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A request for correction to page 5 line 33 has been filed pursuant to Rule 88 EPC. A decision on the request will be taken during the proceedings before the Examining Division (Guidelines for Examination in the EPO , A-V, 2.2).

(54) **A pressure medium controlled operator device for opening and closing a roof window or a hatch**

(57) The invention provides an operator device having a cylinder (1) and a piston which is axially displaceable therein and connected with a piston rod (10) for opening a roof window or a hatch. By pressure medium supply to the cylinder, the piston can be actuated for movement between a first end position, in which the window or the hatch is closed, and a second end position corresponding to an open position of the window or the hatch. In the cylinder, a spring-loaded locking mechanism is arranged which is actuated against the spring load by the movement of the piston in a direction towards the second end position, so as to block the piston in this position. A single locking mechanism is used, which is so designed that it can only be deactuated by pressure medium supply to the cylinder. The locking mechanism may be formed as a ball lock having a number of locking balls which are made to block the movement of the piston at movement of the piston. At the supply of pressure medium the balls are released so that the piston can be moved back to its starting position. The locking mechanism can be optionally placed as a bottom or top lock to enable its application for all types of windows or hatches.

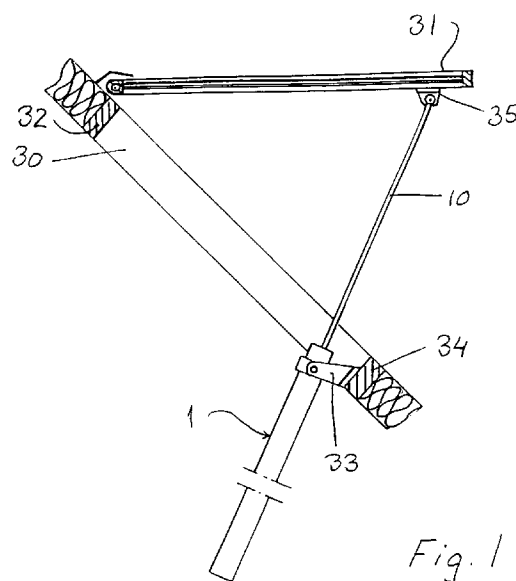


Fig. 1

EP 0 692 640 A2

Description

The present invention relates to a pressure medium controlled operator device for opening and closing a roof window or a hatch, particularly with a view to smoke ventilation, comprising a cylinder which is connected with a main frame structure for the window or the hatch and has a top section and a bottom section and a working piston which is axially displaceable in the cylinder and connected with a piston rod acting as an operating arm, the free end of which is connected with a frame for the window or the hatch, which piston can be actuated by the supply of pressure medium to the cylinder for movement between a first end position in which the window or hatch is closed, and a second end position corresponding to an open position of the window or the hatch, a spring-loaded locking mechanism arranged in the cylinder being actuated against the spring load by the movement of the piston in a direction towards the second end position so as to block the piston in this position.

In many existing opening mechanisms in the form of pressure medium controlled operator devices, the discontinuation of pressure medium in the open position of the window or the hatch will result in a return of the piston to its bottom position and thus closure of the window or hatch. Such an undesired closure may involve a risk of personal injury, for example in case of inspection or cleaning of the window or the opening mechanism, and a further result is that the window or hatch has to be held open manually in an emergency situation where the window or hatch is used as an exit.

Particularly in case of hatches for use in smoke ventilation, stringent requirements are prescribed for safety reasons to the function of the constituent parts of the opening mechanism, and in this application it is exceedingly important that the hatch can be held open even though the pressure medium supply fails.

In an operator device of this type known from EP-A-0 363 575, the cylinder has two separate locking mechanisms which block the piston movement in each of its said end positions. The locking mechanisms are actuated by means of spring-loaded locking pistons which are mounted in an axially displaceable manner in the top section and bottom section of the cylinder and are designed as ball locks with balls which may engage with grooves on the piston rod itself, which therefore has to be formed in solid steel. The locking pistons are spring-biased in a direction towards the locking position and cooperate with the operating piston so that when pressure medium is supplied to actuate the operating piston in a direction towards one end position, the locking piston for the opposite end position is simultaneously actuated to release the locking mechanism against the spring load. In case of failure of the pressure medium supply, release of the locking mechanism requires the locking pistons to be pulled out manually by means of a suitable tool.

In an actuator known from US patent No. 2 713 828,

the working piston is also blocked in the end positions by means of locking mechanisms in the form of ball locks which, in the locking position, engage with grooves formed direct in part of the piston rod.

On this background, the object of the invention is to provide a pressure medium controlled operator device which retains the piston alone in the open position of the window or the hatch, independently of the supply of pressure medium, and thus prevents unintended closure of the window or the hatch, while the operator device is fully operable in the closed position of the window independently of the operative condition of the pressure medium supply, and at the same time is applicable to all types of windows and to any lengths of piston travel. Another object of the invention is to provide an operator device having a locking mechanism which does not make special demands on the other components, and which, especially, leaves a choice of options concerning the design of the piston rod.

This object is achieved according to the invention by using only a single locking mechanism which comprises a ball lock with locking balls for engagement with an actuator member being nondisplaceable in relation to the piston, and is designed so that only at the supply of pressure medium to the cylinder for actuation of the piston for movement in the closing direction of the window or the hatch can the locking mechanism be deactivated for release of the piston for movement in the closing direction of the window or the hatch, and is also designed so as to, with otherwise unchanged components, be connectable optionally with the top section in a first state of installation so that said first and second positions correspond to a bottom position and a top position, respectively, for the piston, or with a bottom section in a second state of installation so that said first and second positions correspond to the top position and bottom position, respectively, of the piston.

This locking mechanism ensures an automatically actuated retention of the open position of the window or the hatch, where the blocking of the piston can only be suspended by the supply of pressure medium. The optional positioning of the locking mechanism with unchanged components has the result that in the design with only one locking mechanism acting in the open position of the window or the hatch, the operator device can be used in all types of windows and hatches. Furthermore, owing to its position inside the cylinder, the locking mechanism will be protected against corrosion and soiling.

In a preferred embodiment of the invention, the locking balls in the pressure medium controlled operator device according to the invention are placed in a ball holder which is nondisplaceable in the cylinder and is positioned radially between an internal slider and an external slider which are both spring-biased in a direction towards said first end position and have stepped portions in their sides facing the ball holder, which portions permit radial movement of the balls from a neutral position in which, at the

movement of the piston in a direction towards the second end position, the internal slider is displaced by said actuator member against the spring bias to a locking position in which, owing to a displacement of the external slider in a direction towards the first end position caused by the spring load, the balls are brought into abutment with a stepped portion of the actuator member and thus block movement of the latter and of the piston in a direction towards the first end position and return movement of the internal slider, while the external slider is displaced against the spring load, when pressure medium is supplied to the cylinder for actuation of the piston for movement in a direction towards the first end position, and thus releases the balls for movement back to the neutral position. With a few movable and interactive components, this embodiment provides a blocking of the movement of the piston and also has the result that contrary to the locking mechanisms in prior art operator devices, the locking mechanism can be easily and rationally assembled as a separate unit which is subsequently mounted in the cylinder of the operator device. As a further advantage, the locking balls are not at any time in contact with the piston rod, which partly prevents wear in the form of scratches which might cause leaks, partly makes it possible to design the piston rod as a relatively thin-walled tube, for example of aluminium.

The invention will be explained in further detail below with reference to the schematic drawing, in which

Figs. 1 and 2 show a pressure medium controlled operator device according to the invention in a first and a second state of installation, respectively,

Figs. 3 and 4 on a larger scale show longitudinal sections through the cylinder in the operator device according to the invention, mounted in the state of installation shown in Fig. 1, and

Fig. 5 also on a larger scale shows a longitudinal section through the cylinder in the operator device according to the invention, mounted in the state of installation shown in Fig. 2.

In the various figures, components having the same or analogous functions are designated by the same reference numerals.

Fig. 1 shows a pressure medium controlled operator device mounted in connection with a hatch or a top-hung window. A main frame structure 30 for the hatch is shown in the figure built into an inclined roof, but the position could, for example, also be horizontal. A frame 31 is hinge-connected with the main frame structure 30 at a main frame top member 32. The operator device comprises a cylinder 1 which is pivotally connected with a main frame bottom member 34 by means of a fitting 33, and a piston rod 10 which is pivotally connected with the frame 31 via a fitting 35. The hatch is opened by supply of pressure medium to the cylinder 1, the piston of which

- not shown in this Figure - moves from a first position corresponding to its bottom position to a second position corresponding to its top position and thus opens the frame 31 of the hatch via the piston rod 10 acting as an operator arm to achieve the position shown in Fig. 1, where a locking mechanism mounted as a top lock and constituting part of the operator device according to the invention, retains the piston against return movement, even though the supply of pressure medium ceases.

In Fig. 2, the operator device is mounted in connection with a roof window built into an inclined roof and hinged at a central axis 36. The window is opened by pressure medium actuating the piston of the cylinder 1 from a first position here corresponding to the top position of the piston to a second position corresponding to the piston bottom position in which the frame 31 of the window is tilted to an open position. In this position, the locking mechanism, here mounted as a bottom lock, retains the piston against return movement. This state of installation is also applicable if the roof window is bottom-hinged, i.e. is hinged at the bottom member 34 of the main frame.

The exact structure of the cylinder 1 of the operator device will appear from Figs. 3-5.

In Fig. 3, the device according to the invention is shown with the piston in its first or starting position, i.e. corresponding to a closed window or hatch in Fig. 1. The cylinder 1 of the device comprises a casing constituted by an external tube 2 and an internal tube 3, and is closed by means of gaskets 2a, 3a and 2b, 3b so as to be pressure-tight at the ends with a bottom section 4 and a top section 5. A piston 6 of a suitable material, such as nitrile rubber (NBR) is in sealing and axially displaceable contact with the inner side of the internal tube 3 of the cylinder. On the side facing the bottom section 4, the piston 6 has a tightening washer 7 and on the opposite side a spacing washer 8. The spacing washer 8 abuts on an actuator member 9 having a portion 9a of reduced diameter. At the end of the actuator member 9 facing away from the piston 6 a recess is shaped to form a shoulder 9b so that the piston rod 10 of the cylinder 1 can be received in the recess in the actuator member 9. The piston rod 10 may consist of a solid round bar of an optional material, but is advantageously made as shown, as a thin-walled tube of a light material, such as aluminium, cut to a suitable length. At the top section 5, the piston rod 10 is sealed against leakage of pressure medium by a sliding seal 23 and a further gasket 24. The piston 6 is connected with the piston rod 10 by means of a clamping member 11 having a head 11a clamping the piston 6 together with the tightening washer 7, the spacing washer 8 and the actuator member 9. The clamping member 11 may be formed as a bolt or a hexagon socket screw which is screwed into one end of the piston rod 10, which may either be formed with a threaded bore itself, or via an insert introduced into the piston rod 10 and having a corresponding threaded bore. A bore 4a is formed in the bottom section 4 for receiving the head 11a of the clamp-

ing member 11. At the top section 5 of the cylinder 1, a locking mechanism is positioned comprising a tubular internal slider 12 which is axially displaceable and is connected with the top section 5 via a spring 13. Radially outside the internal slider 12, a longitudinal stationary ball holder 14 having at least one recess 14a for receiving a corresponding number of balls 15 is screwed into a threaded bore 5a in the top section 5. For this purpose, one end of the ball holder 14 is formed with an external thread 14b. The ball or balls 15 rest(s) in the recess or recesses 14a in the position shown and is(are) retained in the radial direction of the cylinder by the internal slider 12 and a first abutment surface 16a on an external slider 16, which is in sealing abutment with the inner side of the internal tube 3 of the cylinder 1 and the ball holder 14 by means of gaskets 21, 22, and which is connected with the top section 5 via a spring 17.

The window or the hatch is opened as follows. A pressure source outside the cylinder 1 provides it with a pressure medium, such as dry and clean compressed air, through pressure conduits, not shown, and connections 18, 19. The supply of compressed air to the connection 19 is barred in the situation shown, and the compressed air is passed from the connection 18 through a bore 20 in the bottom section 4 into the cylinder 1 on the bottom side of the piston 6, i.e. at the end facing the bottom section 4, whereby the piston 6 is moved axially in the cylinder 1 in a direction towards the top section 5. The piston rod 10 pushes the window or the hatch to an open position. During the movement of the piston 6, the actuator member 9 with the shoulder 9b pushes the internal slider 12 free of the balls 15 against the force from the spring 13. Then the spring 17 actuates the external slider 16 in a direction towards the bottom section 4 so that the slider 16 with a second abutment surface 16b presses the balls 15 in the recess 14a inwards in the radial direction. The actuator member 9 is now positioned with its portion 9a of reduced diameter in alignment with the balls 15, which are forced into a locking position where, as shown in Fig. 4, they are retained on the inner side by the portion 9a and on the outer side by the second abutment surface 16b on the slider 16. If the compressed-air supply fails in the open position of the window or the hatch, the mechanical locking will prevent unintended closure of the window or the hatch, as the balls 15 abut on the shoulder 9b to prevent movement of the slider 12 and the actuator member 9 and thus of the piston rod 10 in a direction towards the bottom section 4.

Closure of the window or the hatch can only be actuated by the supply of pressure medium. The compressed air is passed from the connection 19 via the cavity formed between the internal slider 12 and the ball holder 14 to the upper side of the piston 6, i.e. to the end of the cylinder 1 facing the top section 5. The external slider 16 is pressed by the compressed air in a direction towards the top section against the force from the spring 17, whereby the first abutment surface 16a is positioned in alignment with the balls 15 so that at the displacement

of the internal slider 12 caused by the spring 13, they are forced outwards in a radial direction towards the first abutment surface 16a on the slider 16, and thus no longer prevent movement of the actuator member 9, for which reason the piston 6 can be moved back to the starting position shown in Fig. 3 by the pressure.

In the embodiment shown in Fig. 5, the locking mechanism is mounted as a bottom lock at a bottom section 40 in the cylinder 1. This bottom section 40 is formed correspondingly to the bottom section 4 shown in Figs. 3 and 4, but instead of the bore 4a, it has a threaded bore 40a for connection with the external thread 14b of the ball holder 14. As it will appear, the locking mechanism otherwise has the same components as in Figs. 3 and 4. The actuator member 9 is here mounted on the side of the piston 6 facing away from the piston rod 10, and its shoulder 9b faces the locking mechanism and the bottom section 40. The locking mechanism is actuated and deactivated in a similar manner as in the embodiment described above. The piston is moved by supplying compressed air to the connection 19 from a first position, which is here the top position of the piston 6, via the intermediate position shown in the Figure to a second position corresponding to the bottom position of the piston and an open window. During the piston movement, the shoulder 9b of the actuator member 9 pushes the internal slider 12 free of the balls 15, whereupon the external slider 16 presses the balls 15 inwards in the radial direction to their locking position. The locking mechanism can now only be deactivated by supplying pressure medium to the connection 18 and passing it via the bore 20 through the bottom section 40 into the internal tube 3 to actuate partly the external slider 16 against the force from the spring 17, partly the piston 6 for movement in the closing direction of the window, i.e. in a direction towards the top section 5.

Although the operator device according to the invention in the embodiment described above is pneumatic, and the pressure medium used is compressed air, the invention is not restricted to this, as a hydraulic control could also be applied.

Claims

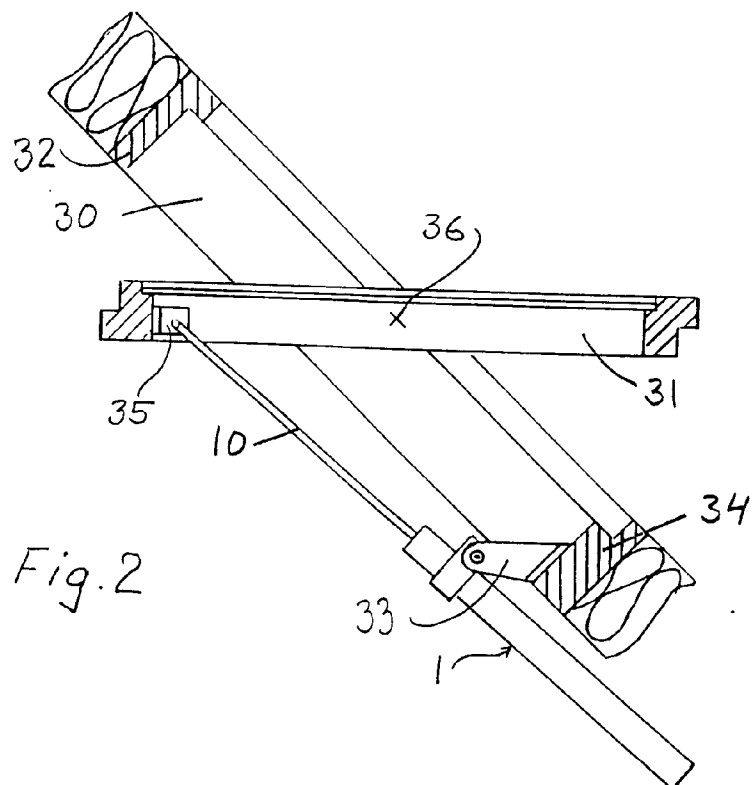
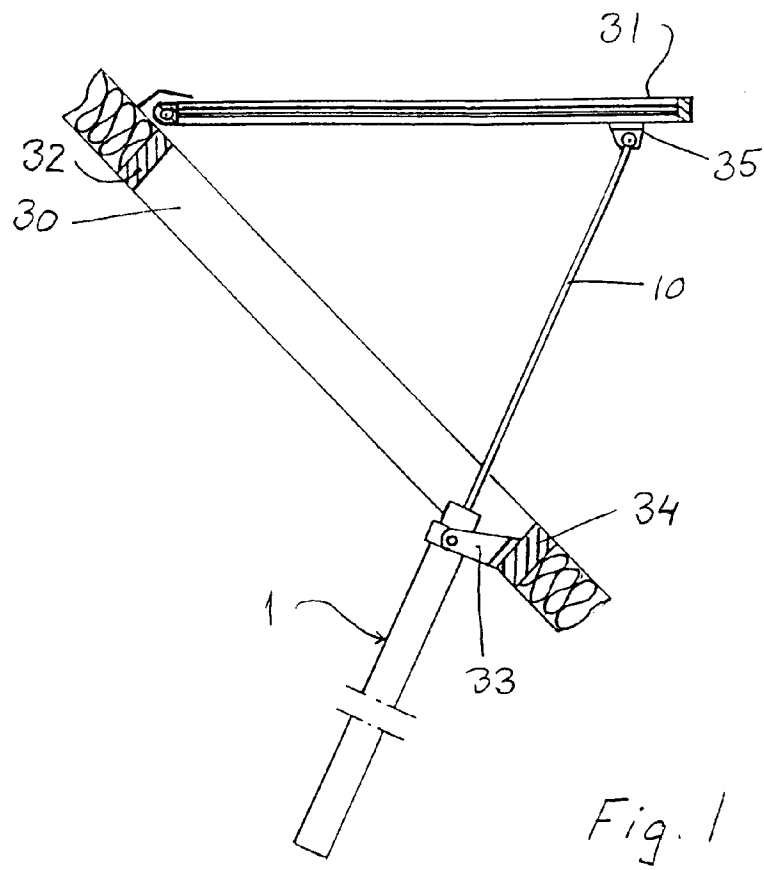
1. A pressure medium controlled operator device for opening and closing a roof window or a hatch, particularly with a view to smoke ventilation, comprising a cylinder (1) which is connected with a main frame structure for the window or the hatch and has a top section (5) and a bottom section (4) and a working piston (6) which is axially displaceable in the cylinder and connected with a piston rod (10) acting as an operating arm, the free end of which is connected with a frame for the window or the hatch, which piston can be actuated by the supply of pressure medium to the cylinder for movement between a first end position in which the window or hatch is closed,

and a second end position corresponding to an open position of the window or the hatch, a spring-loaded locking mechanism arranged in the cylinder being actuated against the spring load by the movement of the piston in a direction towards the second end position so as to block the piston in this position, **characterized** in the use of only a single locking mechanism which comprises a ball lock with locking balls for engagement with an actuator member being nondisplaceable in relation to the piston, and is designed so that only at the supply of pressure medium to the cylinder for actuation of the piston for movement in the closing direction of the window or the hatch can the locking mechanism be deactivated for release of the piston for movement in the closing direction of the window or the hatch, and is also designed so as to, with otherwise unchanged components, be connectable optionally with the top section (5) in a first state of installation so that said first and second positions correspond to a bottom position and a top position, respectively, for the piston, or with a bottom section in a second state of installation so that said first and second positions correspond to the top position and bottom position, respectively, of the piston.

2. An operator device according to claim 1, **characterized** in that the locking balls (15) are placed in a ball holder (14) which is nondisplaceable in the cylinder and is positioned radially between an internal slider (12) and an external slider (16) which are both spring-biased in a direction towards said first end position and have stepped portions in their sides facing the ball holder, which portions permit radial movement of the balls from a neutral position in which, at the movement of the piston in a direction towards the second end position, the internal slider is displaced by said actuator member (9) against the spring bias to a locking position in which, owing to a displacement of the external slider in a direction towards the first end position caused by the spring load, the balls are brought into abutment with a stepped portion of the actuator member and thus block the movement of the latter and of the piston in a direction towards the first end position and return movement of the internal slider, while the external slider is displaced against the spring load, when pressure medium is supplied to the cylinder for actuation of the piston for movement in a direction towards the first end position, and thus releases the balls for movement back to the neutral position.
3. An operator device according to claim 2, **characterized** in that at one end, the ball holder (14) is formed with an external thread (14b).
4. An operator device according to claim 3, **characterized** in that in said first state of installation, said

external thread (14b) on the ball holder (14) is screwed into a threaded bore (5a) in the top section (5), and said actuator member (9) is mounted on the side of the piston (6) facing the piston rod (10).

5. An operator device according to claim 4, **characterized** in the use in said first state of installation of a bottom section (4) formed as a stop at the bottom position of the piston for a clamping member (11, 11a) for the piston on the side thereof facing away from the piston rod (10).
6. An operator device according to claim 3, **characterized** in that in said second state of installation a bottom section with a threaded bore is used for connection with the external thread (14b) of the ball holder (14), and said actuator member (9) is mounted on the side of the piston (6) facing away from the piston rod (10) for striking against said internal slider (12) in the bottom position of the piston (6).
7. An operator device according to any one of the preceding claims, **characterized** in that the piston rod (10) is formed as a relatively thin-walled tube.
8. An operator device according to any one of the preceding claims, **characterized** in that the piston rod (10) is made of a light-weight material, particularly aluminium.



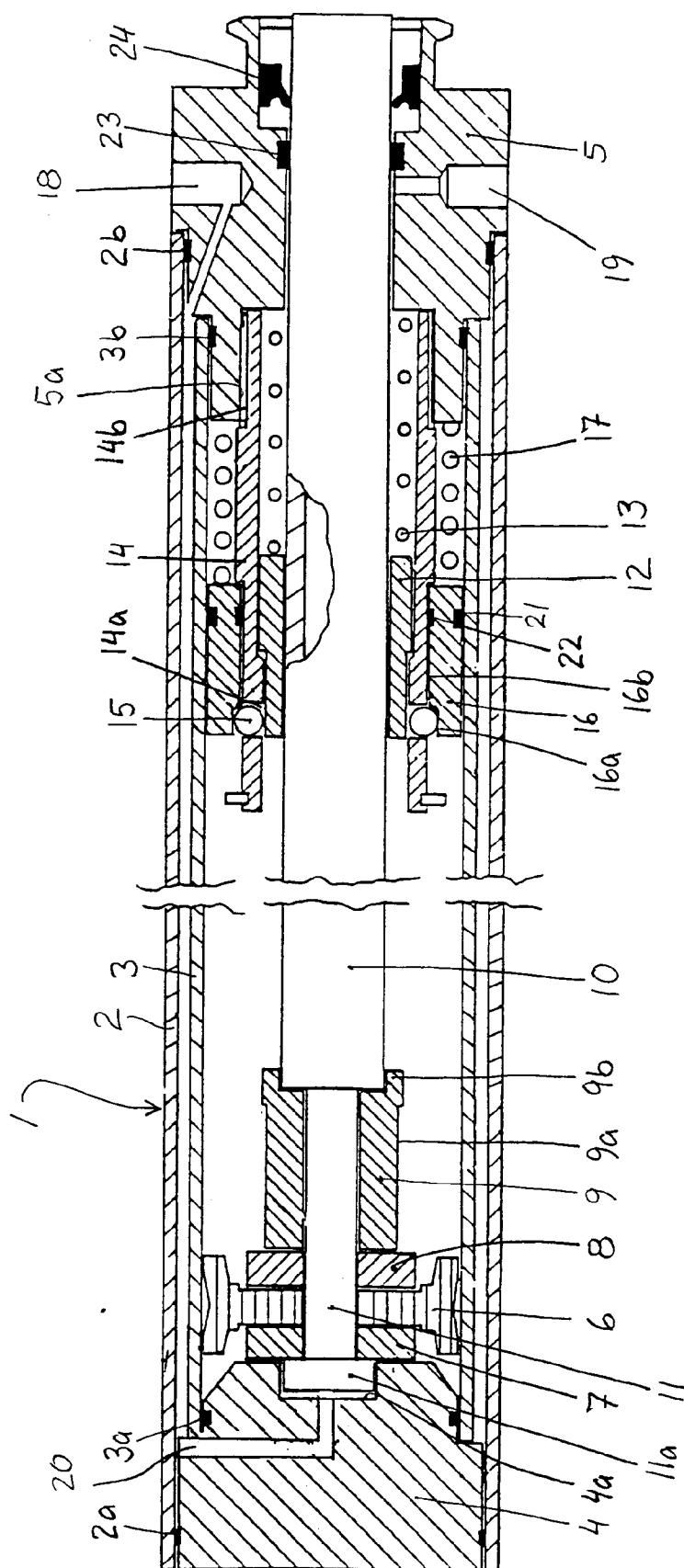


Fig. 3

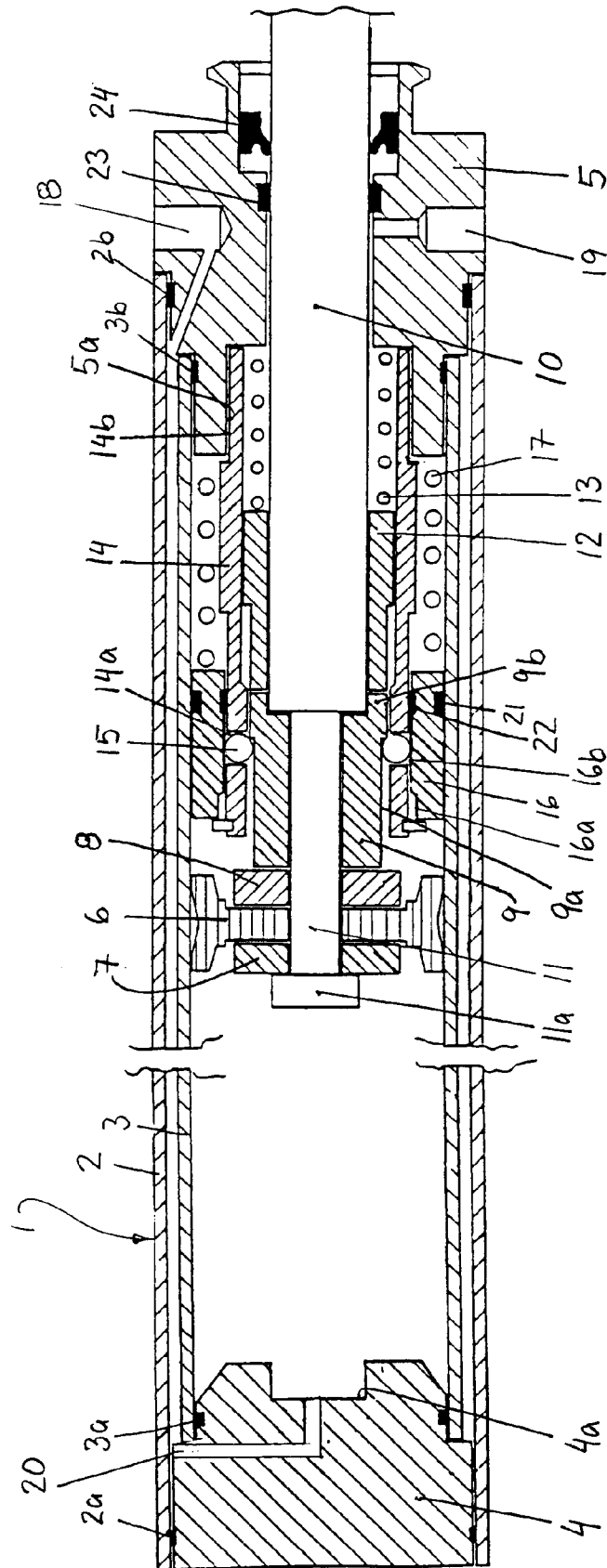


Fig. 4

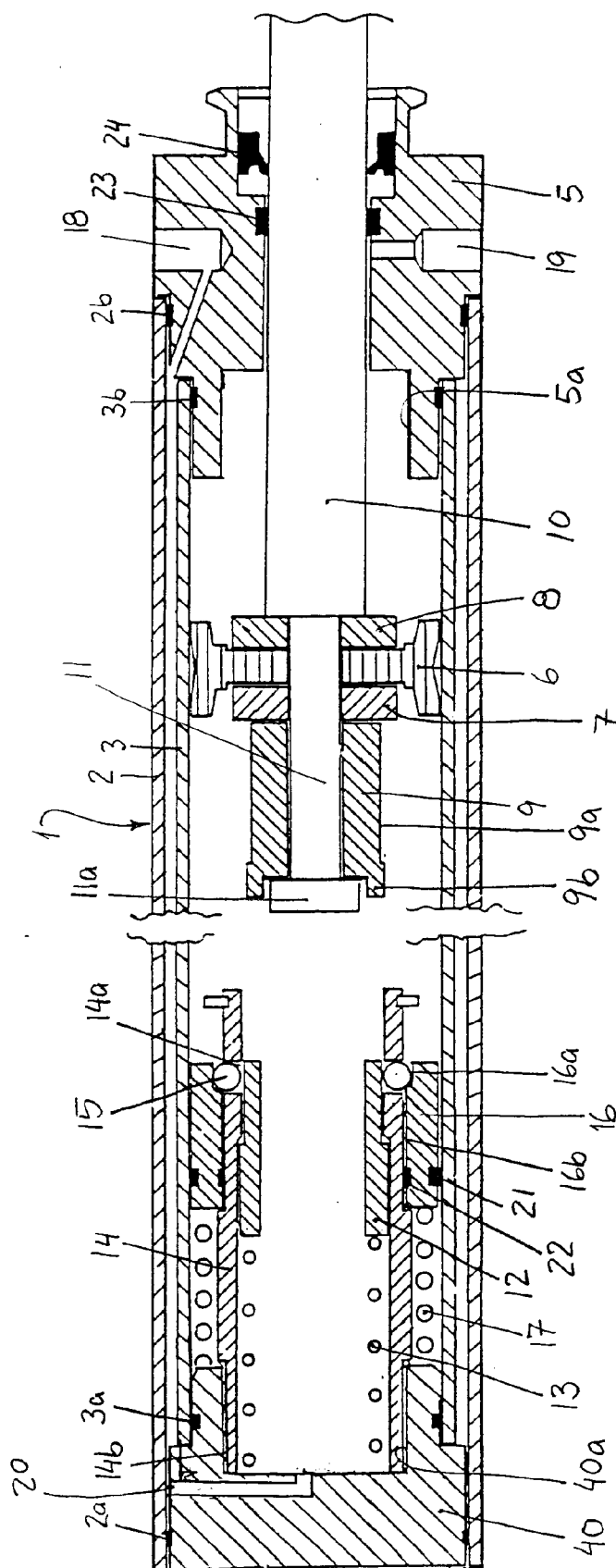


Fig. 5