April 8, 1958 E. L. SCHLAGE 2,829,395

LOW PRESSURE PINION CHAMBER FOR DOOR CLOSERS

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FIG_1

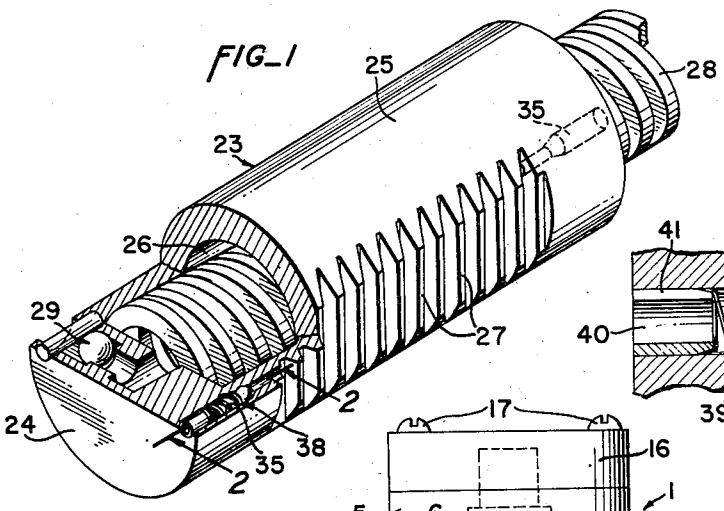


FIG_2

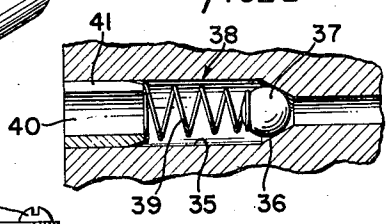


FIG_3

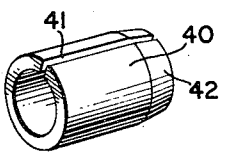


FIG_4

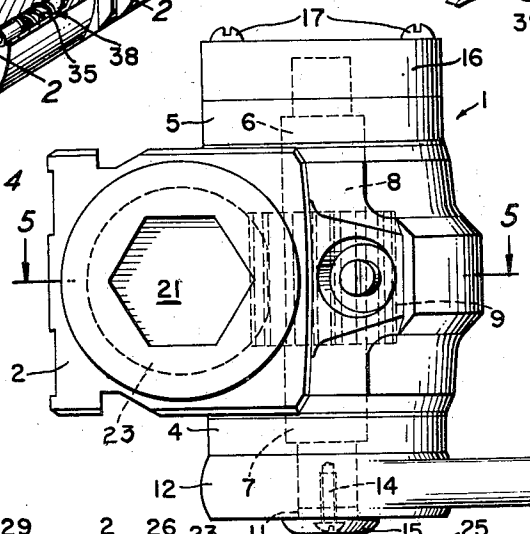
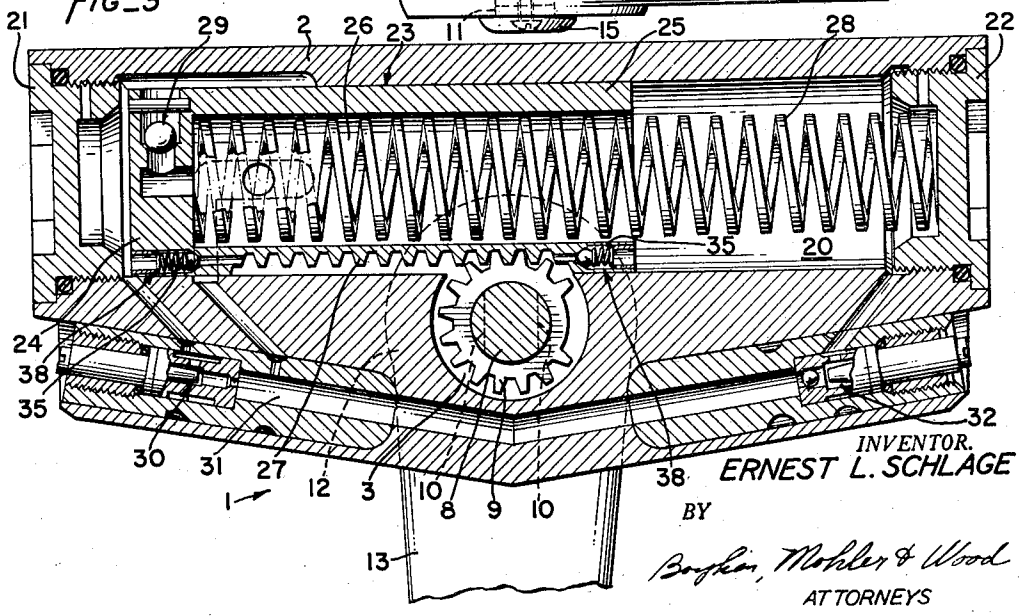


FIG_5



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LOW PRESSURE PINION CHAMBER FOR DOOR CLOSERS

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3 Claims. (Cl. 16—52)

This invention relates to improvements in door closers of the rack and pinion type and more particularly to the provision of means for assuring the maintenance of low pressure in the pinion chamber thereof.

Heretofore, in door closers which were provided with a spring urged piston associated with a rack and pinion to impart rotary motion to operating arms connected to said pinion by a drive shaft, the pinion was housed in a chamber across one side of which the piston cylinder intersected. The pinion chamber was designed for a low pressure operation to avoid leakage of fluid to the exterior of the closer past the rotating drive shaft.

However, the checking fluid in the piston cylinder, usually a light hydraulic oil, would gradually leak past the piston into the pinion chamber thereby increasing the pinion chamber pressure to an intermediate high value between the high and low pressure ends of the piston cylinder. This caused gradual leakage of the closer fluid thereby lowering the efficiency of the closer checking action. Furthermore, where the checking fluid was not compatible with the pinion lubricating oil, the former diluted the latter to the impairment of the closer operation.

In order to prevent the pinion chamber from becoming such a pressure trap this invention provides means for assuring the maintenance of a pressure in the pinion chamber only slightly greater than that on the low pressure end of the piston cylinder.

It is therefore a primary object of this invention to provide a low pressure pinion chamber for a door closer.

Another object of this invention is the provision of means for preventing the occurrence of high pressure in a door closer pinion chamber.

It is still another object of this invention to provide means for preventing fluid leakage from the pinion chamber of a door closer.

Other objects and advantages will become apparent from the following description taken in connection with the accompanying drawing in which:

Fig. 1 is a perspective view, partly broken away, of a door closer piston, rack and spring showing the means of this invention in place thereon;

Fig. 2 is an enlarged cross sectional view taken along the line 2—2 of Fig. 1;

Fig. 3 is a perspective view of the retaining ring of the device of Fig. 2;

Fig. 4 is an end elevational view of a door closer upon which the means of this invention is mounted; and,

Fig. 5 is a cross sectional view taken substantially along line 5—5 of Fig. 4.

The device of this invention is adapted for use with a rack and pinion door closer of the type described in my copending application Serial No. 234,362, filed June 29, 1951, now Patent No. 2,723,416, issued November 15, 1955. Said door closer, generally designated 1, includes a horizontally elongated main body 2 provided with a generally vertical through bore or pinion chamber 3 (Fig. 5). Threaded into the open ends of bore 3

are journal sleeves 4, 5 (Fig. 4) having anti-friction bushings within which the journal portions 6, 7 of drive shaft 8 are mounted for rotation. Drive shaft 8 is symmetrical about a horizontal plane and is long enough to project at its opposite ends beyond sleeves 4, 5.

Intermediate its ends drive shaft 8 is formed with an integral pinion gear 9 which rotates with drive shaft 8 in pinion chamber 3. The outwardly projecting ends of drive shaft 8 are finished with flats 10 (Fig. 5) engageable with a mating, rectangular hole 11 (Fig. 4) in a hub 12 of a driving or operating arm 13. Securement of hub 12 to either end of drive shaft 8 is accomplished by fastening screw 14 and washer 15. The end of the drive shaft not in use at any one time is preferably closed by a cap 16 held in place by machine screws 17 (Fig. 4).

Within body 2 and partially intersecting pinion chamber 3 is an elongated, cylindrical bore 20 (Fig. 5). This bore extends entirely through body 2 and is symmetrical with respect to the central horizontal plane of the body. Opposite ends of bore 20 are closed by identical plugs 21, 22 threaded in body 2. Designed to operate within the cylinder formed by bore 20 is a piston 23 having a head 24 at one end thereof and formed with a skirt 25 defining a cavity 26 opening to the other end (Figs. 1, 4).

Along one side, piston skirt 25 is provided with a plurality of gear teeth 27 constituting a rack in engagement with pinion 9 so that upon rotation of the pinion, the rack and the piston are correspondingly reciprocated, and vice versa. Piston 23, despite its motion, always overlies chamber 3 so that said chamber is isolated from the ends of cylinder 20. A separate supply of lubricant, preferably under atmospheric pressure, can therefore be provided within pinion chamber 3.

Normally, piston 23 is urged toward one extreme position by a helical coil spring 28. Said spring bears at one end on plug 22, passes through cavity 26, and at the other end bears against head 24 of piston 23. Upon a rotation of drive shaft 8 by rotating arm 13 (as in opening a door upon which said closer is mounted), piston 23 is translated toward the right (in Fig. 5) by pinion 9 and spring 28 is compressed. When arm 13 is released spring 28 impels piston 23 toward the left thereby rotating pinion 9 and arm 13 in the opposite direction (so as to close the door).

In order to control the movement of the door in both opening and closing directions, a body of hydraulic fluid, such as oil or an oil substitute, is disposed within cylinder 20. This oil lies within the variable compartments at opposite ends of the cylinder partly bounded by the interposed piston, and only by leakage can such fluid flow into pinion chamber 3.

During operation of the door closer, as described, the hydraulic fluid becomes pressurized in either end of cylinder 20 depending upon the direction of movement of piston 23. Upon a movement of piston 23 to the right (Fig. 5), a high pressure is created in the right end of cylinder 20 causing the hydraulic fluid to flow outwardly through ball check valve 29 mounted in head 24 of said piston. Upon the return of piston 23 to the left by spring 28, a high pressure is created in the left end of cylinder 20 forcing the hydraulic fluid through needle valve 30, connecting passageway 31, and needle valve 32 to return said fluid to the right end of said cylinder. Needle valves 30, 32 are provided for adjusting the speed and power of the door closer as described in the aforementioned copending application and patent.

Heretofore, it has been impossible to completely seal pinion chamber 3 from cylinder 20 so as to prevent leakage of the hydraulic fluid from the end compartments of said cylinder to said chamber under the alter-

nate high pressure operation described. Such leakage has caused the lubricating oil in pinion chamber **3** to become diluted and has depleted the supply of hydraulic fluid in cylinder **20** thereby decreasing the efficiency of the door closer. Such leakage has formed a pressure trap in pinion chamber **3** caused by the pressure therein incerasing to an intermediate high value between the high and low pressure ends of cylinder **20**. Although pinion chamber **3** is conventionally sealed from the exterior of the door closer, such seals are normally only sufficient to prevent leakage of lubricating oil from chamber **3** under normal atomspheric conditions.

In order to maintain a low pressure in pinion chamber **3** to overcome the disadvantages previously described, this invention provides a pair of conduits **35** (shown formed in piston **23**) to communicate between opposite ends of cylinder **20** and pinion chamber **3**. Such conduits are restricted as at **36** (Fig. 2) to form a seat for a closure member or ball **37** of one way valve means, generally designated **38**.

Seats **36** are directed toward opposite ends of piston **23** and a helical coil spring **39** yieldably urges ball **37** into flow preventing engagement with seat **36**. In order to support spring **39** in the position shown, split retaining ring **40** (Fig. 3) is inserted into conduits **35** from the opposite ends of piston **23**. Ring **40** is generally tubular in shape, is split longitudinally as at **41**, and is initially provided with a slightly greater diameter than conduit **35**. The forward end **42** of ring **40** is chamfered to simplify its insertion into a force fitting relationship with conduit **35**.

In operation, valves **38** prevent the flow of hydraulic fluid from either end of cylinder **20** into pinion chamber **3**. However, should leakage provide a pressure in pinion chamber **3** a predetermined amount above that of the lowest pressure in cylinder **20**, a portion of the fluid trapped in pinion chamber **3** flows outwardly through one of said valves to said low pressure end or compartment of cylinder **20**. Hence, one way or check valves **38** act to equalize the pressure between pinion chamber **3** and the low pressure compartment of cylinder **20** thereby assuring the maintenance of a low pressure in said pinion chamber.

In this connection it is important to note that the means of this invention allow the piston and cylinder to be fitted somewhat less exactly (thus reducing friction in the closer) than where close tolerances must be met to prevent leakage past the piston, as described. This invention, then, provides means for preventing the detrimental effects caused by such leakage without requiring that such leakage be prevented.

Although the invention has been described and illustrated in detail, such is not to be taken as restrictive

thereof since it is obvious that modifications could be made therein without departing from the spirit and scope of the invention.

I claim:

1. In combination with a door check and closer having a body provided with a cylinder filled with fluid, a piston mounted for reciprocation in said cylinder, and a drive shaft chamber communicating with said cylinder along one side of said piston and isolated from the remainder of said cylinder by said piston, means for maintaining the pressure in said chamber at a value substantially lower than the highest pressure in said cylinder, said means comprising conduits communicating between said chamber and said cylinder and one may valve means in each of said conduits for preventing fluid flow from said cylinder to said chamber.

2. In combination with a rack and pinion type door check and closer having a body provided with a cylinder filled with fluid, a piston reciprocable in said cylinder, and a pinion chamber communicating with the cylinder along one side of said piston and isolated from the rest of said cylinder by said piston, means for preventing an accumulation of pressure in said chamber by leakage of fluid past said piston, comprising: a pair of conduits through said piston, each opening outwardly of the opposite ends of said piston and communicating with said chamber, and check valves in said conduits for preventing fluid flow from said ends of said piston into said chamber.

3. In combination with a door check and closer having a body provided with a cylinder filled with fluid, a piston mounted for reciprocation in said cylinder, and a drive shaft chamber communicating with said cylinder along one side of said piston and isolated from the remainder of said cylinder by said piston, means for maintaining the pressure in said chamber at a value slightly higher than the lowest pressure in said cylinder, said means comprising: a pair of conduits each communicating between said chamber and said cylinder at each end of said piston, and one way valve means in said conduits for preventing fluid flow from said cylinder to said chamber, said valve means including a restriction in said conduits, and a closure member, spring urged in the direction of flow from said cylinder to said chamber and toward a seated position with respect to said restriction.

References Cited in the file of this patent

UNITED STATES PATENTS

627,828	Page	June 27, 1899
868,357	Norton	Oct. 15, 1907
2,522,252	Billeter	Sept. 12, 1950