Feb. 8, 1955 E. BILLETER 2,701,383

DOOR CLOSER

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Fig. 1

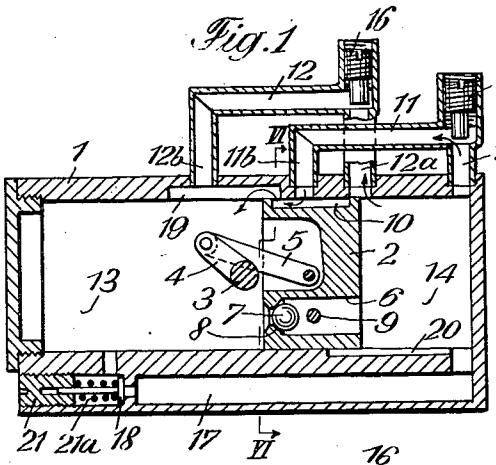


Fig. 2

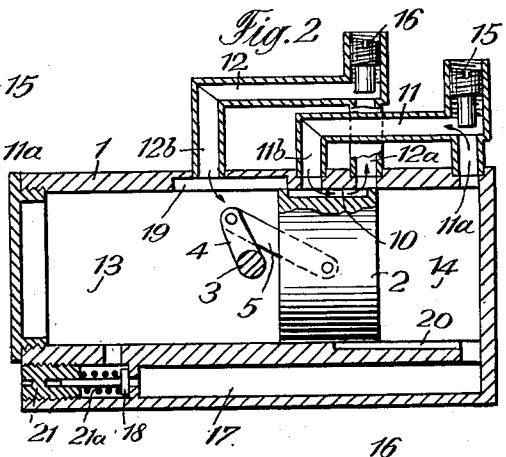


Fig. 3

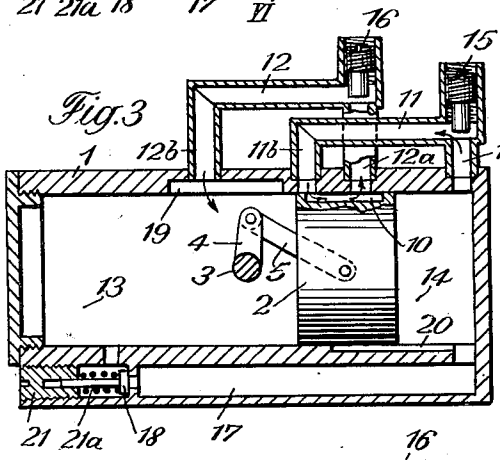


Fig. 4

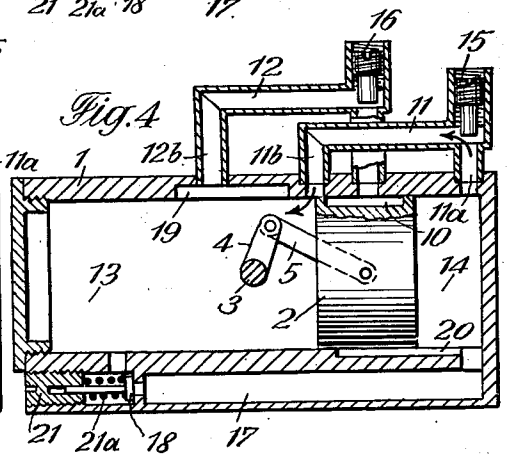


Fig. 5

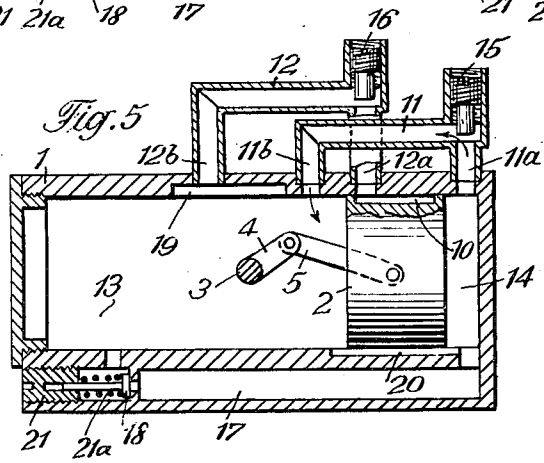
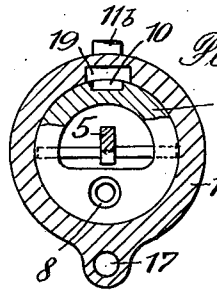


Fig. 6



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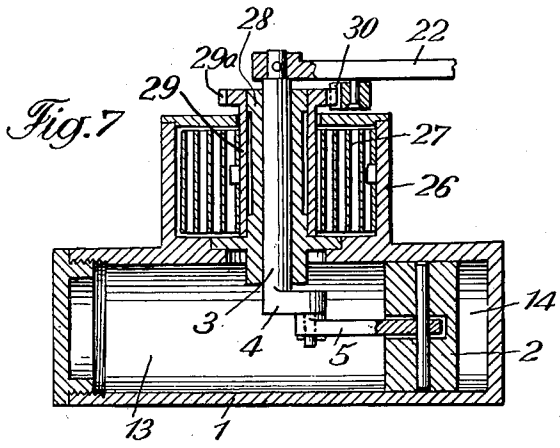
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DOOR CLOSER

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Fig. 7



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2,701,383

DOOR CLOSER

Ernst Billeter, Kusnacht, near Zurich, Switzerland

Application April 24, 1950, Serial No. 157,664

Claims priority, application Switzerland April 28, 1949

3 Claims. (Cl. 16—59)

The present invention relates to door closers and more particularly to door closers of the hydraulically operated type comprising a closing spring, such as are described in my earlier application Ser. No. 42,700, filed August 5, 1948, now Patent No. 2,522,252, issued September 12, 1950, and Swiss Patent No. 262,506.

According to my present invention, the door closer comprises a hydraulic check operating to additionally retard the door closing movement within a certain angle of aperture of the door.

One form of my present invention is illustrated in the accompanying drawings in which—

Figs. 1–5 show the check in longitudinal section in different working positions,

Fig. 6 shows a section on the line VI—VI of Fig. 1, and

Fig. 7 a vertical longitudinal section through the check.

Numeral **1** designates a check cylinder in which a check piston **2** is movable. A crank axle **3** projects through the wall of the check cylinder, being disposed at right angles to the cylinder axis and carrying in cylinder **1** an arm **4** provided with a crank pin which is engaged by a piston rod **5**. The latter, as known in the art, is pivoted to the piston **2** which, therefore, is moved in cylinder **1** on rotating the axle **3**. In piston **2**, further, there is inserted a check valve comprising a ball **7** movable in a duct **6** and adapted for co-operation with a seat **8** and a stop **9**.

In the sliding face of piston **2** is provided a longitudinal groove **10** of rectangular cross-section (Fig. 6). Two return conduits **11** and **12** with their two ends **11***a*, **12***a* and **11***b*, **12***b* open to the inside space of cylinder **1** which through piston **2** is subdivided into a forward chamber **13** and a rear chamber **14** respectively. A closing throttle **15** is provided in the return duct **11**, and an additional throttle **16** in the return duct **12**. By screwing the throttle elements **15**, **16** in or out, the passage cross-sections of the respective ducts **11** and **12** may be reduced or enlarged respectively. The throttle elements always are so adjusted that the throttling action of element **16** is more pronounced than that of element **15**.

On cylinder **1** is provided an override valve (Figs. 1–5) comprising a longitudinal bore **17** which opens into the two cylinder chambers **13** and **14**, and a valve plate **18** which opposes the flow of checking liquid through the said bore. The said plate **18** is loaded by a spring **21***a* which is adjustable by means of a screw plug **21**. A longitudinal groove **19** is provided in the cylinder inside wall adjacent duct-end **12***b*, and another longitudinal groove **20** on the side opposite the ends of the ducts **11** and **12**. The groove **20** is somewhat longer than the check piston **2**.

As shown in Fig. 7, an arm **22** forming a part of an elbow-joint linkage of well known construction, which is connected to the lintel of the door, at one end is pinned to the free end of crank-axle **3**. The check cylinder **1**, however, is rigidly secured to the door. The cylinder **1** carries a spring chamber **26** in which is disposed a closing spring **27** which at one end is secured to the chamber **26** and at the other end to the hub **29** of a spur gear **29***a* fixed on a sleeve **28** which is co-axial with the crank axle **3** and freely rotatable in chamber **26**, the spur gear **29***a* engaging a pawl **30** which is carried by the arm **22**.

The operation of the closer otherwise is as follows. Let it be assumed that the door is in an opening position in which the check components occupy the position shown in Fig. 1. The checking liquid is oil for example.

Under the action of the closing spring **27**, the crank axle **3** is rotated by way of the parts **29**, **30** and **22**, whereby the piston **2** is moved to the right, as shown in Fig. 1. With the check valve **6**—**9** closed, oil is moved out of the cylinder chamber **14**. The said oil flows through the return duct **11**, the piston groove **10** and the groove **19** into the cylinder chamber **13**. A relatively small portion flows through the duct **12** into the said chamber **13**. The closing movement, therefore, is checked more or less in dependency on the setting of the throttle elements **15**, **16**.

When, however, a certain reduced door opening angle has been reached, i. e. when the check components occupy the position shown in Fig. 2, the piston **2** interrupts the communication between the grooves **10** and **19**. The return ducts **11** and **12** now are series-connected by the piston groove **10**. The extent of delay of the closing movement is defined by that throttling element which has the more pronounced throttling action, i. e. by the throttling element **16**. It has to be noted that, according to the extent of such throttling, the door closing movement within the said certain door opening angle which corresponds to the positions of the piston **2** in Figs. 2 and 3, may be delayed as desired, i. e. down to standstill, in which case the throttling element **16** is entirely closed. When the piston **2** is positioned as shown in Fig. 4, i. e. when it uncovers the mouth of duct-end **11***b*, the displaced oil flows from the cylinder chamber **14** through the duct **11** directly into the forward chamber **13** so that the door closing movement again is checked only through the action of throttle element **15**. In order to slightly accelerate the closing movement at the end of the piston stroke, for the purpose of ensuring proper engagement of the door latch, the said groove **20** is provided in cylinder **1**. When the piston **2** has attained the position shown in Fig. 5, the oil may escape from chamber **14** through an additional passage past piston **2**, namely through the longitudinal groove **20**, so that the door closing movement is checked to a lesser extent. When it is desired from any reason whatever to quickly close the door by hand, the pull exerted on the door by a person closing the door, causes the piston **2** to move faster, whereby the oil pressure in cylinder chamber **14** is raised. The increased oil pressure is propagated through the bore **17** and, overcoming the action of spring **21***a*, causes valve **18** to open, whereby a direct passage of relatively large cross-section is produced between the cylinder chambers **14** and **13**. The door closing movement thus is checked substantially less by the throttle elements **15** and **16** respectively.

When opening the door, the excess pressure built up on the forward piston end face causes the ball **7** in piston **2** to leave its seat **8**, the ball **7** through the stop **9** being prevented from leaving the bore **6**. Thus there is provided direct communication between the cylinder chambers **13** and **14** so that the piston **2** may be moved, and thus the door opened without encountering any appreciable checking action.

It is to be noted that the range within which the piston will be additionally checked through the throttling element **16**, may correspond to any desired range of door opening angles. The arrangement suitably may be such that the piston movement is additionally checked during that time in which the displacement rate is a maximum and, therefore, the check piston **2** is checked most effectively.

What I claim as new and desire to secure by Letters Patent is:

1. A door closer comprising a hydraulic checking device including a cylinder and a piston therein, throttling means in said device for controlling the closing movement of the door, and a second throttling means in said device for producing a throttling action limited to a certain range of the door closing movement, the throttling action of said second throttling means being superposed to the throttling action produced by said first mentioned throttling means to provide for an unhindered passage through the door opening by an increased door braking action during said range of closing movement.

2. A door check comprising a hydraulic checking device including a cylinder and a piston therein, a pair of throttle passages in communication with said cylinder to by-pass fluid around said piston, said passages overlap-

ping with the outlet of one passage intermediate the inlet and outlet of the other passage, said cylinder having a groove in its wall extending from the outlet of said other passage to a point adjacent said intermediate outlet of said one passage, and said piston having a groove in its wall and operative as said piston moves to successively place said intermediate outlet in communication with said cylinder groove, whereby said passages are in parallel relation, and to place said intermediate outlet in communication with said other passage inlet, whereby said passages are in series.

3. A door check as defined in claim 2 wherein the second of said passages is more restricted than the first passage.

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