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54 **Door closer.**

57 A door closer for a floor hinge comprises a housing (18) embedded within a floor (14) to which a door (12) is installed. A hinge shaft (20) extends vertically from one side of the housing (18). Two pneumatic cylinders (30A, 30B) are horizontally ar-

ranged side by side within the housing (18) and from which respective piston rods (28A, 28B) extended to both sides of the hinge shaft (20). A V-shaped drive lever (44) is fixed in the centre of the hinge shaft (20) and comprises two legs (48A, 48B).

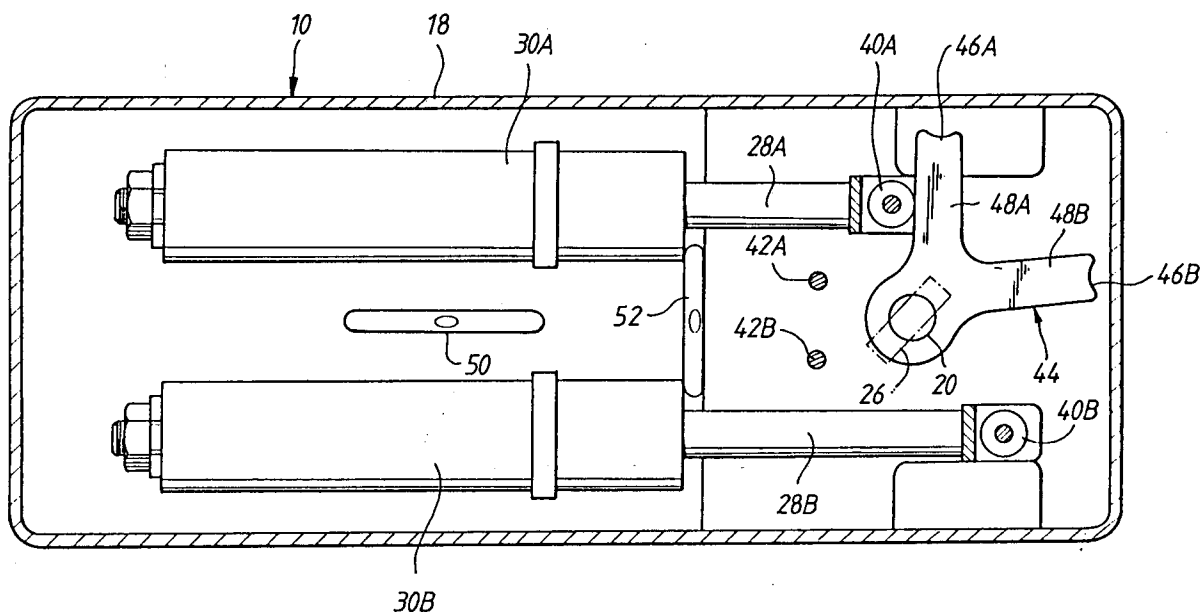


FIG. 4.

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The present invention relates to a door closer, and particularly although not exclusively to a door closer for a floor hinge, in which closing of a door from each direction is controlled by a pneumatic cylinder, with the door being latchable in the fully open position.

In the prior art, a typical door closer for a floor hinge comprises a pneumatic, hydraulic or spring-loaded cylinder housed in a housing being embedded within the floor surface. A piston rod extends towards a hinge shaft of the door, and a cam having a multi-stepped symmetrical cam lobe co-operates with the piston rod on the hinge shaft. In this prior art, the hinge shaft is rotated about its axis when the door is opened, the piston rod of the pneumatic, hydraulic or spring-loaded cylinder is retracted by the cam lobe while the cam mounted to the hinge shaft is rotated, and if an opening force is not further applied to the door by complete opening of the door, the energy accumulated in the cylinder pushes the piston rod, which rotates the hinge shaft through the cam, thereby rotating the door in the direction of closing. The door closer of the prior art, however, has the drawback that a single cylinder is used for both of the two opening directions of the door, and this results in the cylinder becoming fatigued within a short time. In addition, the shape of the cam of the hinge shaft abutting the piston rod must be precisely machined, and latching of the door at the required opening angle is difficult.

An object of the present invention is to provide a door closer in which opening and closing of a door in both directions are under the control of pneumatic cylinders, one for each direction.

Another object of the present invention is to provide a door closer in which the door can be securely latched open in each direction.

A further object of the present invention is to provide a door closer including a means whereby the plane of components within the housing can be horizontally aligned with the surface of floor when the housing of the door closure is embedded within the floor.

According to the present invention there is provided a door closer characterised by a housing arranged to be embedded within a floor to which a door is installed; a vertical hinge shaft extending from the housing; two cylinders, horizontally arranged side-by-side within the housing, each having a piston rod, the piston rods, when extended being positioned one on each side of the hinge shaft; and a V-shaped drive lever connected to the hinge shaft and comprising two legs, each piston rod being arranged to co-operate with a respective one of the legs to close the door.

The piston rod of each pneumatic cylinder may have a roller mounted on its end which abuts a

respective leg of the drive lever. Each leg of the drive lever may have a concave recess formed at its end, which is engaged by the roller mounted on the piston rod of each pneumatic cylinder when the door is opened at the angle of more than 90° , for example, about 100° .

A first levelling means may be placed at the bottom of the housing in the direction of the housing axis and a second levelling means (perpendicular to the first) may be placed adjacent to the first levelling means, such that the hinge shaft can be correctly vertically positioned when the housing is embedded on the floor.

The invention may be carried into practice in a number of ways, and one specific embodiment will now be described, by way of example, with reference to the drawings, in which:

Figure 1 is a sectional view taken on line I-I of Figure 2, illustrating the inner construction of a door closer according to an embodiment of the present invention, when the door is closed;

Figure 2 is a sectional view taken on line II-II of Figure 1;

Figure 3 is a sectional view taken on line III-III of Figure 2;

Figure 4 is a sectional view similar to that of Figure 1, showing the position when the door is opened to an angle of 45° in one direction;

Figure 5 is a sectional view similar to that of Figure 1, showing the position when the door is opened to an angle of 90° in one direction;

Figure 6 is a sectional view similar to that of Figure 1, with the door being latched in an open position, and at an angle of greater than 90° in one direction; and

Figure 7 is a sectional view similar to that of Figure 1, showing the position when the door is opened in the other direction.

The preferred embodiment of the present invention will be explained in more detail with reference to the accompanying drawings.

A door closer 10 comprises a rectangular housing 18 which is embedded in a floor 14 such that an upper cover 16 is flush with the surface of floor. A door 12 is installed above the cover.

A vertical hinge shaft 20 arranged on one side of the housing 18 is supported by bearings 22, 24; the upper end of the hinge shaft 20 comprises a door connecting plate 26 which is fixedly connected to the bottom of the door 12. The hinge shaft 20 can be freely rotated with respect to the housing 18 when the door 12 is opened and closed.

On the other side of the housing 18, two pneumatic cylinders 30A, 30B are arranged side by side. Each cylinder has a piston rod 28A, 28B, and these extended towards respective sides of the hinge shaft 20. The pneumatic cylinders 30A, 30B

are fixed by brackets 32, 33, 34 to the housing 18.

At the front end of each piston rod 28A, 28B, there are mounted respective yokes 36A, 36B. Respective rollers 40A, 40B are rotatively mounted to respective shafts 38A, 38B. Two vertical stops 42A, 42B are mounted on either side of the hinge shaft 20.

A V-shaped drive lever 44 is mounted horizontally in the middle of the hinge shaft 20. The drive lever 44 is symmetrical and comprises two legs 48A, 48B, at the front ends of which there are concave recesses 46A, 46B. Each leg 48A, 48B is located toward a respective side of the housing 18 when the door 12 is closed. Abutting the outer surface of each leg 48A, 48B are the rollers 40A, 40B of the piston rods 28A, 28B, when these are extended to their fullest extent from the pneumatic cylinders 30A, 30B (Figure 1). Each pneumatic cylinder 30A, 30B has equal shape, size and power.

Also, at the bottom of the housing 18, a first levelling member 50 is located, extending in the direction of axis of the housing 18 between the two pneumatic cylinders 30A, 30B. A second levelling member 52 extending perpendicular to the first levelling member 50 is located nearby.

Operation of the preferred embodiment will now be explained. The housing 18 of the door closer 10 is embedded in the floor 14 before an upper cover 16 is applied. One can embed the housing 18 in the floor 14 so that the hinge shaft 20 is correctly aligned in the vertical direction by observing the first and second levels 50, 52. After that, one can complete the floor hinge such that the upper cover 16 is covered and fixed, and the upper door-connecting plate 26 of the hinge shaft 20 is connected to the bottom of the door 12.

When the door 12 is closed, the two legs 48A, 48B of the drive lever 44 are each positioned toward a respective side of the housing 18 as shown on Figure 1, and each piston rod 28A, 28B of the pneumatic cylinder 30A, 30B is extended to its fullest extent so that each roller 40A, 40B mounted at its distal end is abutted against the outer surface of each leg 48A, 48B.

When the door 12 is opened counterclockwise (Figure 4 and Figure 5), the hinge shaft 20 rotates counterclockwise and one leg 48A of the drive lever 44 pushes the piston rod 28A of the pneumatic cylinder 30A via the roller 40A and causes it to be retracted. Figure 4 shows the opened state of the door 12 at an angle of 45° and Figure 5 shows the opened state of the door 12 at an angle of 90°. The other leg 48B of the drive lever 44 separates from the piston rod 28A of the pneumatic cylinder 30B at the other side, and thus is not under the control of the pneumatic cylinder 30B.

When the force which is holding the door open is removed, the piston rod 28A extends by virtue of the accumulated energy of the pneumatic cylinder 30B. This causes the hinge shaft 20 to rotate clockwise, thereby closing the door 12. The other leg 48A of the drive lever 44 rotates clockwise until it abuts the roller 40A of the piston rod 28A.

It may sometimes be desirable to latch the door open, at an angle of more than 90°. In this case, when the door 12 is opened, for example to an angle of 100° in one direction, the leg 48A of the drive lever 44 is rotated further counterclockwise. The piston rod 28A is further retracted, and the roller 40A of the piston rod 28A engages the concave recess 46A of the leg 48A and is latched at the same time (Figure 6). As the roller 40A engages the concave recess 46A, movement of the piston rod 28A is restricted.

Accordingly, the door 12 remains latched open so long as no closing force is applied to the door.

In order to close the door 12 in when it is in the latched state shown in Figure 6, a closing force is applied to the door so that the roller 40A is offset from the concave recess 46A formed in the leg 48A of the drive lever 44. The door 12 is then closed by the power of the pneumatic cylinder 30A.

Figure 7 shows the door closer when the door is open in the other direction. It will be understood that the door is operated in the same manner as in the aforesaid explanation.

Claims

1. A door closer (10) characterised by a housing (18) arranged to be embedded within a floor (14) to which a door (12) is installed; a vertical hinge shaft (20) extending from the housing; two cylinders (30A, 30B), horizontally arranged side-by-side within the housing, each having a piston rod, the piston rods, when extended being positioned one on each side of the hinge shaft; and a V-shaped drive lever (44) connected to the hinge shaft and comprising two legs (48A, 48B), each piston rod (28A, 28B) being arranged to co-operate with a respective one of the legs to close the door.
2. A door closer as claimed in Claim 1 wherein the piston rod (28A, 28B) of each cylinder (30A, 30B) has a roller (40A, 40B) which is arranged to abut the respective leg (48A, 48B) of the drive lever (44).
3. A door closer as claimed in Claim 1 or Claim 2 in which each leg (48A, 48B) of the drive lever has a concave recess formed at its end, which engages with the respective piston rod (28A,

28B) when the door is opened more than a predetermined amount.

4. A door closer as claimed in Claim 3 when dependent upon Claim 2 in which each roller (40A, 40B) is arranged to engage with the respective recess. 5
5. A door closer as claimed in any one of the preceding claims in which one of the legs (48A, 48B) moves out of contact with the respective piston rod (28A, 28B) when the door is pushed to an open position, the door being urged closed by virtue of the other piston rod pressing against the other leg. 10
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6. A door closer as claimed in any one of the preceding claims including stop means (42A, 42B) secured to the housing, which abut one of the legs (48A, 48B) when the door is in a predetermined fully open position and so prevent the door being opened further. 20
7. A door closer as claimed in any one of the preceding claims including mutually-perpendicular first and second levelling means (50, 52) within the housing. 25

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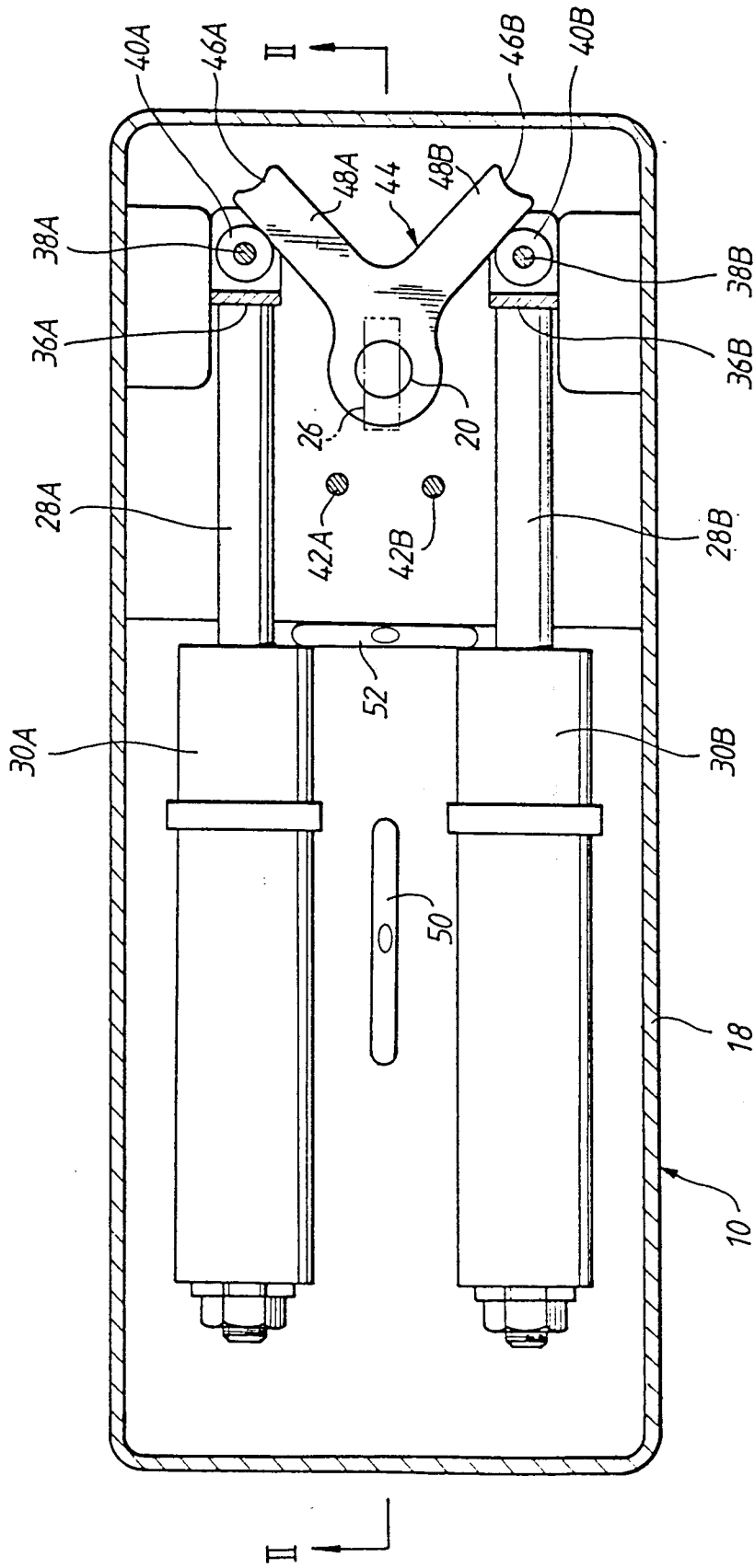


FIG. 1.

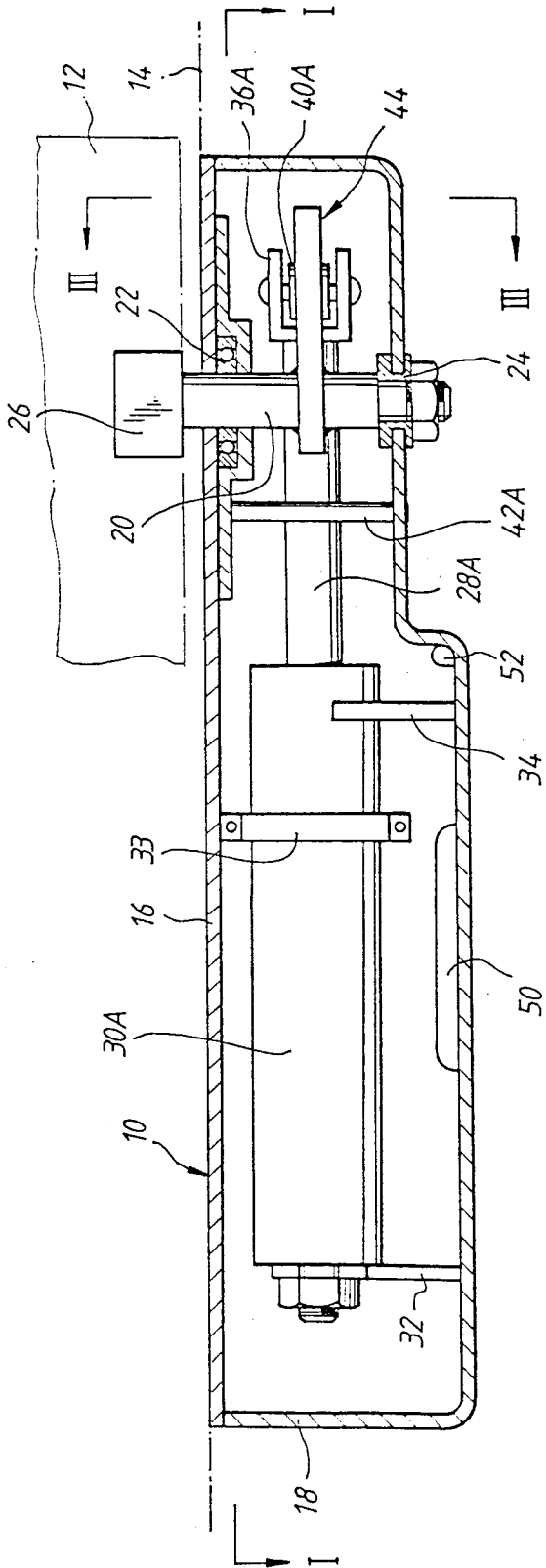


FIG. 2.

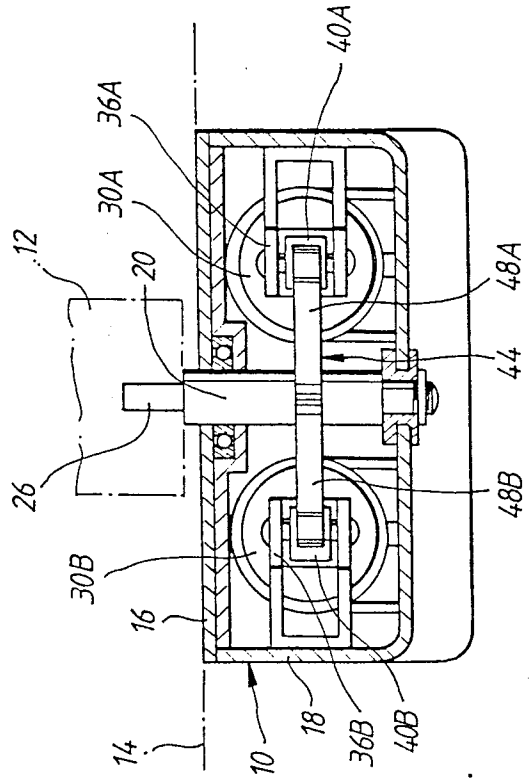


FIG. 3.

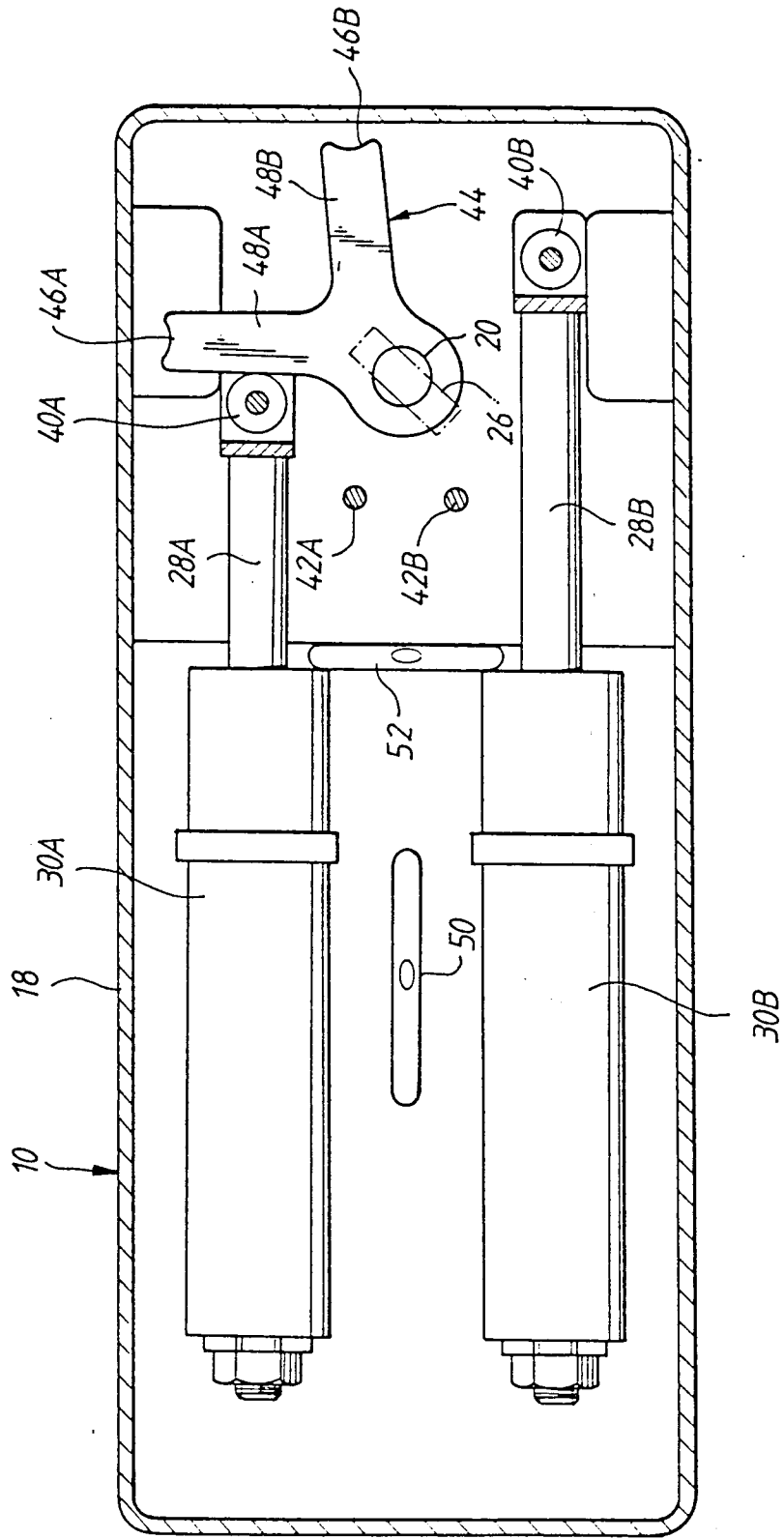


FIG. 4.

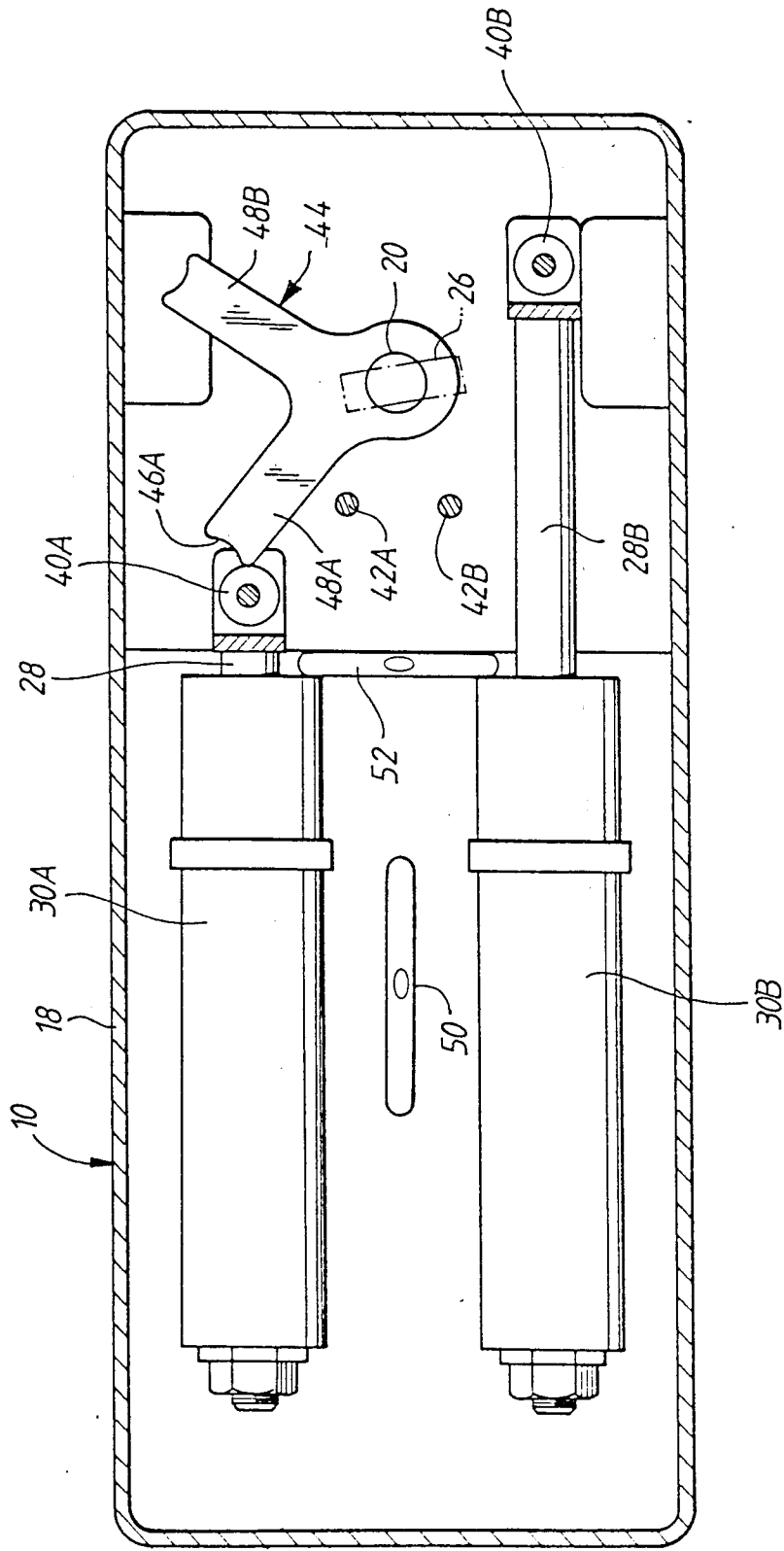


FIG. 5.

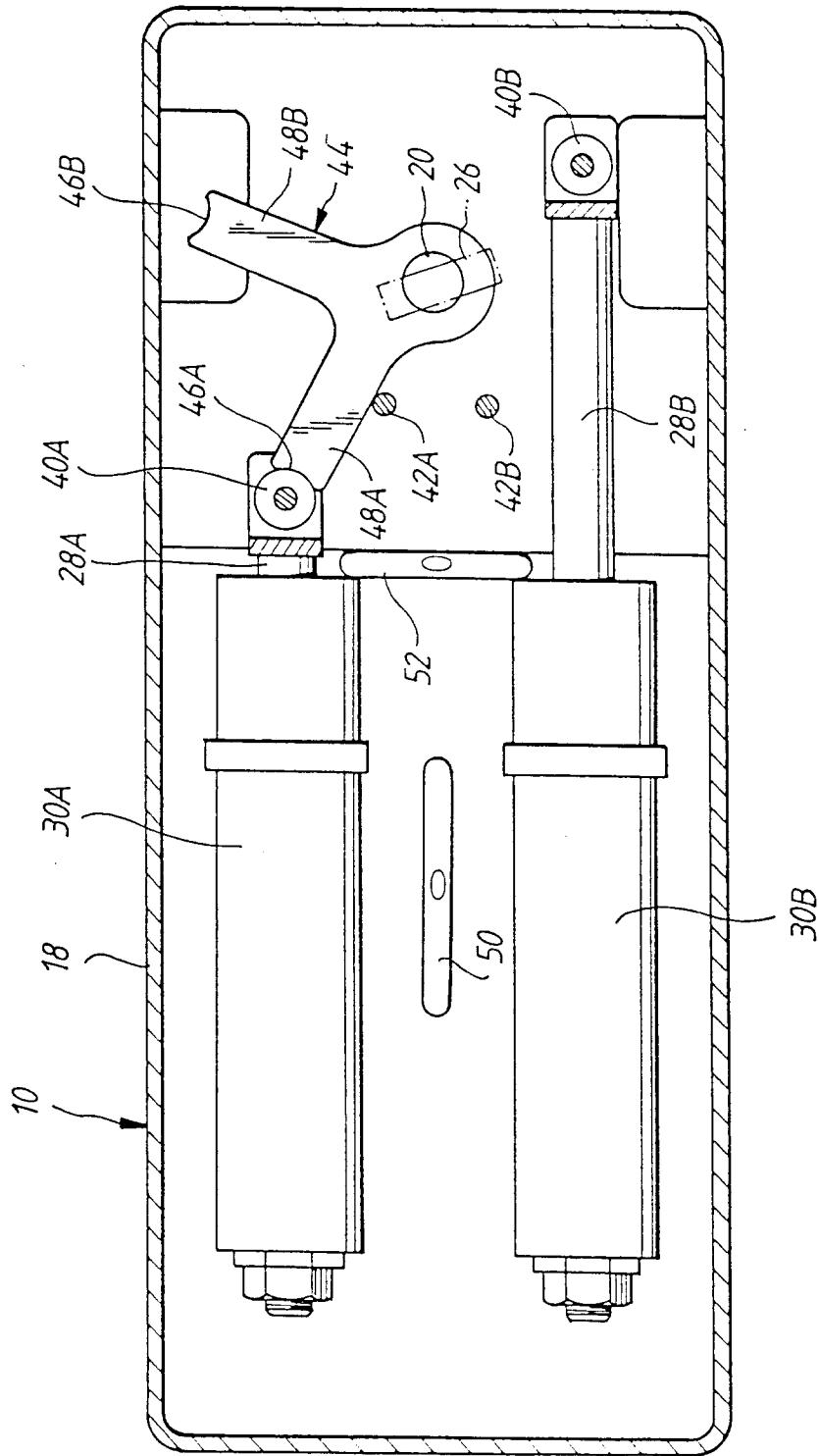


FIG. 6.

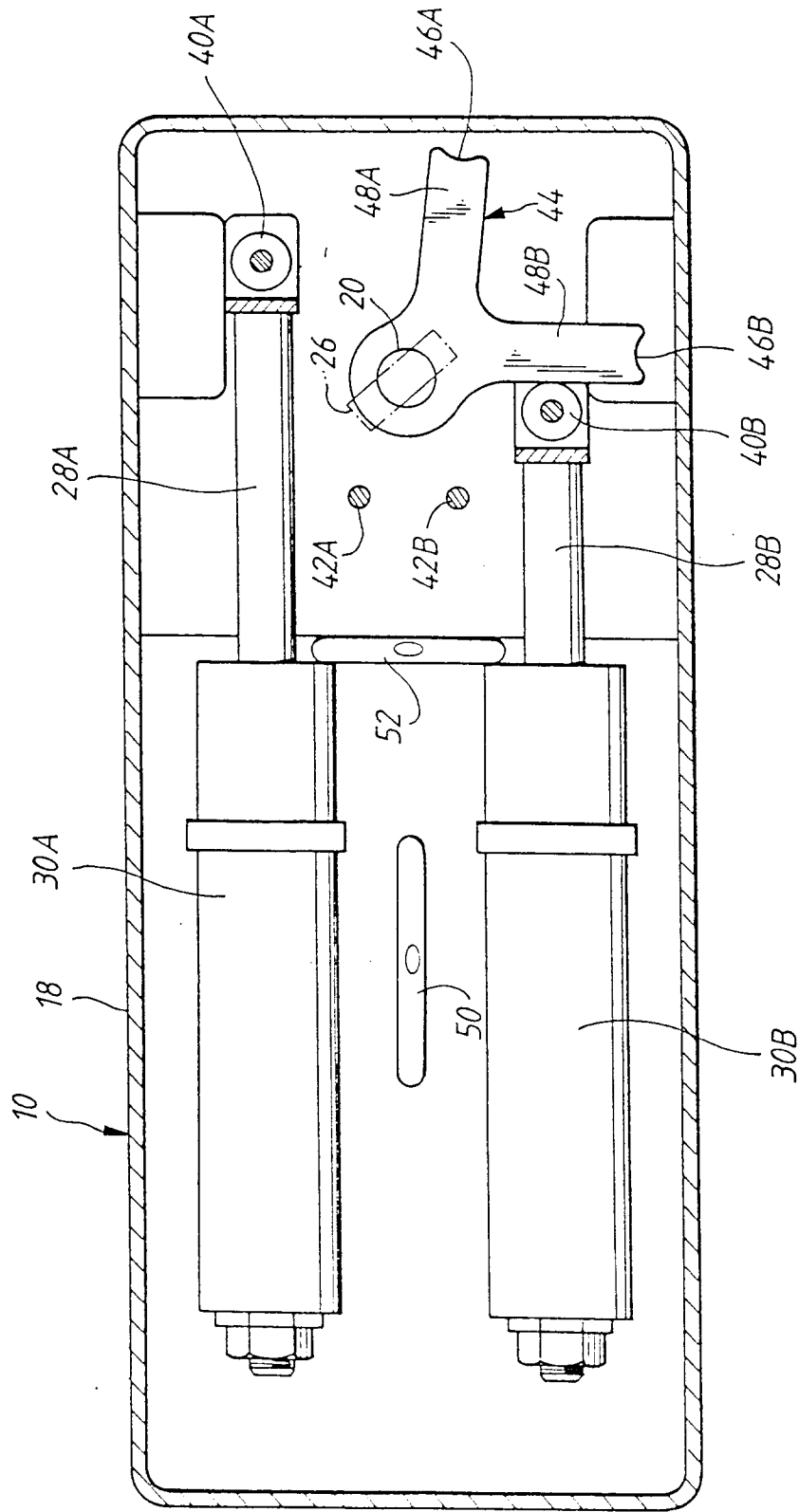


FIG. 7.



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EUROPEAN SEARCH REPORT

Application Number
EP 94 30 0259

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
X	GB-A-1 160 268 (STANMORE SPRINGS LIMITED) * claim 1; figure 1 * ---	1,3,6,7	E05F3/22
A	EP-A-0 544 253 (JEBRON LIMITED) * claim 1; figure 1 * ---	1-7	
A	EP-A-0 244 506 (SANTO INDUSTRIES CO., LTD) * claim 1; figure 9 * ---	1-7	
A	DE-A-38 01 379 (GEZE GMBH & CO) * claim 1; figure 6 * -----	1-7	
The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (Int.Cl.6)
			E05F
Place of search		Date of completion of the search	Examiner
THE HAGUE		10 June 1994	Kirsten, K
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