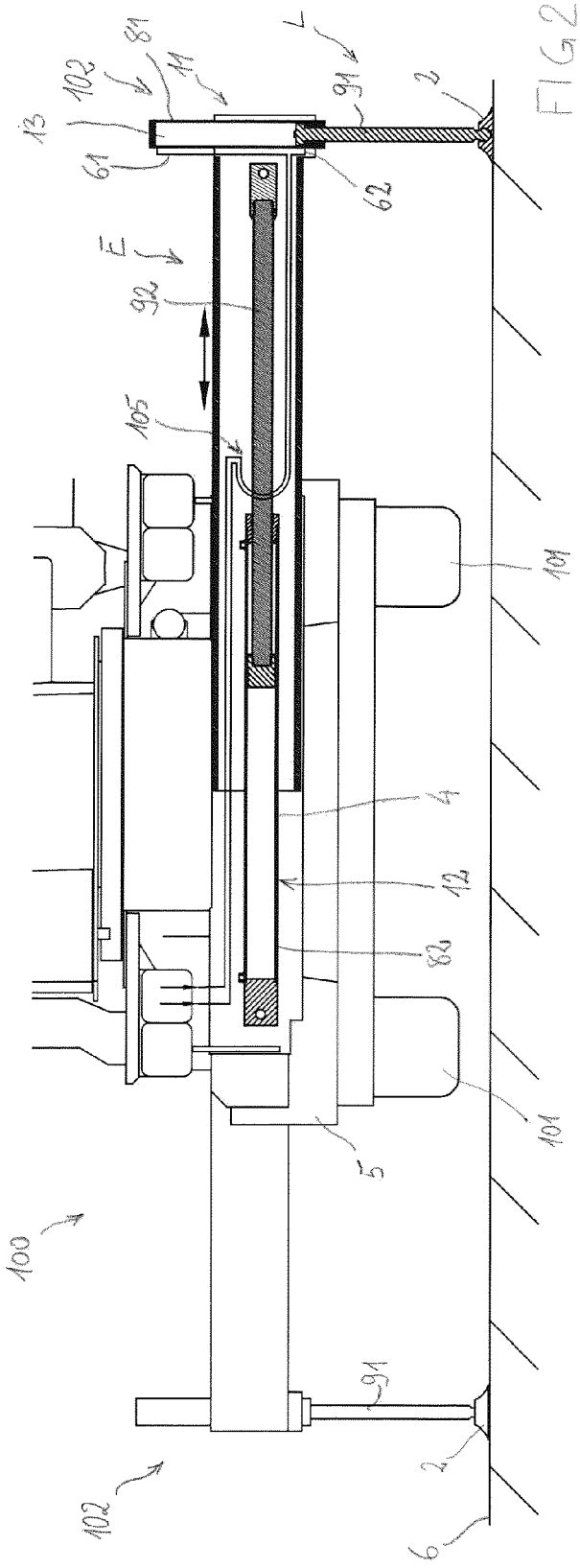

L
81
11
102
91
2
13
61
62
E
92
105
101
4
12
82
5
100
91
102
2
6

FIG 2

FIG 3

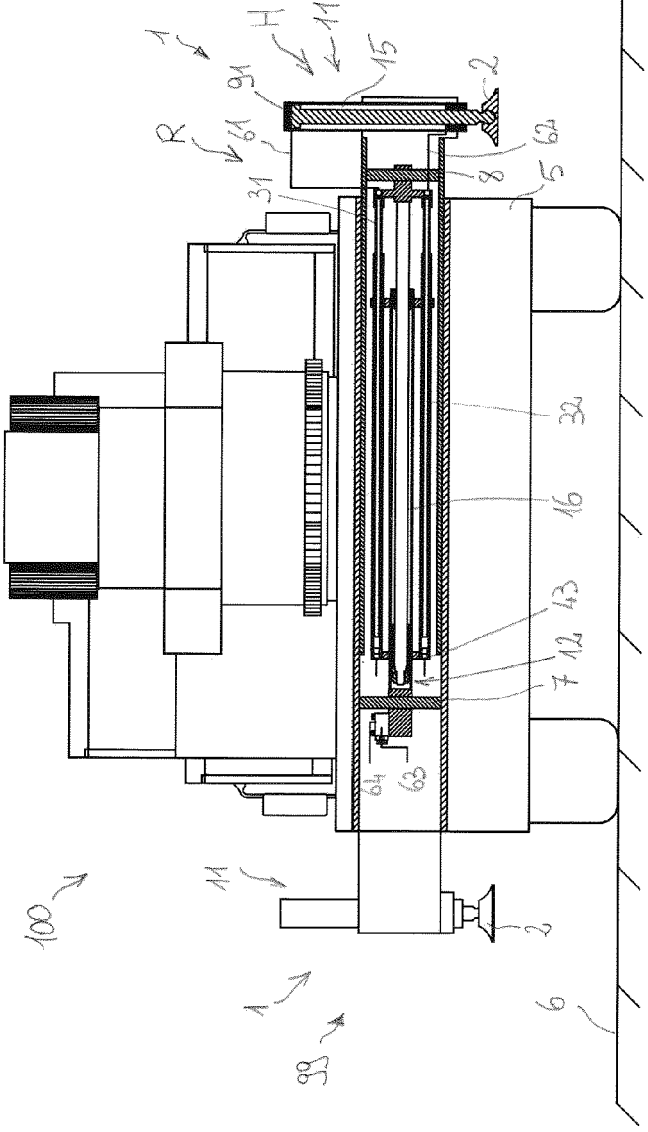


FIG 3A

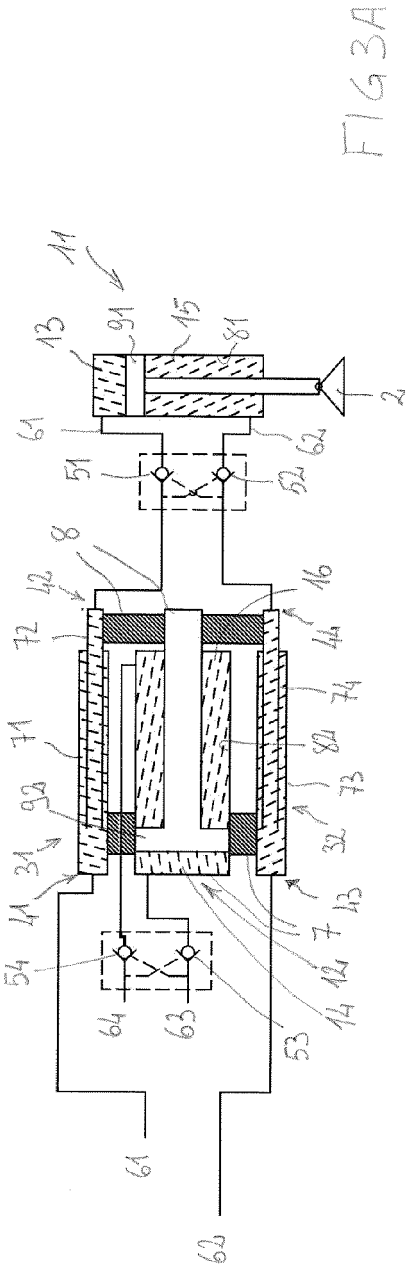


FIG4

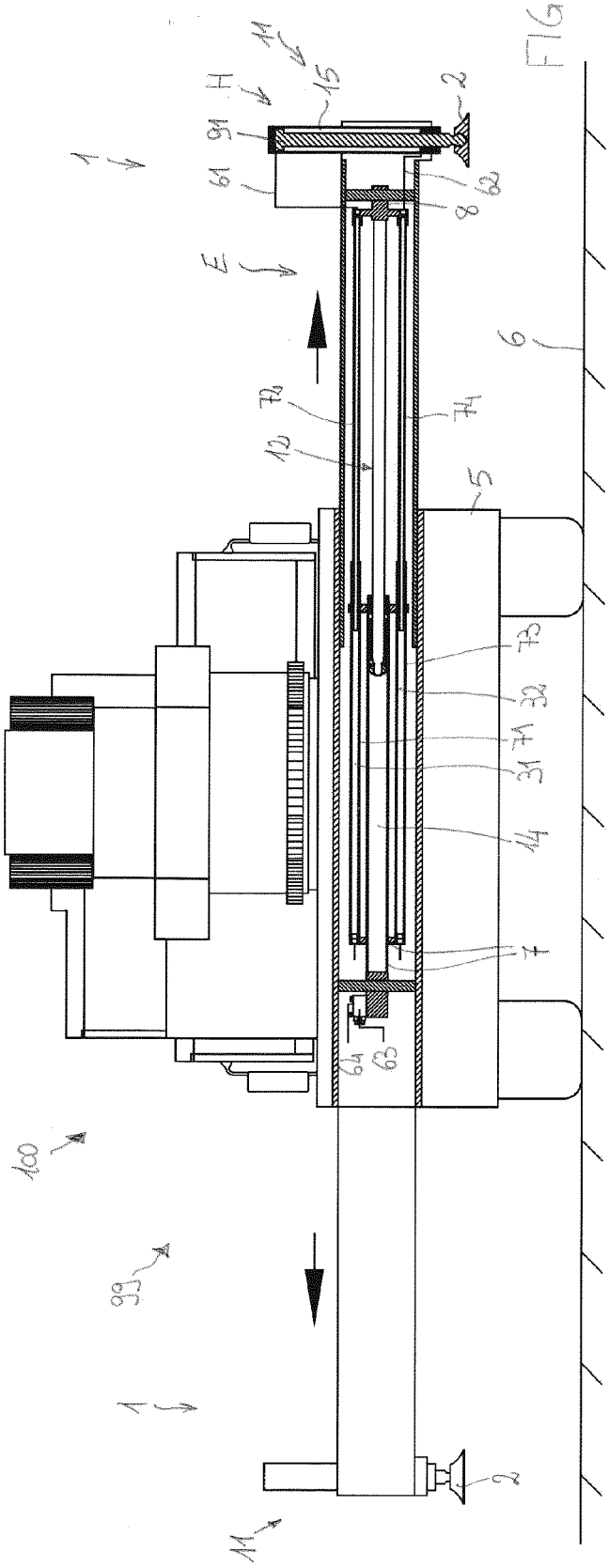
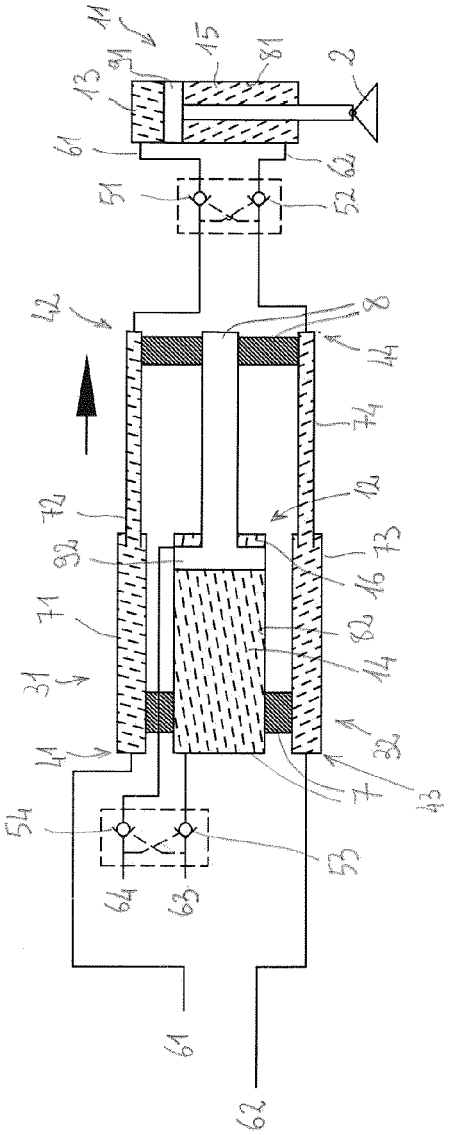


FIG4A



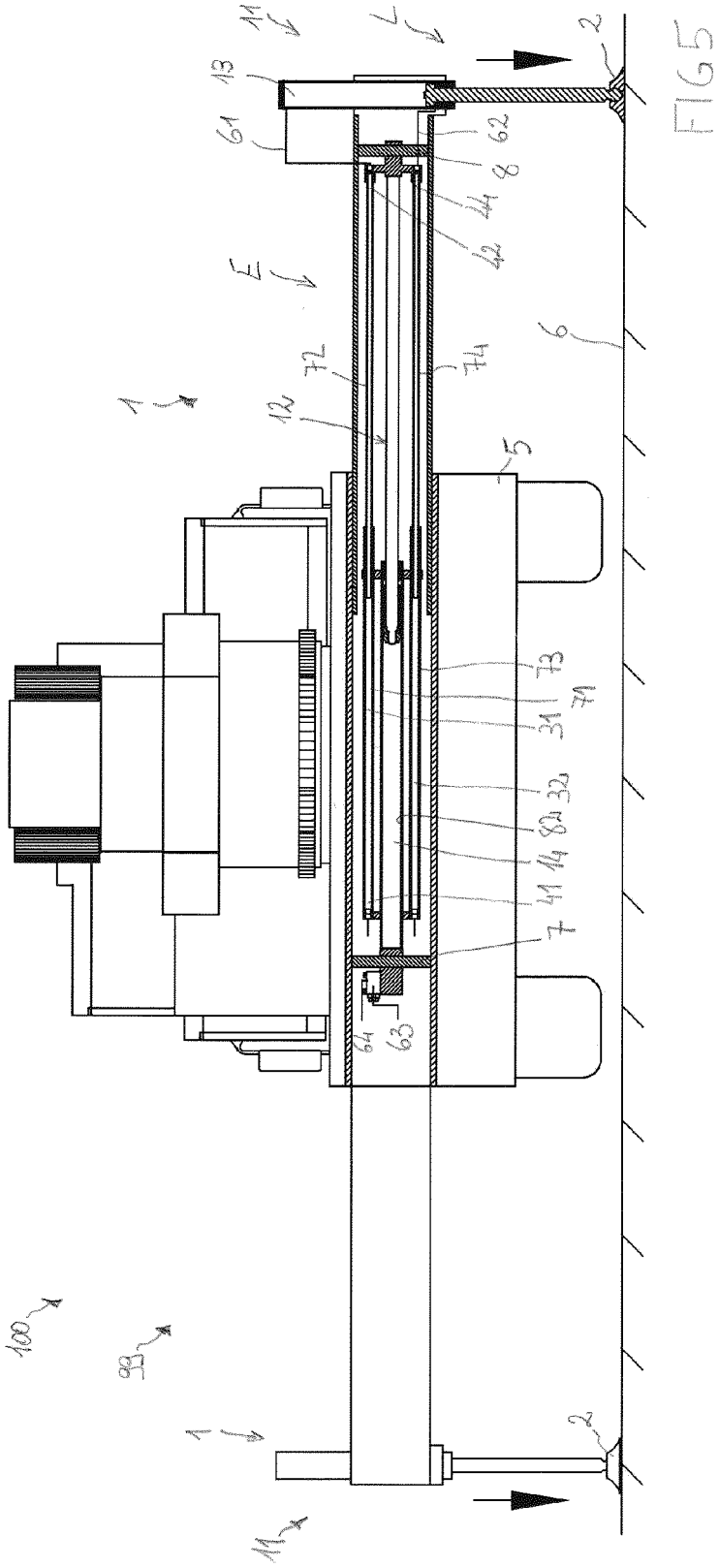
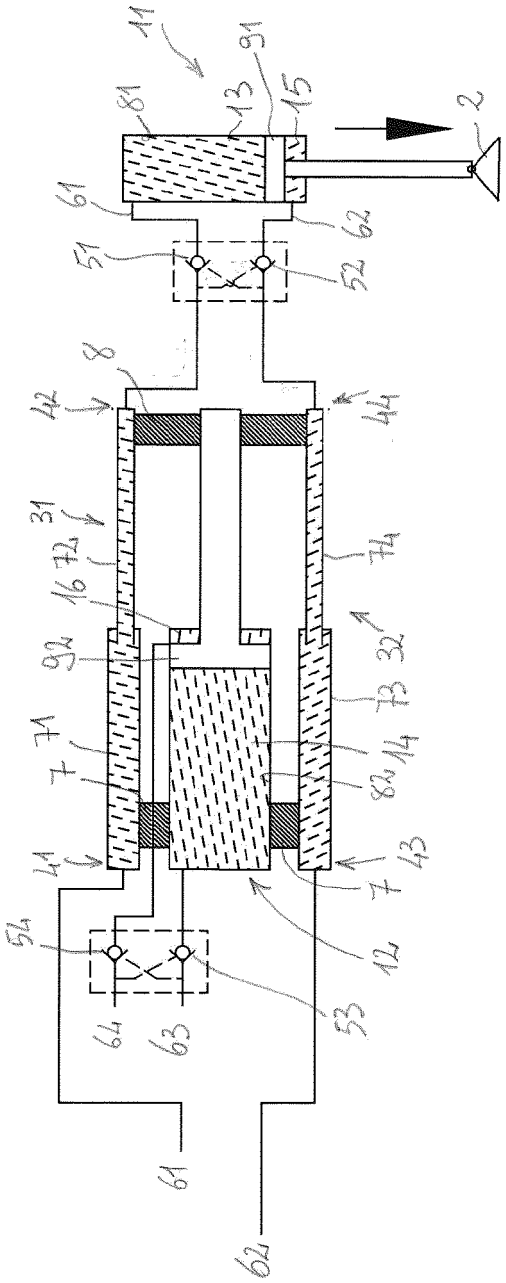

11
L
2
13
61
62
8
44
42
E
6
72
71
1
12
5
73
31
71
32
80
14
41
7
64
63
100
93
1
2
11

FIG 5

FIG 5A


11
91
81
13
15
2
61
62
51
52
8
42
44
31
72
74
16
92
32
73
71
14
7
82
41
43
12
53
64
63
61
62

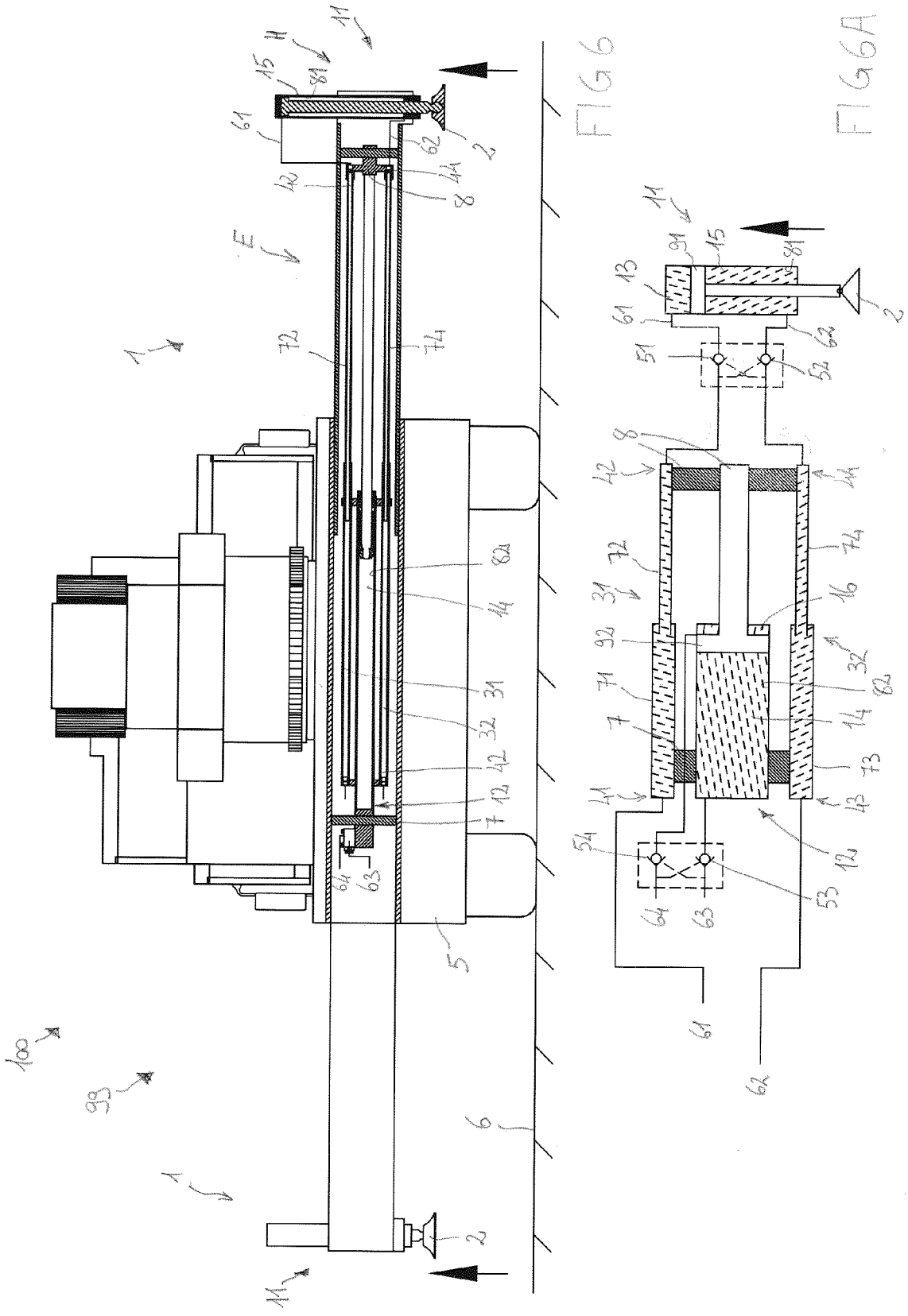


FIG 6

FIG 6A

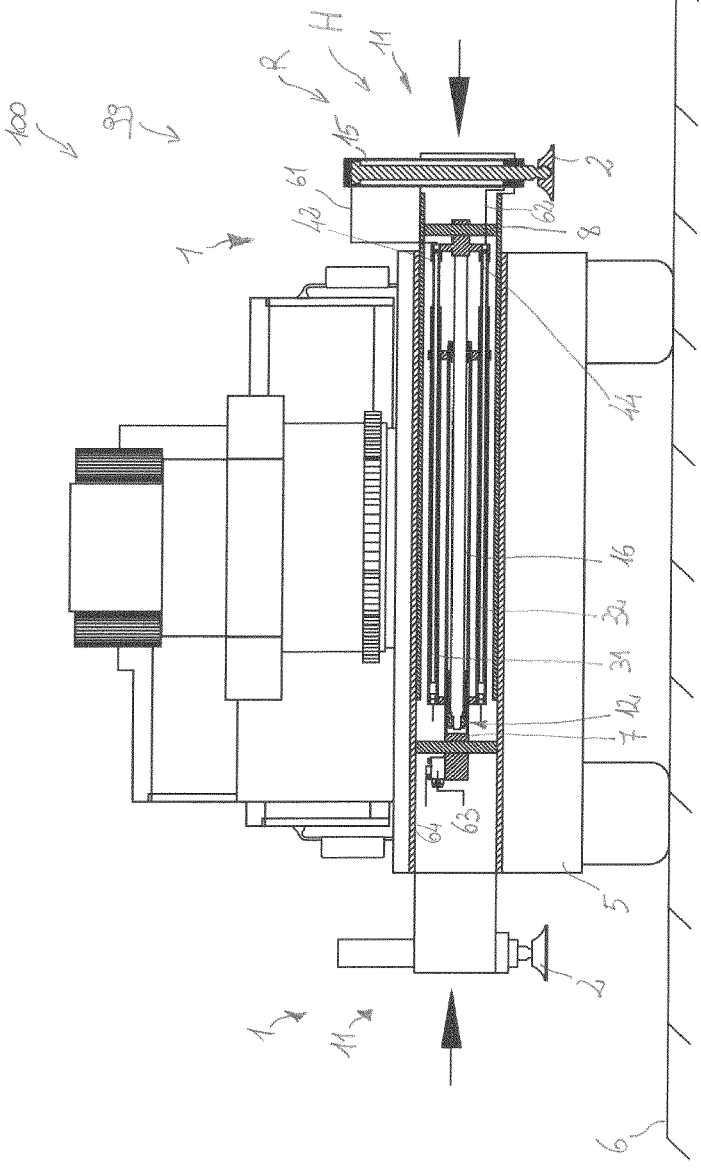


FIG 7

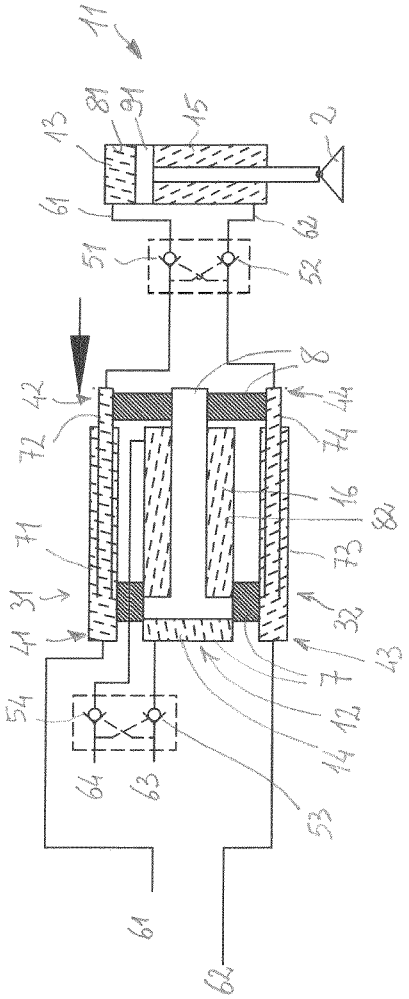


FIG 7A

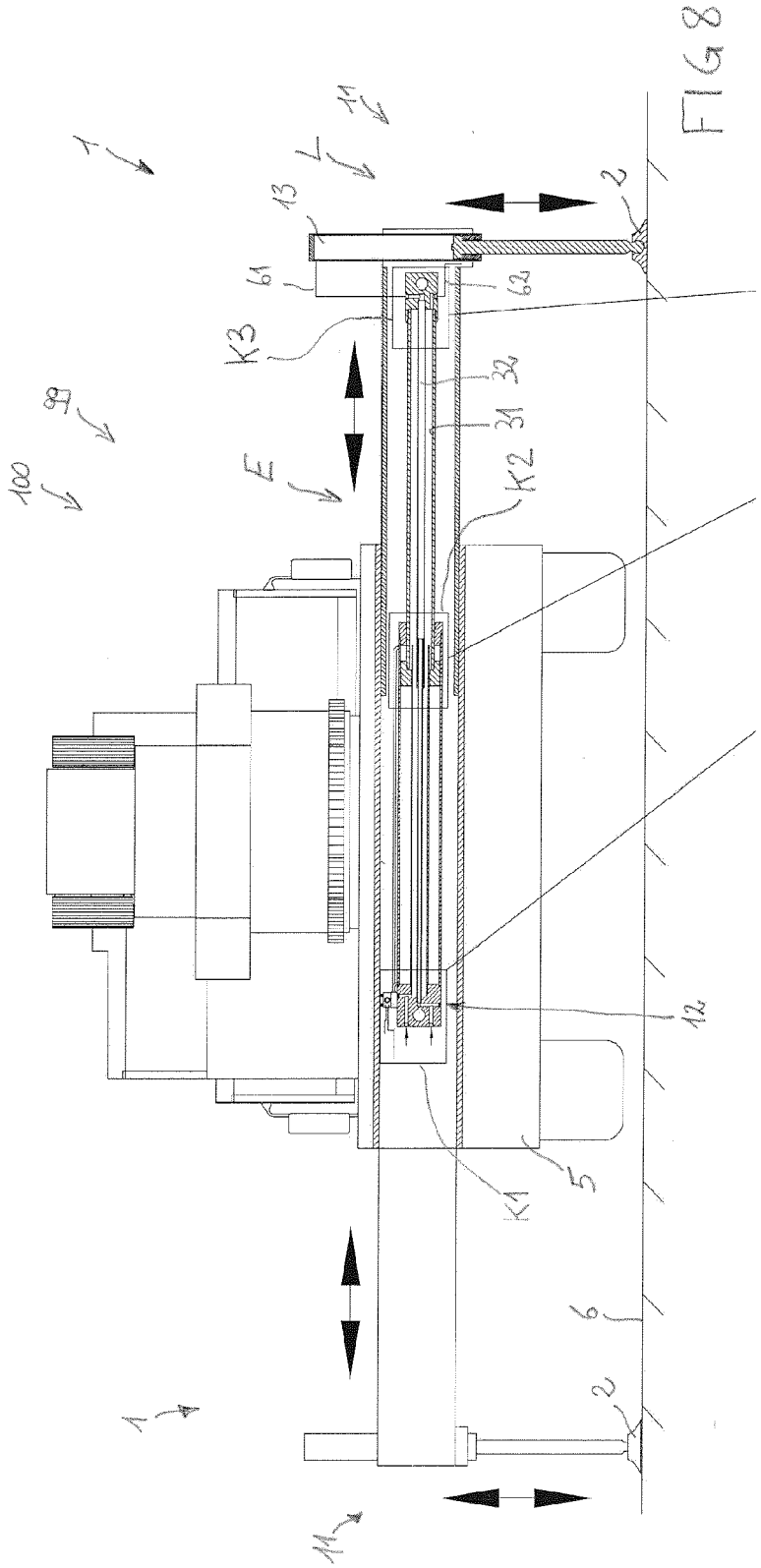


FIG 8
1
11
L
13
2
61
62
K3
32
31
99
100
E
K2
12
K1
5
6
4
11

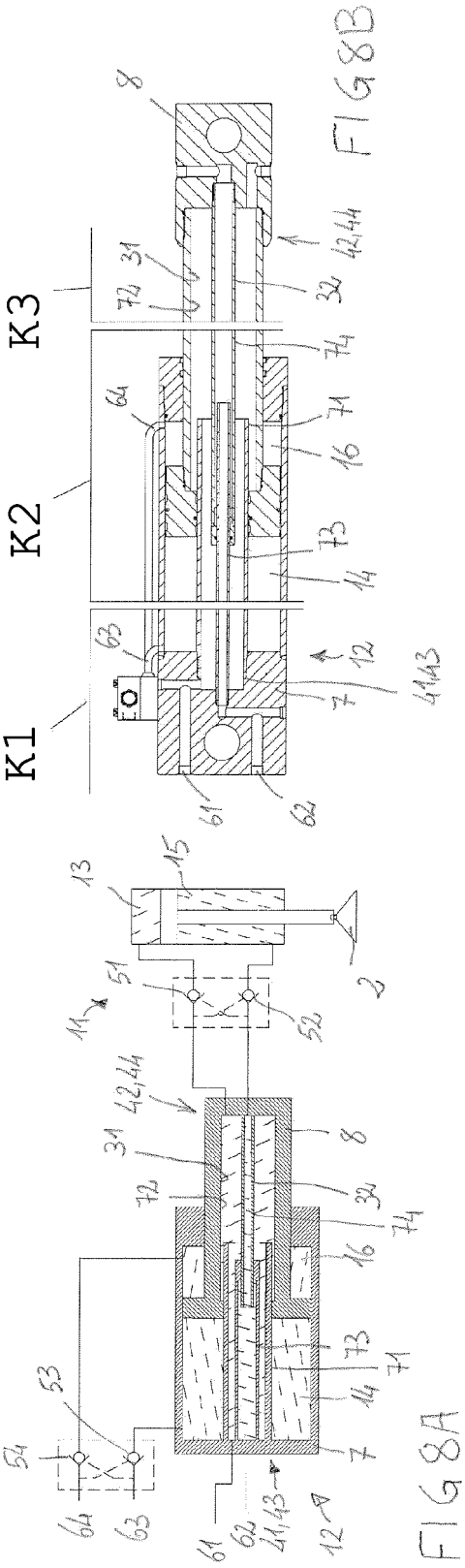
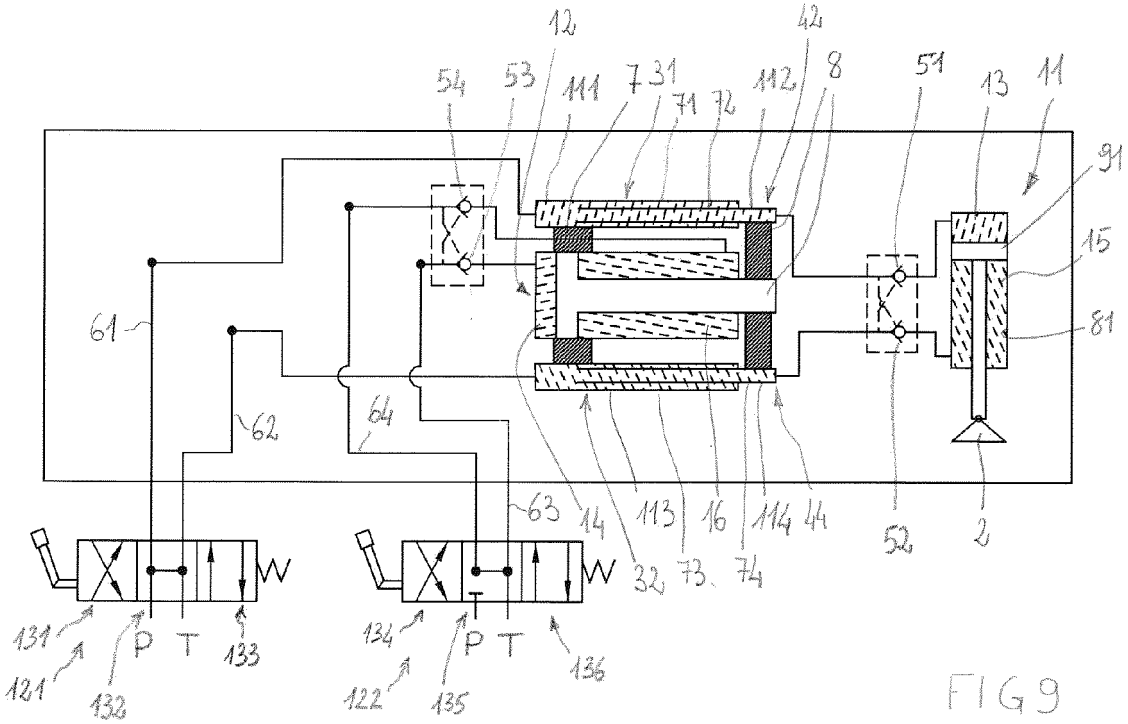

K1
K2
K3
8
1
42,44
31
72
32
74
64
71
16
73
14
63
12
7
41,43
61
62
13
15
2
51
52
11
53
54

FIG 8B

FIG 8A


12
42
54
53
111
7
31
71
72
112
8
51
13
11
91
15
81
61
62
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63
14
113
16
114
44
52
2
32
73
74
131
121
132
P
T
133
134
122
135
P
T
136

FIG 9

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EUROPEAN SEARCH REPORT

Application Number
EP 20 16 7927

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X Y A	US 3 856 152 A (PARRETT J ET AL) 24 December 1974 (1974-12-24) * column 1, lines 9-48 * * column 3, line 57 - column 14, line 23 * * figures * -----	1,2,5, 8-10 3,4,6 7	INV. B66C23/80 B66C13/12 B60S9/12
X Y	CN 2 601 238 Y (SANSE LIGHTING CO LTD ANHUI PR [CN]) 28 January 2004 (2004-01-28) * abstract; figures * -----	1,5,8,10 4,6	
Y A	US 6 813 988 B2 (KRUPPA LEONARD [US] ET AL) 9 November 2004 (2004-11-09) * column 1, lines 15-23 * * column 1, lines 24-50 * * columns 3-4 * * figures * -----	3 1,8,10	
A	DE 93 01 899 U1 (LANGERBEIN-SCHARF GMBH & CO) 29 July 1993 (1993-07-29) * page 3, line 16 - page 6, line 26 * * figures * -----	1	TECHNICAL FIELDS SEARCHED (IPC) B66C B60S

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	18 August 2020	Özsoy, Sevda

CATEGORY OF CITED DOCUMENTS

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18-08-2020

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CN 2601238 Y	28-01-2004	NONE	
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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

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- US 3856152 A **[0009]**