

The present invention relates to a door closer. Specifically but not exclusively, it relates to a closure using a pneumatic cylinder in which a door may be latched in its open position (for example when the door is opened more than 90°). It further relates, in the preferred embodiment, to a closer which increases the speed of closure as the door moves towards the closed position.

A conventional door closer comprises a linkage arm which is either loaded by a spring or attached to a pinion gear assembled to a rack portion of a piston element, so that when the door is closed the pinion gear is rotated by the piston element. The closing speed of the door is controlled by rotation of the linkage arm.

Such a type of door closer is disclosed in US-A-4,285,094, US-A-4,378,612, US-A-4,393,787 and US-A-4,937,914. This type of door closer, however, does not have both the function of being able to latch the door open automatically, when the door is opened beyond a predetermined limit, and the function of completely and securely closing the door toward the door frame by increasing the closing speed as the door approaches the frame.

Another type of known closer has a pneumatic, hydraulic or spring-loaded cylinder in which a piston rod is directly connected to the door or the door frame. This type of door closer is shown, for example, in US-A-4,190,926 and US-A-4,817,238. Such closers, however, do not have the function of latching the door in the fully open position, when the door is opened beyond a predetermined limit. Also, such door closers do not have the function of increasing the closing speed of the door as the closure is completed.

An object of the present invention, at least in a preferred embodiment, is to provide a door closer constructed such that the door may be latched open when it is pushed open beyond a certain angle. A further object is for at least the preferred embodiment to increase the closing speed of the door as the door draws near the door frame while the door is being closed.

According to the present invention there is provided a door closer characterised by a housing arranged to be mounted to a door, a first linkage arm extending from the housing, and a second linkage arm one end of which is articulated to the first linkage arm and other end of which is connected to a bracket arranged to be mounted to a door frame; and wherein the door closer further comprises a cylinder within the housing having a piston rod which co-operates with a drive lever.

Preferably, the upper end of the aforesaid drive shaft has the drive lever mounted thereto, one end of the first linkage arm being fixedly connected to the drive shaft.

Preferably, the drive lever has a concave recess formed at its end, into which the roller of the piston rod can be engaged.

Also preferably, a piston having a bleed bore is slidably mounted in the pneumatic cylinder, the piston rod is attached to the piston, and a passage having a slightly larger length than that of the piston is formed inside the front end of the cylinder.

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

Figure 1 is a schematic plan view illustrating a door closer according to an embodiment of the present invention, with the door in the closed position;

Figure 2 shows the closer with the door at an angle of about 45°;

Figure 3 shows the closer with the door at an angle of about 90°;

Figure 4 shows the closer with the door latched at an angle of more than 90°;

Figure 5 is a schematic plan view showing how complete closure of the door is achieved by increasing rotation speed when the door draws near the door frame;

Figure 6 is a sectional view of the door closer with the door in the closed position;

Figure 7 is a sectional view taken on line VII-VII of Figure 6;

Figure 8 is a sectional view similar to Figure 6 with the door at an angle of about 45°;

Figure 9 is a sectional view similar to Figure 6 with the door at an angle of about 90°;

Figure 10 is a sectional view similar to Figure 6 with the door latched at an angle of more than 90°; and

Figure 11 is a sectional view similar to Figure 6 showing the increasing rotation speed of the door as the door draws near the door frame.

The present invention in its preferred embodiment will be explained in more detail with reference to the accompanying drawings. Figure 1 shows that one side of a door 10 is connected by a hinge 12 to a door frame 14, and that the other side of the door has a door handle 18, by the operation of which a latch bolt 16 is brought into operation. In Figure 1, the door 10 is closed.

A door closer 20 according to the preferred embodiment of the present invention comprises a housing 22 mounted to the door 10, from which a first linkage arm 24 and a second linkage arm 26 articulated to the first linkage arm 24 extend. The end of the second linkage arm 26 is connected to a bracket 28 which is mounted to the door frame 14. Figure 1 to Figure 5 illustrate the operation of a door equipped with such a door closer 20.

Figure 1 illustrates the door in the closed position against the door frame 14 with the door 10 latched to the door frame 14 by the latch bolt 16 which may be opened by the door handle 18.

The door 10 is opened by turning the handle 18 which retracts the latch bolt 16.

Figure 2 and Figure 3 respectively show the door 10 opened at angles of 45° and 90° with respect to the door frame 14.

Figure 4 shows the door 10 opened at an angle of more than 90°. In this position it may be latched by the door closure: details will be described later.

Figure 5 shows the door 10 drawing near the door frame 14 in the almost completely closed state. The door 10 can be completely and securely closed after overcoming the obstacle represented by the edge of the latch bolt 16 since the closing speed of the door is increased by the door closure of the preferred embodiment: details will be explained later.

Figure 6 and Figure 7 show that the preferred door closure 20 comprises a housing 22 having an extended head portion 30. Mounted within the housing is a pneumatic cylinder 34 from which a piston rod 32 extends. The end of the piston rod 32 extends into the head portion 30. In the pneumatic cylinder 34 there is a slidable-mounted piston 38 having a bleed bore 36 which can be closed by means of a washer 35. At the end of the piston rod 32, a yoke 40 is mounted and to its shaft 42, a roller 44 is rotatably mounted.

In the extended head portion 30, a U-shaped bracket 46 is mounted. A drive shaft 48 is mounted at a position offset from the route of the piston rod 32, and its upper end 50 extends outwardly from the head portion 30; one end of the first linkage arm 24 is fixedly connected to the upper end. Fixedly mounted to the middle of the drive shaft 48 is a drive lever 54, its rotation range being restricted by stops 52a, 52b mounted at both sides of the bracket 46. The side of the drive lever 54 is contacted by the roller 44 of the piston rod 32, and at its upper end a concave recess 56 is formed.

In the pneumatic cylinder 34, a passage 58 is provided which is slightly longer than the piston 38. The passage 58 is formed at one side of the cylinder 34, towards the front end.

Operation of the door closer of the preferred embodiment will now be explained.

As shown in Figure 1, when the door 10 is closed against the door frame 14, the piston rod 32 of the pneumatic cylinder 34 is extended and in this position the roller 44 presses against the drive lever 54 (Figure 6).

As shown in Figure 2 and Figure 3, the first linkage arm 24 rotates counterclockwise about the central axis of the drive shaft 48 when the door 10 is opened. By virtue of this rotation of the drive

shaft 48, the drive lever 54 is rotated counterclockwise and thus the piston rod 32 abutted by the roller 44 is forced to retract against the pressure of compressed air within the pneumatic cylinder (Figure 8 and Figure 9).

When the door is to be opened at a predetermined angle of opening, for example, more than 90° (desirably about 100°), it is sometimes desirable to latch the door in this position. When the door 10 is opened to an angle of more than 90° as shown in Figure 4, the drive lever 54 is rotated from the position shown in Figure 9 to the position shown in Figure 10. The roller 44 of the piston rod 32 which abuts the side of the drive lever 54 engages into the concave recess 56 formed at the distal end of the drive lever 54. In this position, movement of the piston rod and of the drive lever is restricted. Accordingly, the door 10 remains latched open so long as an external closing force is not applied to it. The door 10 is closed by the power of the pneumatic cylinder when an external closing force is applied.

For example, when the door 10 is latched open, as shown in Figure 4 and Figure 10, a closing force applied to the door causes the roller 44 of the piston rod 32 to be removed from the concave recess 56 of the drive lever 54, and to move down to abut the side of the drive lever 54. The piston rod 32 begins to extend by pressure within the pneumatic cylinder 34, thereby rotating the drive lever 54 clockwise. Accordingly, the door 10 is gradually closed while the first linkage arm 24 is rotated clockwise.

When the door 10 approaches the door frame 14 as shown in Figure 5, it is desirable that closing speed of the door 10 be increased. That is because the latch bolt 16 of the door may act as an obstacle to the door fully closing.

To this end, the pneumatic cylinder 34 is slightly modified in the preferred embodiment by the provision of the passage 58 at the inner front end of the cylinder 34. This passage is slightly longer than the piston 38. When, by extension of the piston rod 32, the piston 38 reaches the front end of the pneumatic cylinder 34 adjacent the passage 58, fluid from in front of the piston 38 is rapidly moved towards the rear through the passage 58. This causes the speed of movement of the piston and hence the piston rod to increase. Consequently, the door 10 is completely closed toward the door frame 14 while the drive lever 54 is rapidly rotated clockwise at an increased speed.

Claims

1. A door closer characterised by a housing (20) arranged to be mounted to a door (10), a first linkage arm (24) extending from the housing,

and a second linkage arm (26) one end of which is articulated to the first linkage arm (24) and other end of which is connected to a bracket (28) arranged to be mounted to a door frame; and wherein the door closer further comprises a cylinder (34) within the housing having a piston rod (32) which cooperates with a drive lever (54). 5

2. A door closer as claimed in Claim 1 in which the drive lever (54) is coupled to the first linkage arm (24). 10
3. A door closer as claimed in Claim 2 in which the drive lever is mounted to a drive shaft (48), one end of the first linkage arm (24) being fixedly coupled to the drive shaft. 15
4. A door closer as claimed in any one of the preceding claims in which the drive lever (54) has a concave recess (53) therein, the piston rod (34) being engageable within the recess, so latching the door in an open position. 20
5. A door closer as claimed in any one of the preceding claims in which the piston rod (34) includes a roller (44) at the end thereof. 25
6. A door closer as claimed in Claim 5 when dependent upon Claim 4 in which the roller (44) is engageable within the recess (56). 30
7. A door closer as claimed in any one of the preceding claims in which the piston rod (34) is secured to a piston (38) within the cylinder (34), the piston having a bleed bore (36) therein. 35
8. A door closer as claimed in Claim 7 in which the cylinder (34) provides a bypass fluid channel (58) towards its forward end. 40

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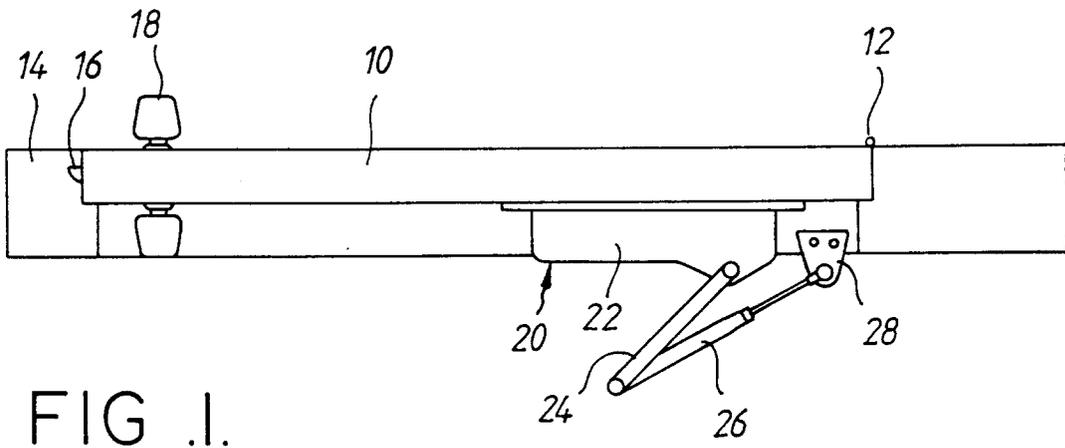


FIG. 1.

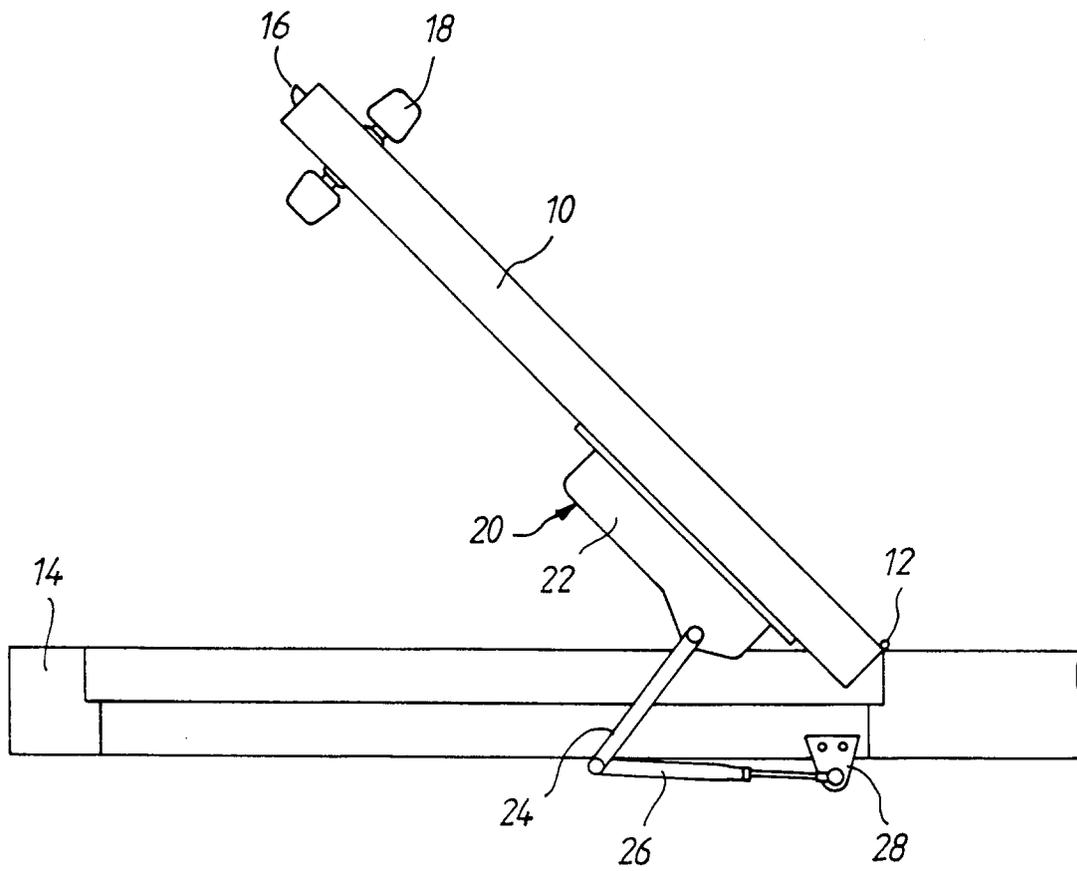


FIG. 2.

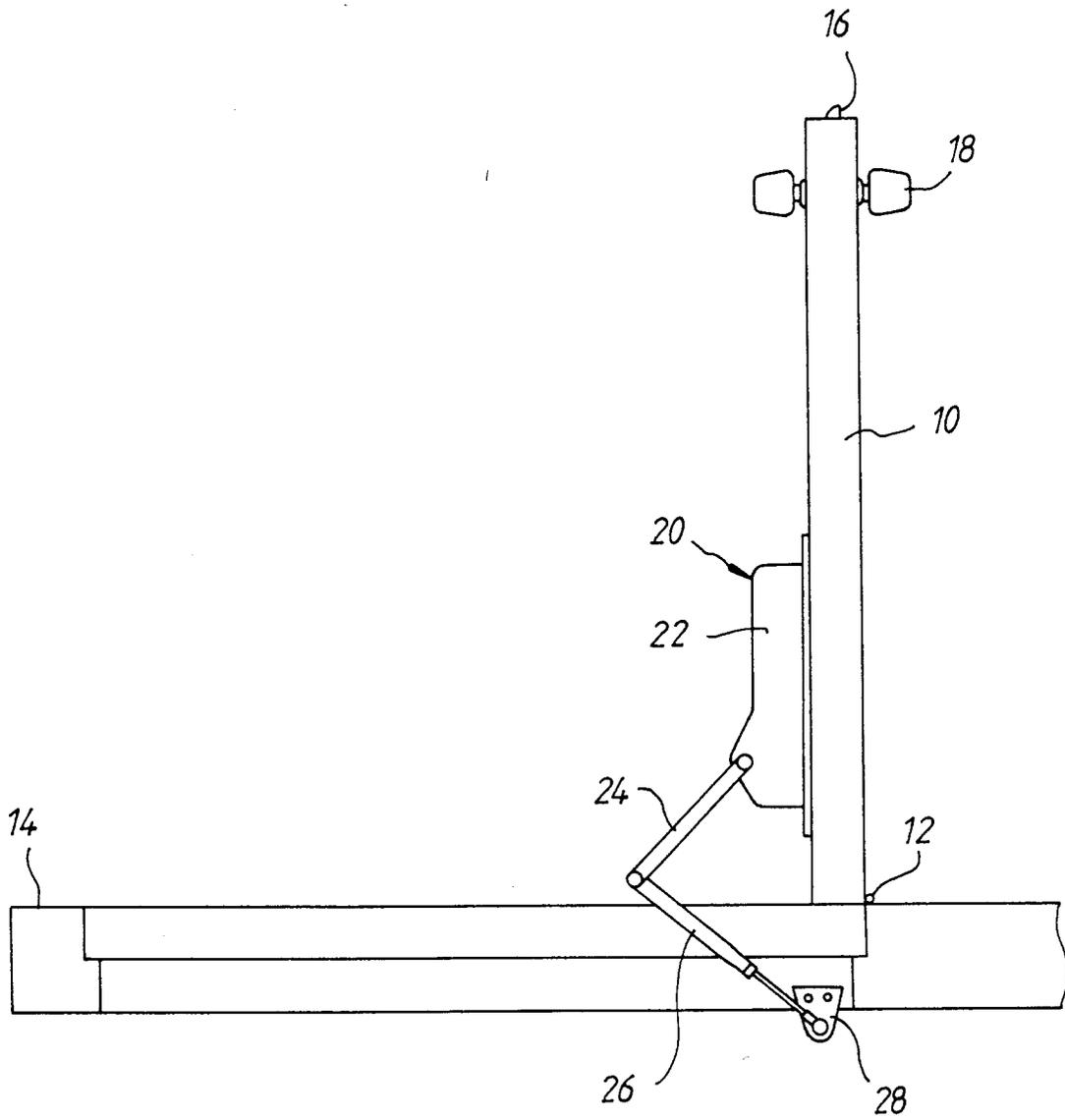


FIG. 3.

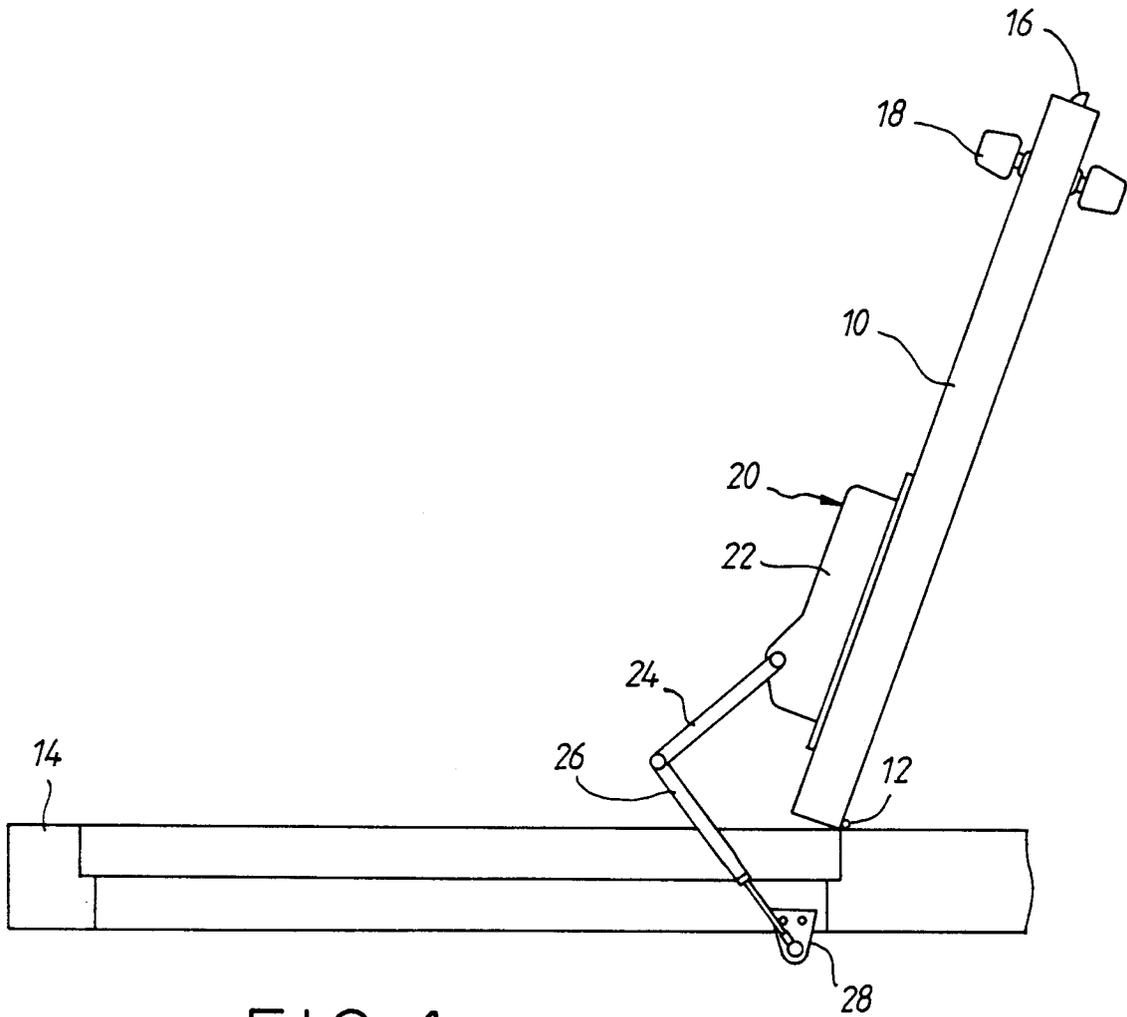


FIG. 4.

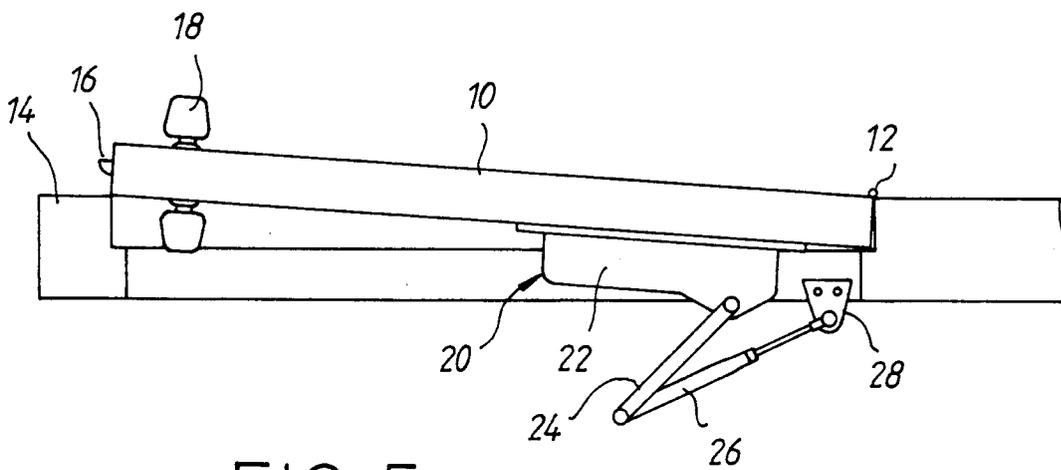


FIG. 5.

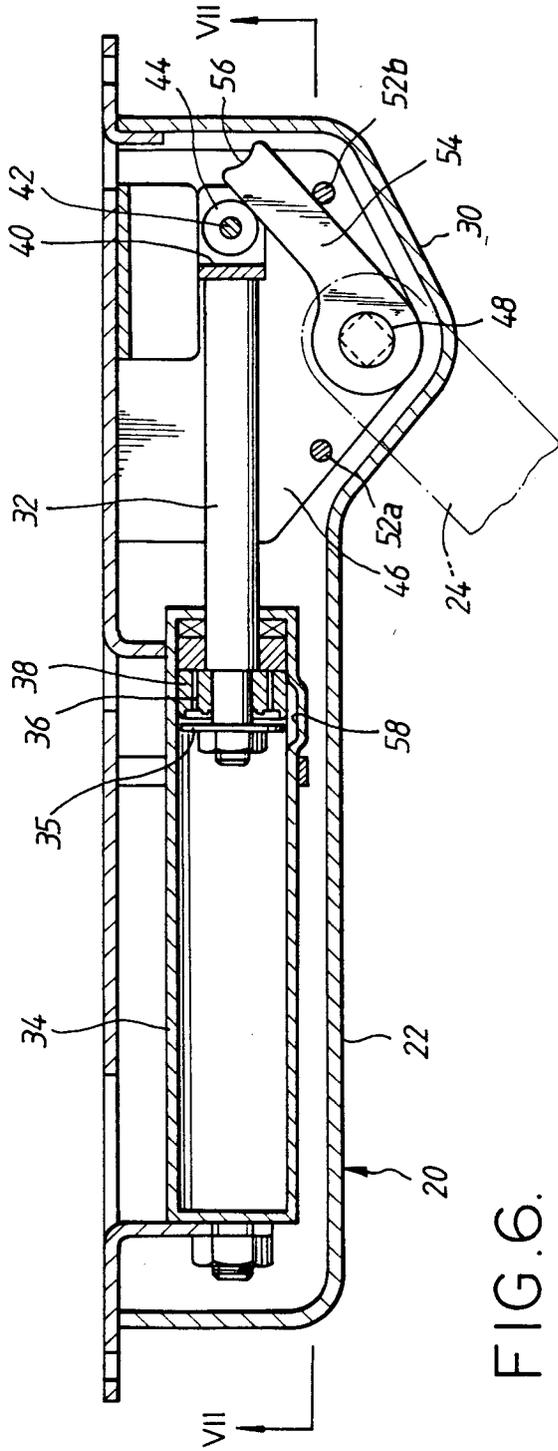


FIG. 6.

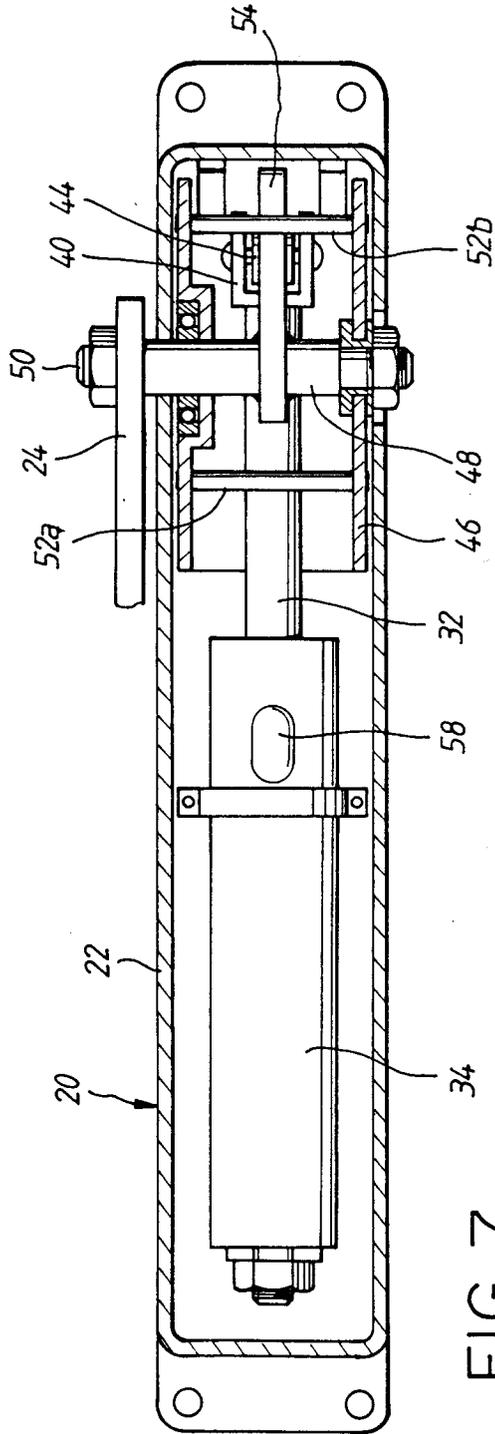


FIG. 7.

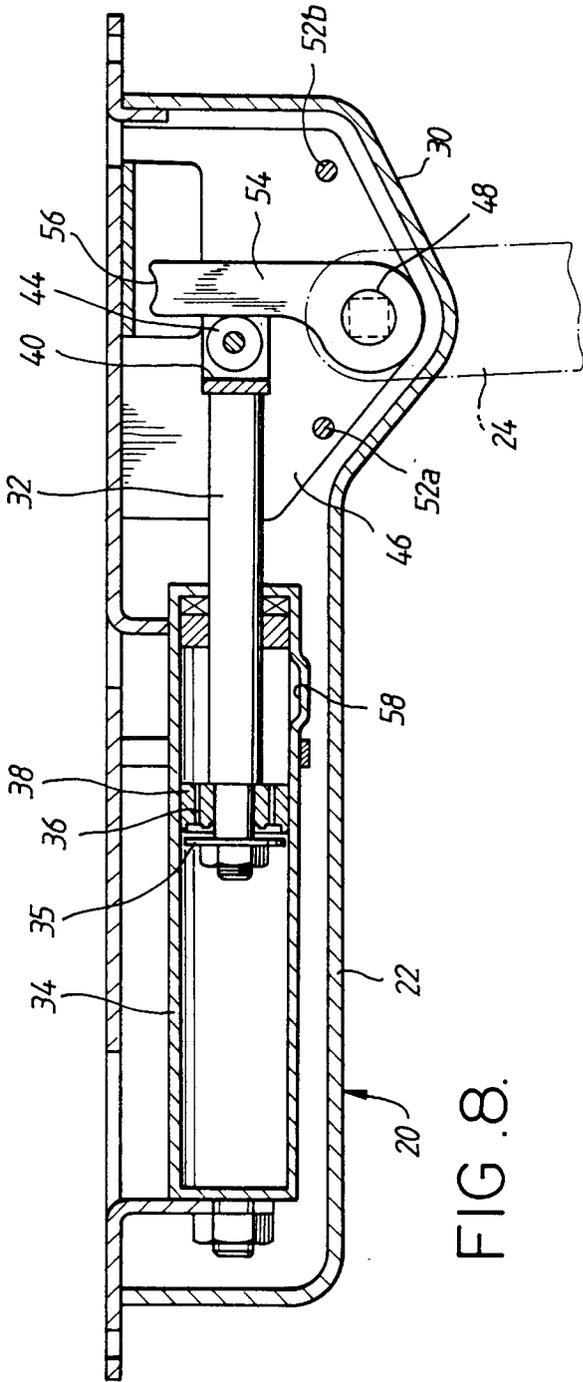


FIG. 8.

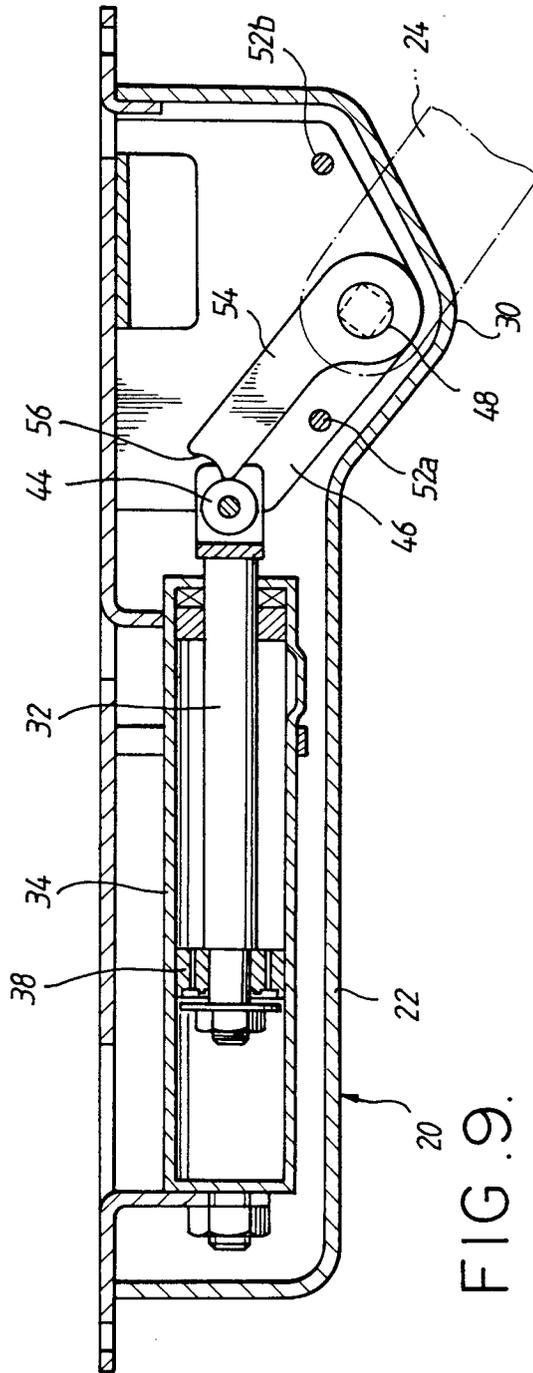


FIG. 9.

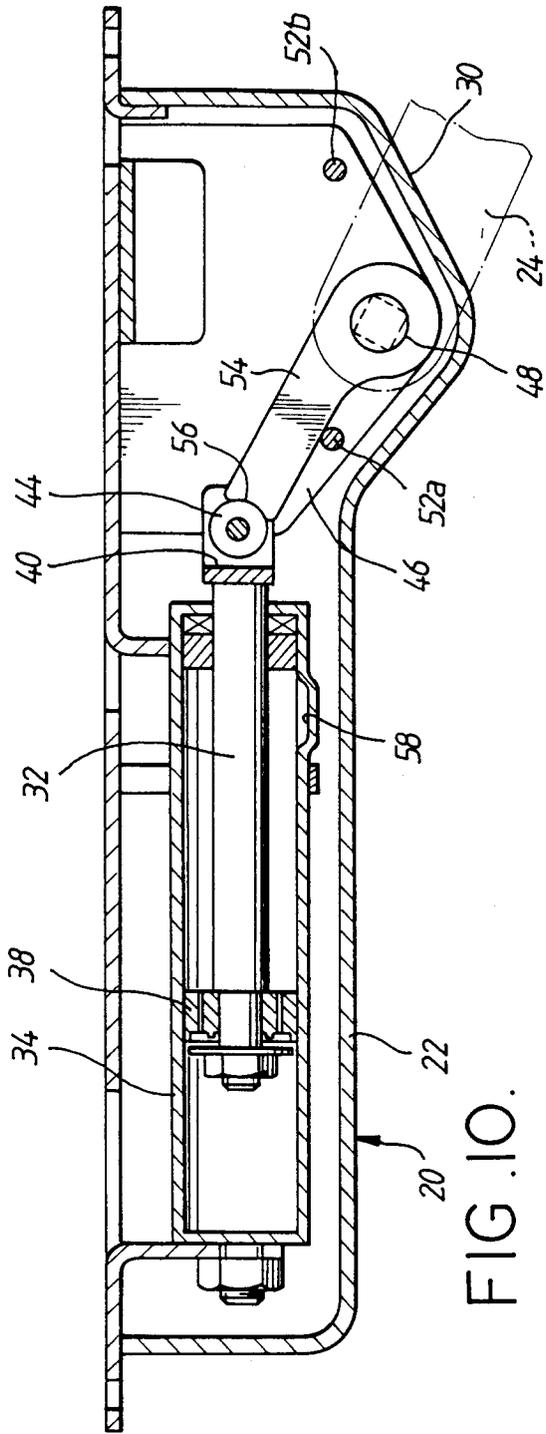


FIG. 10.

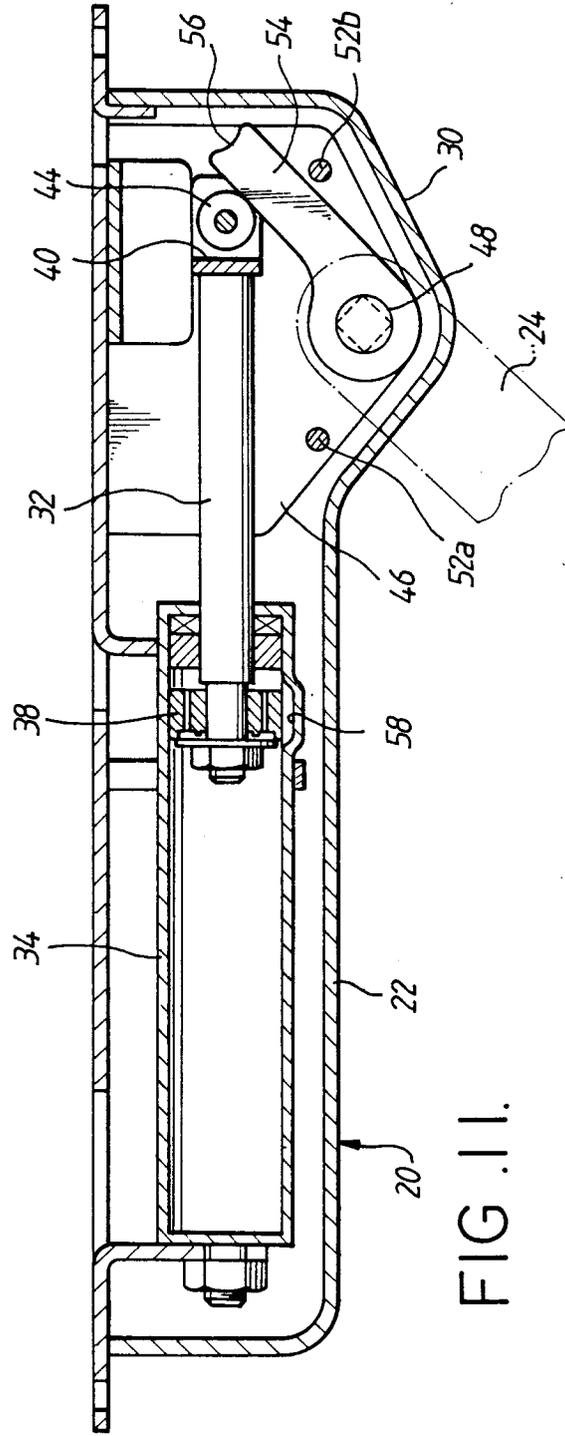


FIG. 11.



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	DE-A-23 13 513 (EATON GMBH) * claim 1; figures 5,2 * ---	1-6	E05F3/22
A	GB-A-1 512 016 (BARBER) * claim 1; figure 3 * ---	1-8	
A	DE-A-23 03 934 (THE STANLEY WORKS) * claim 1; figure 1 * ---	1-8	
A	EP-A-0 409 445 (RYOBI LTD) * claim 1; figures 2,5 * -----	1-8	
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
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			