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(54) Concealed door closer with adjustable back check

(57) A concealed door closer (10) with an adjustable back check includes a mount (20), a pivot unit (30) mounted to the mount, two damping units (40) connected with the pivot unit, two flow adjusting valves (50a, 50b) mounted in the mount, and a back check adjusting valve (60) mounted in the mount. An external force for opening door drives the pivot unit to rotate so as to actuate the damping units to move. The back check exerting on the door leaf during opening door can be adjusted subject to different conditions by controlling the position of the back check adjusting valve. As soon as the external force exerting on the door leaf for opening the door leaf is released, the door leaf will be gradually closed by the actuation of the damping units, and the speed at which the door closer closes the door can be adjusted by controlling the flow adjusting valves.

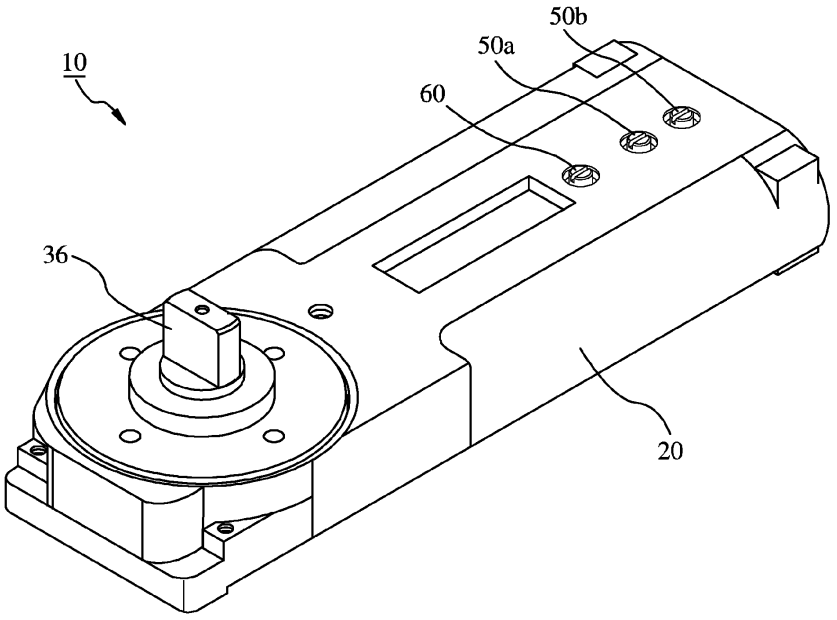


FIG.1

EP 2 505 755 A2

Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention relates generally to concealed door closers and more particularly, to such a concealed door closer having an adjustable back check.

2. Description of the Related Art

[0002] A door closer is an apparatus for automatically closing a door leaf after the door leaf is opened. By means of a concealed door closer or a surface-mounted door closer connected between the door leaf and the door frame, the door leaf can be automatically closed after it is opened. Taking a concealed door closer, such as a floor hinge, for example, the external force exerting on the door leaf for opening the door leaf will cause a pivot that is connected with the door leaf to rotate and the rotation motion of the pivot will drive a damping unit to move and store the energy for returning the door leaf. As soon as the external force exerting on the door leaf is released, the door leaf will be automatically returned to its closed position because the resilient rebounding force provided by the spring of the damping unit will force the pivot to turn reversely.

[0003] Generally, concealed door closers may not be supplied with an optional 'back check' function. The back check function controls the amount of resistance against a door passing a selected point. It provides resistance within the door closer to prohibit the door leaf from being thrown open, thereby preventing the door leaf, especially a glass door leaf from damage caused by people kicking or throwing the door open and also by the door being violently blown open by the wind. However, the back check function built in the conventional concealed door closer is fixed, unadjustable, resulting in that the preset magnitude of the back check may let a weak person feel too hard to open the door and a strong person feel too easy to open the door. In other words, the back check of the conventional concealed door closer can not be adjusted subject to different conditions of use, which is in need of improvement.

SUMMARY OF THE INVENTION

[0004] The present invention has been accomplished in view of the above-noted circumstances. It is an object of the present invention to provide a concealed door closer, which can adjust the magnitude of the back check subject to different conditions of use.

[0005] Another object of the present invention is to provide a concealed door closer that can forcedly release an exceeding pressure exerting thereon so as to prevent damage thereof.

[0006] To attain the above-mentioned objects, the present invention provides a concealed door closer with adjustable back check, which comprises a mount, a pivot unit, two damping units, at least one flow adjusting valve and a back check adjusting valve. The mount is provided with an interior oil chamber, an oil guiding passage in fluid communication with the oil chamber, at least one first adjustment hole inwardly extending from a surface of the mount in fluid communication with the oil guiding passage, and a second adjustment hole inwardly extending from the surface of the mount in fluid communication with the oil guiding passage. The pivot unit is rotatably disposed in the oil chamber of the mount and has a pivot extending through a top surface of the mount and being rotatable by a pushing or drawing force exerting on the door leaf connected with the pivot. The two damping units are disposed in the oil chamber of the mount, located by two lateral sides of the oil guiding passage respectively and connected with the pivot unit, such that the damping units are able to be driven by a rotation movement of the pivot unit to move along a longitudinal direction of the mount so as to provide a damping effect upon opening or closing door. The flow adjusting valve is disposed in the first adjustment hole and insertable into the oil guiding passage of the mount to control the flow rate of the hydraulic oil running in the oil guiding passage. The back check adjusting valve is disposed in the second adjustment hole, insertable into the oil guiding passage of the mount, and located between the pivot unit and the flow adjusting valve to control the flow rate of the hydraulic oil running from the oil chamber into the oil guiding passage upon opening door.

[0007] Preferably, each damping unit is equipped with a pressure releasing valve that can forcedly release the hydraulic oil under the condition that the back check adjusting valve is completely tightened in the second adjustment hole and the door leaf is forced to open or the door leaf is forced by a wind blow or an external force to close, thereby preventing the door closer from damage due to an exceeding pressure.

BRIEF DESCRIPTION OF THE DRAWING

[0008] The present invention will become more fully understood from the detailed description given herein below and the accompanying drawings which are given by way of illustration only, and thus are not limitative of the present invention, and wherein:

FIG. 1 is a perspective view of a door closer according to a preferred embodiment of the present invention;

FIG. 2 is an exploded view of the door closer in accordance with the preferred embodiment of the present invention;

FIG. 3 is a cross-sectional view of the door closer of the preferred embodiment of the present invention, showing that the pistons are moved leftward to block the first oil conduit;

FIG. 4 is a partially cross-sectional view of the door closer of the preferred embodiment of the present invention, showing that the back check adjusting valve is completely tightened in the second adjustment hole;

FIG. 5 is similar to FIG. 4, but showing that the back check adjusting valve is loosened;

FIG. 6 is anther partially cross-sectional view of the door closer of the preferred embodiment of the present invention, showing that the pressure releasing valve is forced to open;

FIG. 7 is similar to FIG. 3, but showing that the pistons are moved rightward to block the first and fourth oil conduits;

FIG. 8 is similar to FIG. 5, showing that the flow adjusting valves are completely tightened;

FIG. 9 is similar to FIG. 8, but showing that one of the flow adjusting valves is loosened;

FIG. 10 is similar to FIG. 7, but showing that the pistons are moved rightward to block the third oil conduit;

FIG. 11 is similar to FIG. 9, showing that one flow adjusting valve is completely tightened in the first adjustment hole, and

FIG. 12 is similar to FIG. 11, but showing that the flow adjusting valve is loosened.

DETAILED DESCRIPTION OF THE INVENTION

[0009] As shown in FIGS. 1—2, the door closer, denoted by reference numeral 10 and provided by a preferred embodiment of the present invention, comprises a mount 20, a pivot unit 30, two damping units 40, two flow adjusting valves 50a and 50b, a back check adjusting valve 60, a check valve 70, and two pressure releasing valves 80.

[0010] Referring to FIGS. 2-4, the mount 20 is shaped like an elongated cubic and provided at an inside thereof with an oil chamber 21 for storage of hydraulic oil, an oil guiding passage 22 communicated with the oil chamber 21, and two first adjustment holes 23a and 23b and a second adjustment hole 24, which inwardly extend from a top surface of the mount 20 and are communicated with the oil guiding passage 22 respectively. The oil guiding passage 22 is composed of a first section 221, a second section 223 beneath the first section 221, and a third section 225 above the second section 223. A steel ball 227 is disposed between the first and third sections 221 and 225 to block the first section 221 from the third section 225. Further, an end of the first section 221 is communicated with the oil chamber 21 and the other end of the first section 221 is communicated with the second section 223 through the second adjustment hole 24. Two ends of the second section 223 are communicated with the oil chamber 21 through a first oil conduit 25 and a second oil conduit 26 respectively. The third section 225 is communicated with the first adjustment holes 23a and 23b. Through the first adjustment hole 23a, the third section 225 is communicated with the second section 223. By means of a third oil conduit 27 located between the two first adjustment holes 23a, 23b and a fourth oil conduit 28 located between the first adjustment hole 23a and the second adjustment hole 24, the third section 225 is communicated with the oil chamber 21. Furthermore, the mount 20 is further provided with a mounting hole 29, which inwardly extends from a rear surface of the mount 20 and is communicated with the second section 223 of the oil guiding passage 22, the second oil conduit 26 and the first adjustment hole 23b.

[0011] As shown in FIGS. 2-3, the pivot unit 30 includes two plates 32 disposed in the oil chamber 21 face to face, three rollers 34 mounted between the two plates 32 and located at three vertexes of an imaginary triangle respectively, and a pivot 36 rotatably mounted between the two plates 32 and located at a center among the three rollers 34. The pivot 36 has a top end extending through the top surface of the mount 20 for connection with a door leaf, and a bottom end provided with a cam 362, which is pushable against one of the three rollers 34 when the pivot 30 is rotated so as to move the two plates 32 along the longitudinal direction of the mount 20.

[0012] The two damping units 40 are disposed inside the oil chamber 21 of the mount 20 and located by two lateral sides of the oil guiding passage 22 respectively. Since two damping units 40 are identical to each other, hereunder only one unit will be described for concise illustration. As shown in FIGS. 2-3, the damping unit 40 includes a link 42, a spring 44 and a piston 46. An end of the link 42 is connected between the two plates 32 and the other end of the link 42 is connected with the piston 46. The spring 44 is sleeved onto the link 42 and located between the two plates 32 and the piston 46. In this way, the movement of the plates 32 will drive the piston 46 that is mounted to the link 42 to move along the longitudinal direction of the mount 20. During the movement of the piston 46, the spring 44 will be compressed to store energy for returning the spring 44 to its former shape.

[0013] The flow adjusting valves 50a and 50b are screwingly inserted into the first adjustment holes 23a and 23b respectively in such a way that they are insertable into the oil guiding passage 22 of the mount 20, as shown in FIGS. 2 and 4, such that the speed at which the door closer 10 closes the door can be adjusted by adjusting the flow rate of the hydraulic oil through the flow adjusting valves 50a and 50b.

[0014] The back check adjusting valve 60 is screwingly inserted into the second adjustment hole 24 in such a way that it is insertable into the oil guiding passage 22 of the mount 20. The back check adjusting valve 60 is located between the pivot unit 30 and the flow adjusting valve 50a for controlling the flow rate of the hydraulic oil running from the first section 221 of the oil guiding passage 22 into the second section 223 of the oil guiding passage 22, as shown in FIGS. 2 and 4. The back check adjusting valve 60 is composed of a first valve body 62 and a steel made first check valve ball 64. The first valve

body 62 has a first stepped hole 622 extending along a longitudinal direction thereof in fluid communication with the second section 223 of the oil guiding passage 22, and a first through hole 624 transversely extending in communication with the first stepped hole 622 and the first section 221 of the oil guiding passage 22. The first check valve ball 64 is moveably mounted in the first stepped hole 622 and normally located adjacent to the diameter reducing portion of the first stepped hole 622. The ball 64 can be driven by oil pressure to move away from the aforesaid diameter reducing portion to an open position for allowing the hydraulic oil to run from the second section 223 of the oil guiding passage 22 to the first section 221 of the oil guiding passage 22 through the first stepped hole 622 and the first through hole 624. Because the first check valve ball 64 blocks the first stepped hole 622 in one way, it can prohibit the hydraulic oil in the oil chamber 21 from running into the second section 223 of the oil guiding passage 22 from the first section 221 of the oil guiding passage 22 through the through hole 624 and the stepped hole 622.

[0015] The check valve 70 is screwingly inserted into the mounting hole 29 and provided with a valve body 72 and a steel made second check valve ball 74, as shown in FIG. 4. The valve body 72 has a second stepped hole 722 extending along a longitudinal direction thereof in fluid communication with the second section 223 of the oil guiding passage 22, and a second through hole 724 transversely extending in fluid communication with the second stepped hole 722 and the second oil conduit 26. The second check valve ball 74 is moveably mounted in the second stepped hole 722 and normally located adjacent to the diameter reducing portion of the second stepped hole 722. The second check valve ball 74 can be driven by oil pressure to an open position for allowing the hydraulic oil to run from the second section 223 of the oil guiding passage 22 to the oil chamber 21 through the second stepped hole 722, the second through hole 724 and the second oil conduit 26. As shown in FIGS. 4 and 5, the hydraulic oil in the oil chamber 21 can not flow into the second section 223 of the oil guiding passage 22 through the second conduit 26 because of the one-way blocking effect provided by the second check valve ball 74.

[0016] The two pressure releasing valves 80 are respectively mounted in the pistons 46 of the two damping units 40 and arranged in two reverse pressure releasing directions for fitting different door opening directions. The two pressure releasing valves 80 are identical to each other. Hereinafter only one pressure releasing valve 80 will be recited for concise illustration. As shown in FIGS. 2 and 3, the pressure releasing valve 80 comprises a third valve body 82 mounted in the piston 46 and provided with a third stepped hole 822 extending along a longitudinal direction thereof, a third check valve ball 84 moveably mounted in the third stepped hole 822 and located normally adjacent to the diameter reducing portion thereof, a pin 86 transversely mounted in the valve body 82 across the third stepped hole 822, and a spring 88 mounted between the third check valve ball 84 and the pin 86 for providing the third check valve ball 84 a return force. In a normal situation, the third check valve ball 84 will block the hydraulic oil in oil chamber 21 from flowing from a left side of the piston 46 to a right side of the piston 46 through the third stepped hole 822 as shown in FIG. 3. However, when the oil pressure exceeds over the resilient force exerting on the third check valve ball 84 by the spring 88, the third check valve ball 84 will be forced to move to a position allowing the hydraulic oil to flow from the left side of the piston 46 to the right side of the piston 46 through the third stepped hole 822 as shown in FIG. 6.

[0017] The configuration of the concealed door closer 10 of the present invention has been detailedly described in the above paragraphs. The operation and feature of the concealed door closer of the present invention will be recited hereunder.

[0018] When the door leaf connected with the pivot 36 is opened to drive the pivot 36 to rotate, the cam 362 at the bottom of the pivot 36 will push one of two rollers 34 that are located by a left side of the cam 362 to drive the plates 32 to move leftward along the longitudinal direction of the mount 20, such that the two pistons 46 of the damping units 40 will gradually move leftward along with the plates 32, as shown in FIG. 3. In the meantime, the hydraulic oil in the oil receiving camber 21 at the left side of the pistons 46 will flow to the second section 223 of the oil guiding passage 22 through the first oil conduit 25, and then flow into the second stepped hole 722 while pushing the second check valve ball 74 of the check valve 70 away, and then pass through the second through hole 724 and the second oil conduit 26 into the oil chamber 21 at the right side of the pistons 46. When the pistons 46 continuously move leftward to a position where the first oil conduit 25 is fully blocked by the pistons 46 under the condition that the back check adjusting valve 60 is fully tightened in the second adjustment hole 24 to block the communication between the first section 221 and the second section 223 of the oil guiding passage 22 as shown in FIG. 4, the pistons 46 will stop moving leftward because the hydraulic oil in the oil chamber 21 is prohibited from flowing from the first section 221 to the second section 223, resulting in that the door leaf will stop opening. If it is this case, the door leaf will open about 54 degrees to 66 degrees and then stop opening. Under this circumstance, if the door leaf is continuously pushed by an external force for opening the door leaf, the third check valve ball 84 of the pressure releasing valve 80 will receive an exceeding oil pressure and then be pushed away, as shown in FIG. 6, to a position allowing the hydraulic oil at the left side of the pistons 46 to flow to the right side of the pistons 46 through the third stepped hole 822 of the pressure releasing valve 80 for forcedly releasing the exceeding pressure. On the other hand, when the pistons 46 continuously move leftward to a position where the first oil conduit 25 is fully blocked by the pistons 46, if the back check adjusting valve 60 is loosened to

allow communication between the first section 221 and the second section 223 of the oil guiding passage 22 as shown in FIG. 5, the hydraulic oil in the oil chamber 21 at the left side of the pistons 46 will flow from the first section 221 of the oil guiding passage 22 to the second section 223 of the oil guiding passage 22 through the gap between the back check adjusting valve 60 and the second adjustment hole 24, and then flow into the second stepped hole 722 while pushing the second check valve ball 74 of the check valve 70 away, and then pass through the second through hole 724 and the second oil conduit 26 into the oil chamber 21 at the right side of the pistons 46.

[0019] If the external force exerting on the door leaf for opening the door leaf is released under the above-mentioned situation, the door leaf, which is supposed to return back to its closed position, will stop moving in case the flow adjusting valve 50a is tightened in the first adjustment hole 23a as shown in FIG. 8. However, if the flow adjusting valve 50a is loosened, the pistons 46 of the damping units 40 will move rightward due to the resilient rebounding force of the springs 44 exerting on the pistons 46. In the meantime, because the pistons 46 of the damping units 46 block the first oil conduit 25 and the fourth oil conduit 28 as shown in FIG. 7, the hydraulic oil in the oil chamber 21 at the right side of the pistons will flow through the third oil conduit 27 and the gap between the flow adjusting valve 50a and the first adjustment hole 23a into the second section 223 of the oil guiding passage 22, and then a part of the hydraulic oil will flow into the oil chamber 22 at left side of the pistons 46 through the gap between the back check adjusting valve 60 and the second adjustment hole 24 and the first section 221 of the oil guiding passage 22, and the other part of the hydraulic oil will flow into the first stepped hole 622 of the back check adjusting valve 60 while pushing the first check valve ball 64 of the back check adjusting valve 60 away, and then pass through the first through hole 624 and the first section 221 of the oil guiding passage 22 into the oil chamber 21 at the left side of the pistons 46, as shown in FIG. 9.

[0020] When the door leaf is closing, the pistons 46 of the damping units 40 will keep moving rightward. As soon as the pistons 46 move rightward to fully block the third oil conduit 27, as shown in FIG. 10, the pistons 46 will stop moving in case the flow adjusting valve 50b is fully tightened in the first adjustment hole 23b as shown in FIG. 11. If it is this case, the door leaf will stop at an angle about 15 degrees. On the other hand, if the flow adjusting valve 50b is loosened as shown in FIG. 12 while the door leaf is closing and the third oil conduit 27 is blocked, the hydraulic oil in the oil chamber 21 at the right side of the pistons 46 will flow into the third section 225 of the oil guiding passage 22 through the second oil conduit 26 and the gap between the flow adjusting valve 50b and the first adjustment hole 23b. Thereafter, because the third oil conduit 27 is fully blocked by the pistons 46 and the fourth oil conduit 28 is not fully blocked by the pistons 46, the hydraulic oil in the third section 225 will have a part thereof flowing into the oil chamber 21 at the left side of the pistons 46 through the fourth oil conduit 28 and the other part thereof passing through the gap between the flow adjusting valve 50a and the first adjustment hole 23a into the second section 223 of the oil guiding passage 22 and then through the first oil conduit 25 into the oil chamber 21 at the left side of the pistons 46 until the door leaf is completely closed.

[0021] From the above disclosure, it can be understood that the back check exerting on the door leaf during opening door and the open angle of door leaf can be adjusted subject to different conditions of use by controlling the position of the back check adjusting valve 60. The deeper the back check adjusting valve 60 is inserted into the second adjustment hole 24, the lesser the hydraulic oil can pass through the gap between the back check adjusting valve 60 and the second adjustment hole 24, i.e. the more the back check will exert on the door leaf during opening door. When the back check adjusting valve 60 is fully tightened in the second adjustment hole 24, the maximum angle that the door leaf can open is about 54 degrees to 66 degrees and the back check exerting on the door leaf reaches a maximum value. On the contrary, the shallower the back check adjusting valve 60 is inserted into the second adjustment hole 24, the more the hydraulic oil is able to pass through the gap between the back check adjusting valve 60 and the second adjustment hole 24, i.e. the lesser the back check will exert on the door leaf. If an exceeding force exerts on the door leaf under the condition that the back check adjusting valve 60 is fully tightened in the second adjustment hole 24, the pressure releasing valve 80 will forcedly function to release the exceeding pressure so as to prevent the door leaf and/or the concealed door closer 10 of the present invention from damage.

[0022] It is to be understood that the purpose of using two flow adjusting valves 50a and 50b is to gain a two-step door closing effect. In practice, the concealed door closer of the present invention can be equipped with one adjusting valve 50a only, such that only one-step door closing effect can be attained.

Claims

1. A concealed door closer, **characterized in that** the concealed door closer (10) comprises:

   a mount (20) having an oil chamber (21), an oil guiding passage (22) in fluid communication with the oil chamber, at least one first adjustment hole (23a) inwardly extending from a surface of the mount in fluid communication with the oil guiding passage, and a second adjustment hole (24) inwardly extending from the surface of the mount in fluid communication with the oil guiding passage;

a pivot unit (30) rotatably disposed in the oil chamber (21) of the mount (20) and having a pivot (34) extending through a top surface of the mount;

two damping units (40) disposed in the oil chamber (21) of the mount (20), located by two lateral sides of the oil guiding passage (22) respectively and connected with the pivot unit (30), such that the damping units are able to be driven by a rotation movement of the pivot unit to move along a longitudinal direction of the mount;

at least one flow adjusting valve (50a) disposed in the at least one first adjustment hole (23a) and insertable into the oil guiding passage (22) of the mount (20); and

a back check adjusting valve (60) disposed in the second adjustment hole (24), insertable into the oil guiding passage (22) of the mount (20), and located between the pivot unit (30) and the flow adjusting valve (50a).

2. The concealed door closer of claim 1, **characterized in that** the oil guiding passage (22) comprises a first section (221), a second section (223) beneath the first section, and a third section (225) above the second section; an end of the first section (221) is in fluid communication with the oil chamber (21) and the other end of the first section (221) is in fluid communication with the second section (223) through the second adjustment hole (24); two ends of the second section (223) are in fluid communication with the oil chamber (21) through a first oil conduit (25) and a second oil conduit (26) respectively; the third section (225) and the second section (223) are in fluid communication with each other through the first adjustment hole (23a) and the third section (225) is in fluid communication with the oil chamber (21) through a third oil conduit (27) that is located by a side of the first adjustment hole (23a) remote from the second adjustment hole (24).

3. The concealed door closer of claim 2, **characterized in that** the third section (225) of the oil guiding passage (22) is further communicated with the oil chamber (21) through a fourth oil conduit (28) located between the first adjustment hole (23a) and the second adjustment hole (24).

4. The concealed door closer of claim 2, **characterized in that** the mount (20) comprises two said first adjustment holes (23a, 23b), which are spaced from each other and located by front and rear sides of the third oil conduit (27) respectively, and the concealed door closer (10) comprises two said flow adjusting valves (50a, 50b); each one of said first adjustment holes (23a, 23b) is inserted with one of said flow adjusting valves (50a, 50b), which is extendable into the oil guiding passage (22) of the mount (20).

5. The concealed door closer of claim 4, **characterized in that** the mount (20) comprises a mounting hole (29) inwardly extending from a rear surface of the mount and being in fluid communication with the second section (223) of the oil guiding passage (22), the second oil conduit (26) and one of said first adjustment holes; a check valve (70) is disposed in the mounting hole.

6. The concealed door closer of claim 5, **characterized in that** the check valve (70) comprises a valve body (72) having a stepped hole (722) extending along a longitudinal direction of the valve body (72) in fluid communication with the second section (223) of the oil guiding passage (22), and a through hole (724) transversely extending and being in fluid communication with the stepped hole (722) and the second oil conduit (26), and a check valve ball (74) moveably mounted in the stepped hole (722) and moveable by an external oil pressure to a position allowing the stepped hole (722) to be communicated with the second section (223) of the oil guiding passage (22).

7. The concealed door closer of claim 2, **characterized in that** the back check adjusting valve (60) comprises a valve body (62) having a stepped hole (622) extending along a longitudinal direction of the valve body (62) in fluid communication with the second section (223) of the oil guiding passage (22), and a through hole (624) transversely extending and being in fluid communication with the stepped hole (622) and the first section (221) of the oil guiding passage (22), and a check valve ball (64) moveably mounted in the stepped hole (622) and moveable by an external oil pressure to a position allowing the stepped hole (622) to be communicated with the second section (223) of the oil guiding passage (22).

8. The concealed door closer of claim 1, **characterized in that** the pivot unit (30) comprises two plates (32), three rollers (34) mounted between the two plates (32), and said pivot (36); the two plates are disposed inside the oil chamber (21) and connected at a side thereof with the two damping units (40); said pivot (36) is rotatably mounted between the two plates (32) and has a top end extending through the top surface of the mount (20), and a bottom end provided with a cam (362), which is pushable against one of the three rollers (34) when the pivot (36) is rotated.

9. The concealed door closer of claim 8, **characterized in that** each of the damping units (40) comprises a piston (46), a link (42) having an end connected between the two plates (32) and the other end connected with the piston (46), and a spring (44) mounted on the link (42) and located between the two plates (32) and the piston (46).

10. The concealed door closer of claim 9, **characterized in that** it further comprises two pressure releasing valves (80) respectively mounted to the pistons (46) of the two damping units (40) in two reverse directions for releasing pressure.

11. The concealed door closer of claim 10, **characterized in that** each of the pressure releasing valves (80) comprises a valve body (82) mounted to one of the pistons (46) and provided with a stepped hole (822) extending along a longitudinal direction of the valve body (82), a check valve ball (84) moveably mounted in the stepped hole (822), a pin (86) transversely mounted in the valve body (82) across the stepped hole (822), and a spring (88) mounted between the check valve ball (84) and the pin (86).

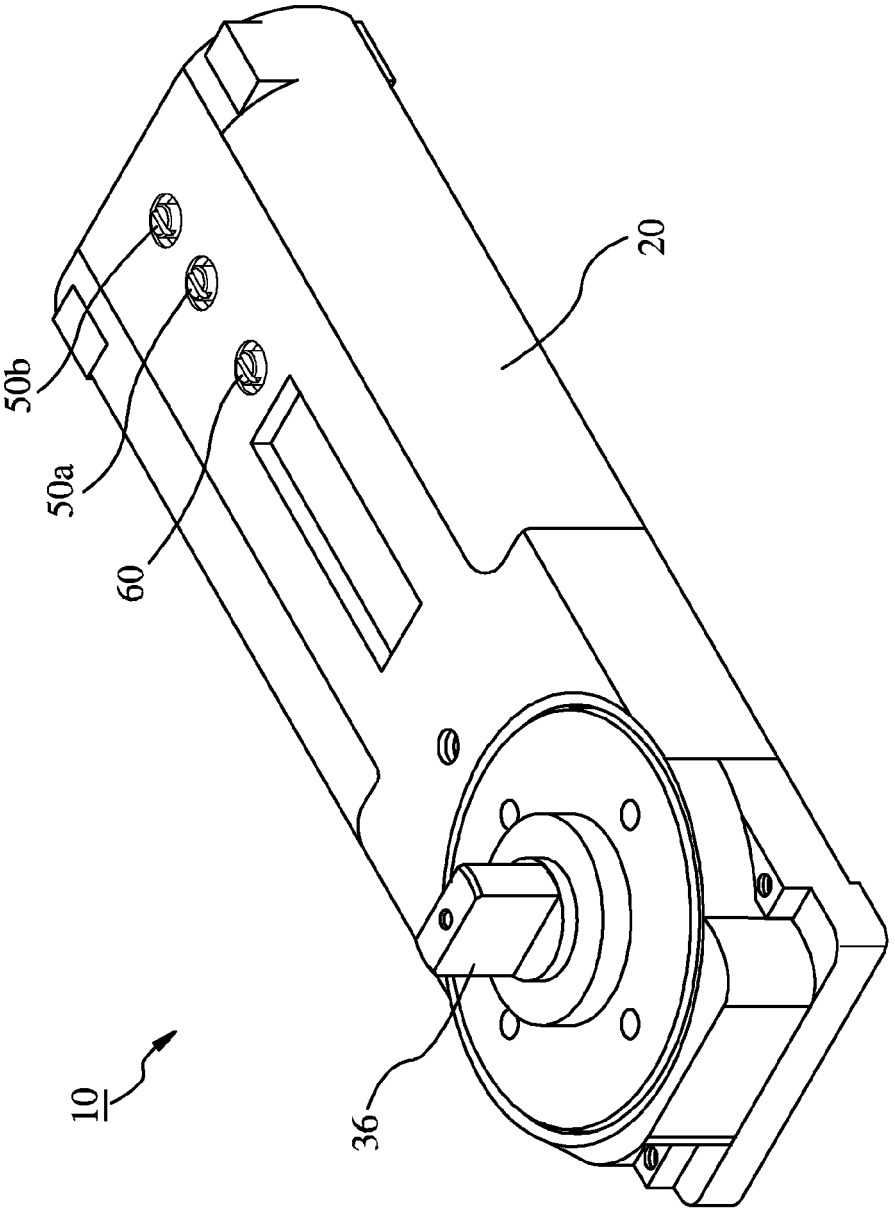
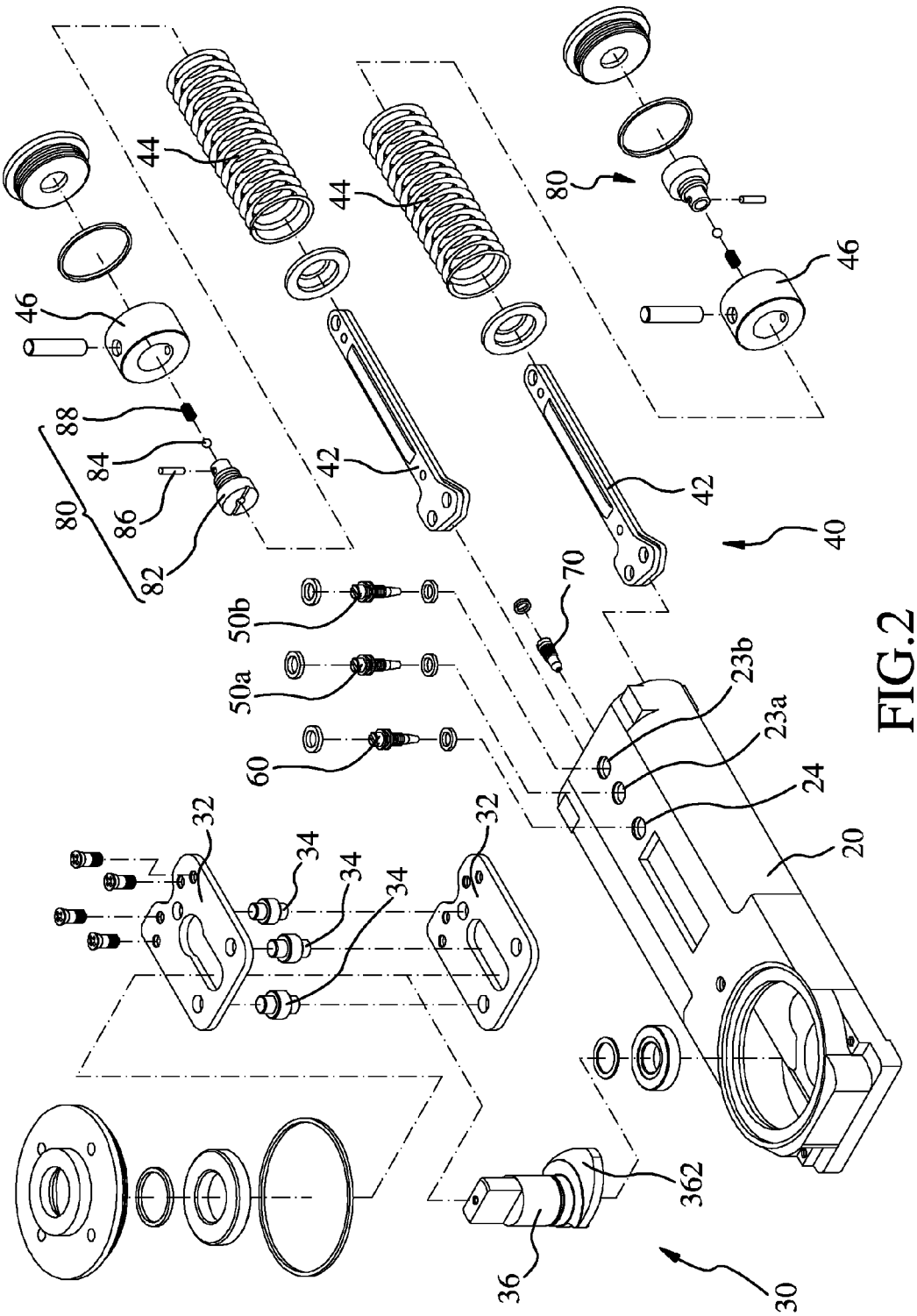


FIG.1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44
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88
84
86
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80
42
42
40
70
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23b
23a
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20
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362
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30

FIG.2

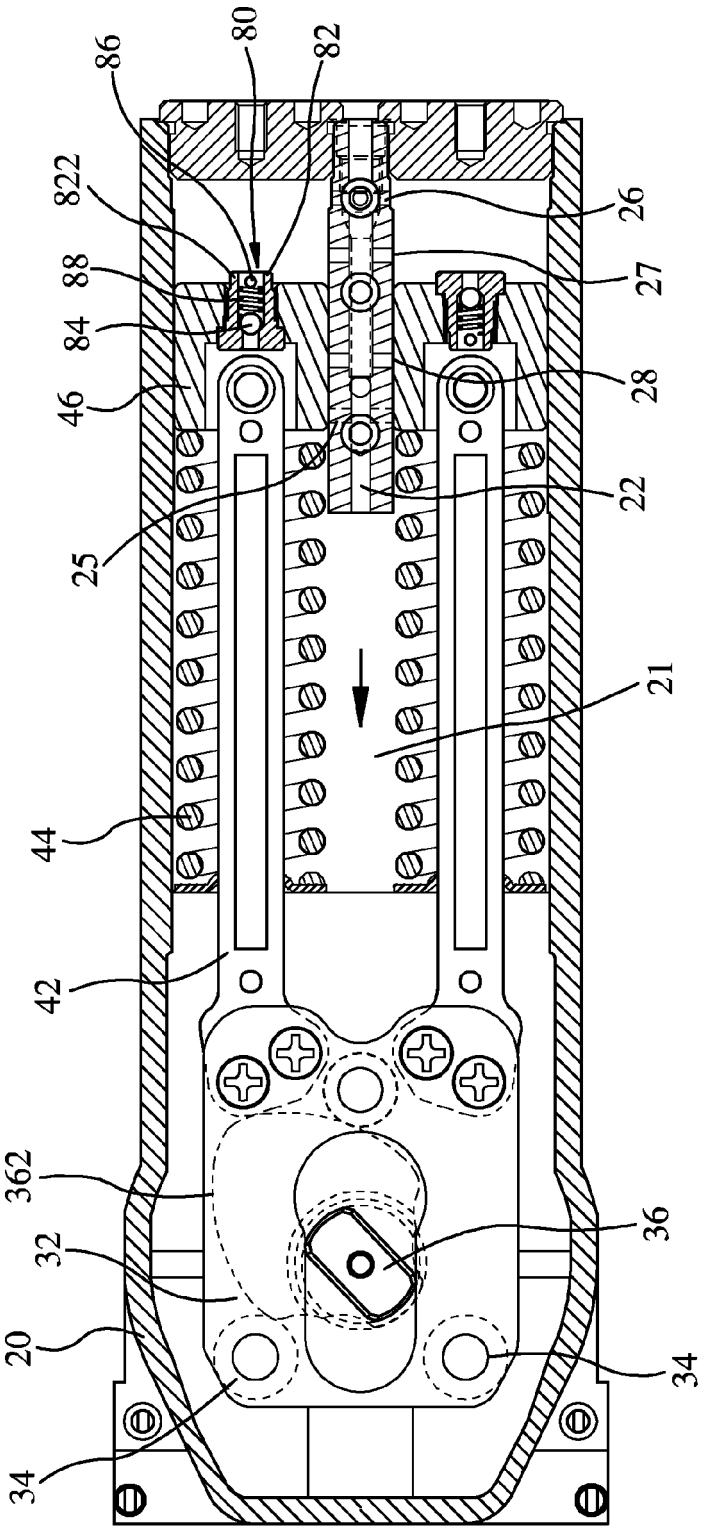

FIG.3

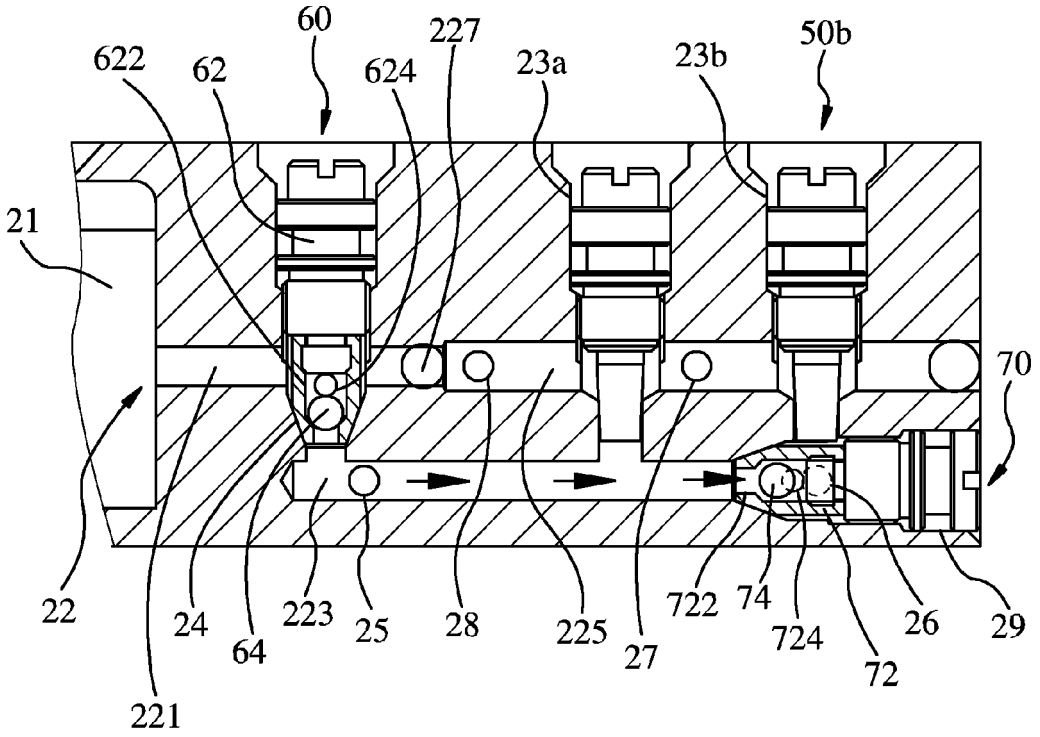
60
622
62
624
227
23a
23b
50b
21
70
22
24
64
223
25
28
225
27
722
74
724
26
29
72
221

FIG.4

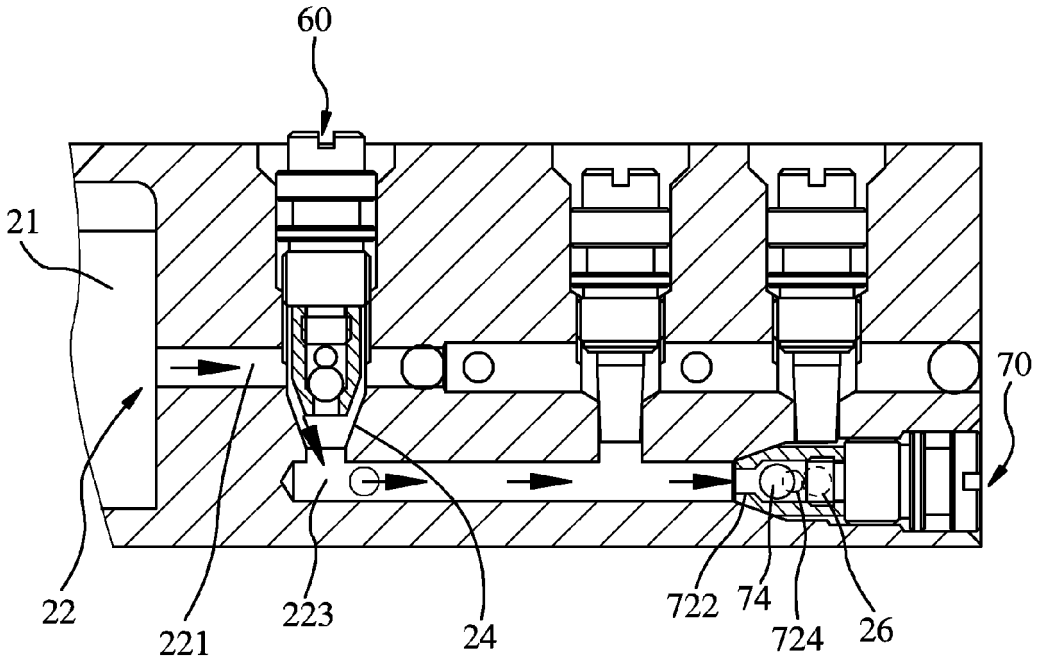
60
21
70
22
221
223
24
722
74
724
26

FIG.5

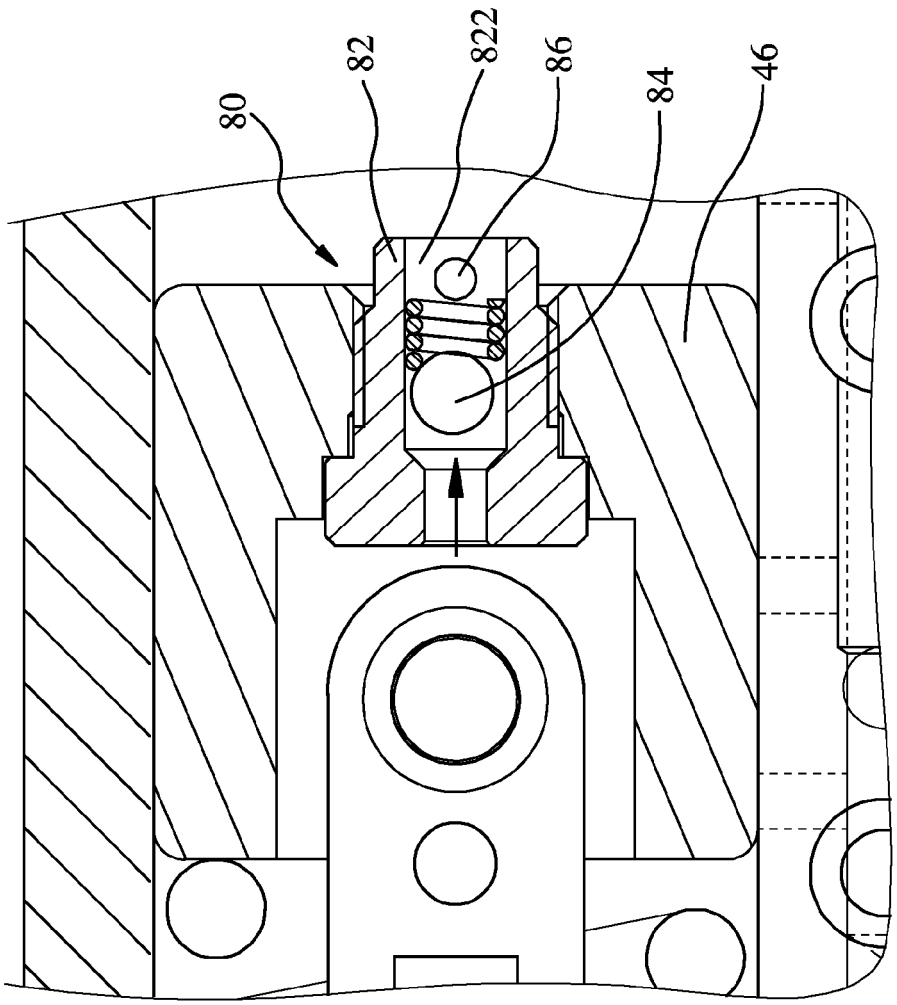

FIG.6

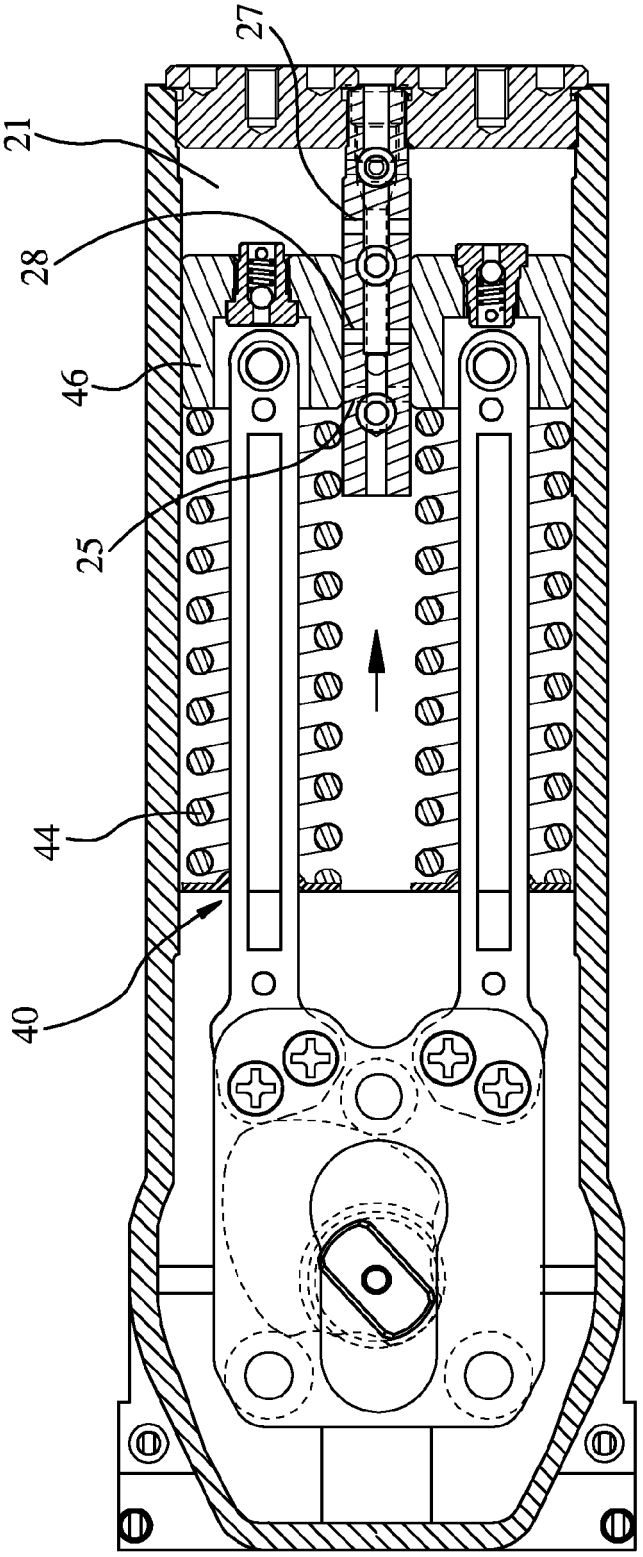

FIG.7

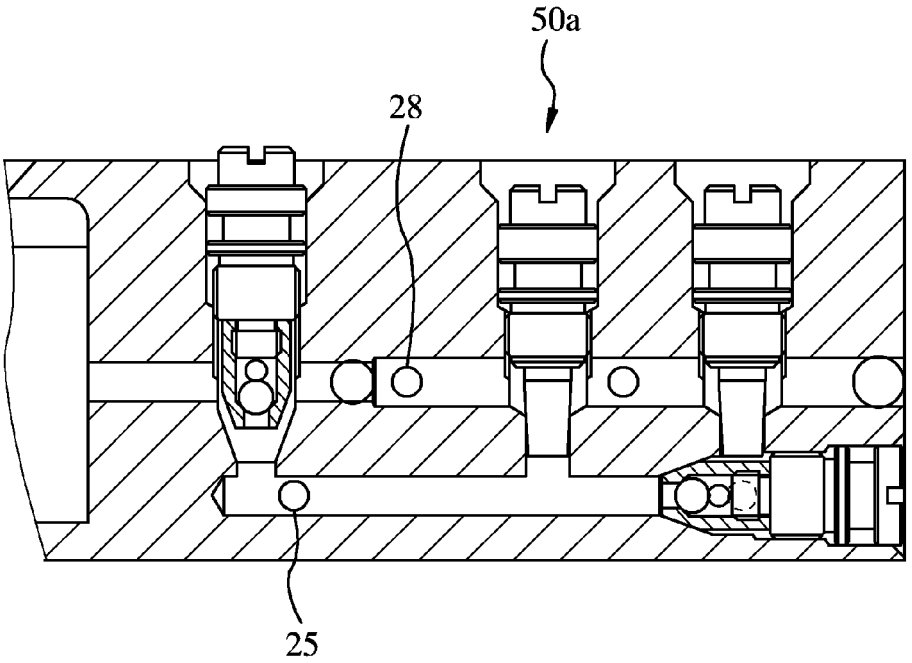

FIG.8

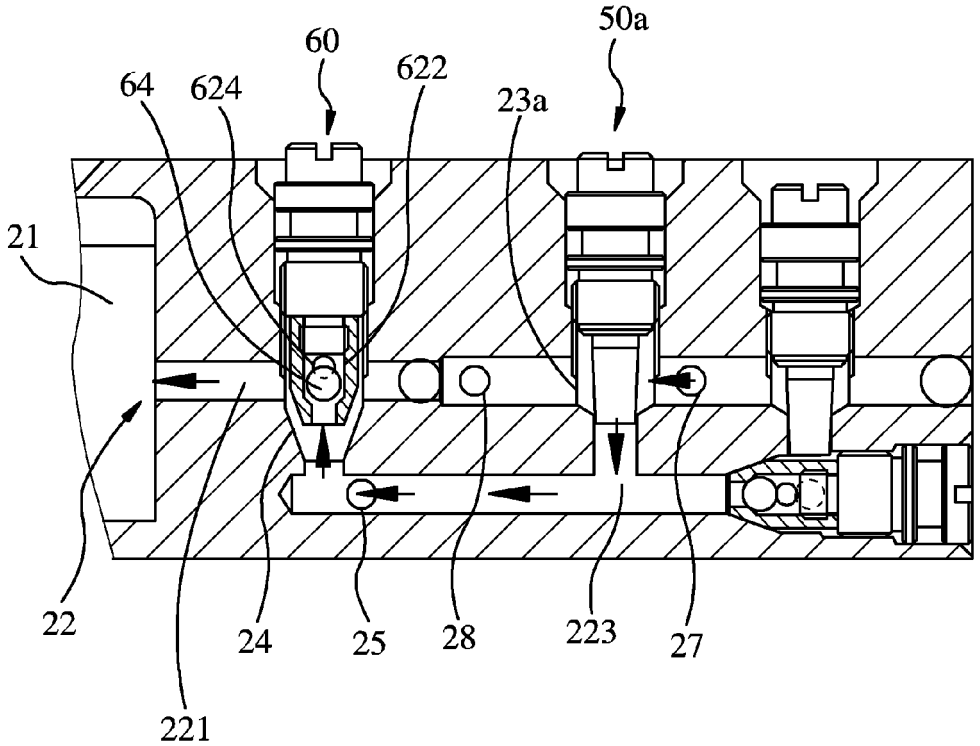

FIG.9

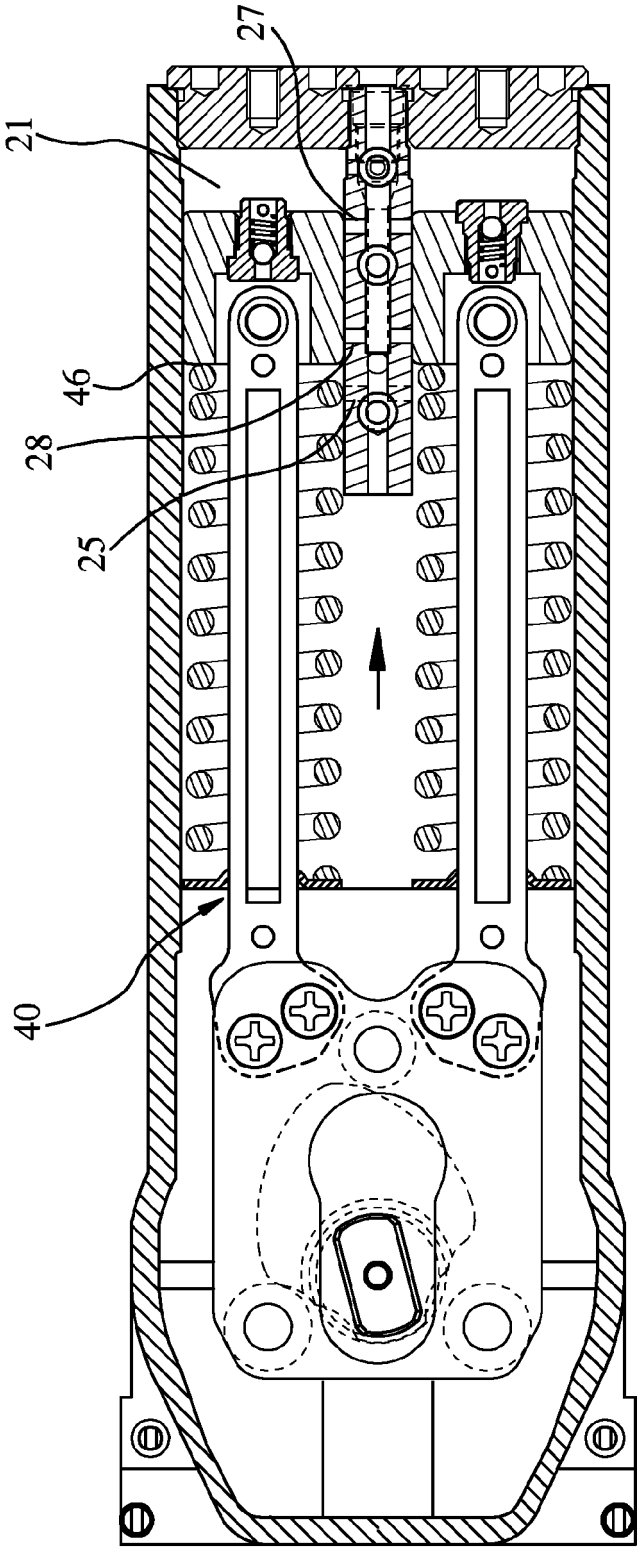

FIG.10

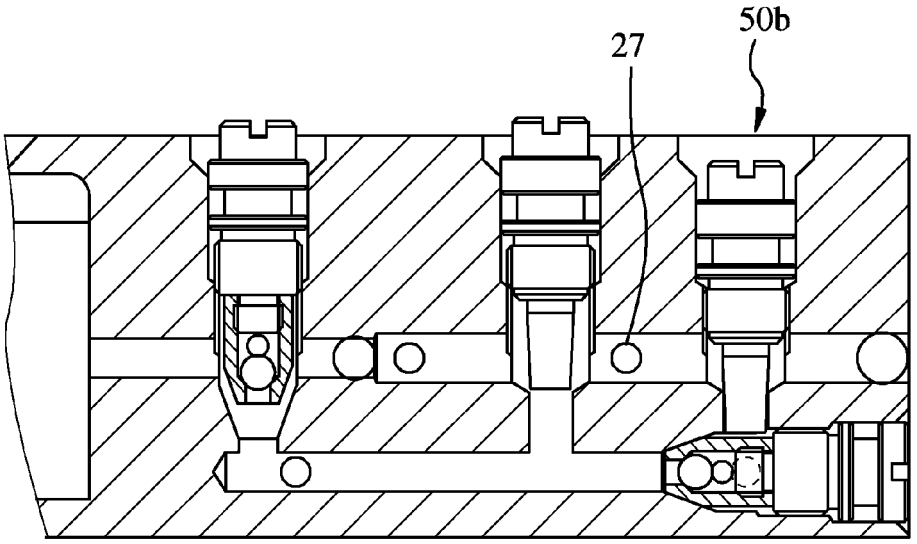

FIG.11

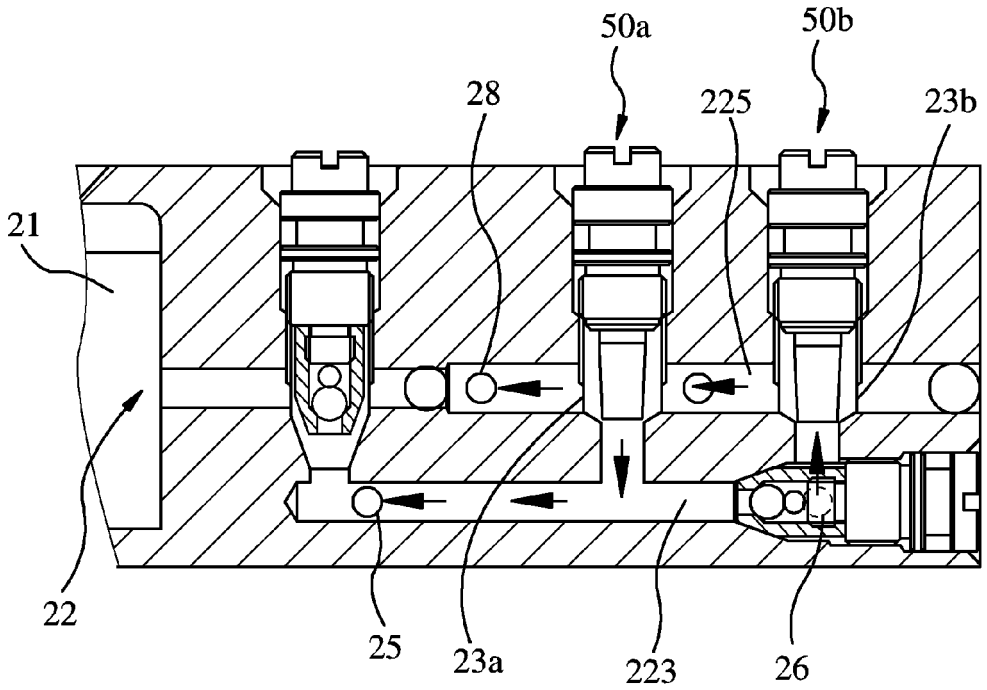

FIG.12