Feb. 11, 1969 T. R. LASIER ETAL 3,426,383

DOOR CLOSER MECHANISM

Filed June 28, 1967 Sheet 1 of 5

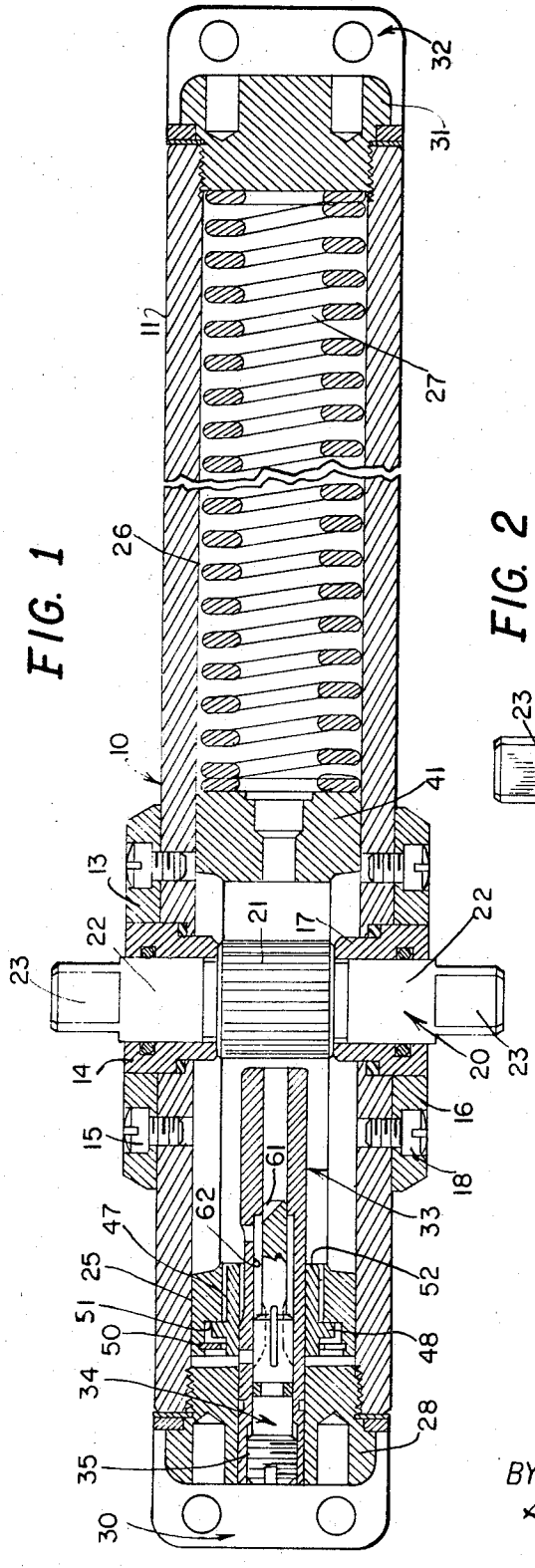


FIG. 1

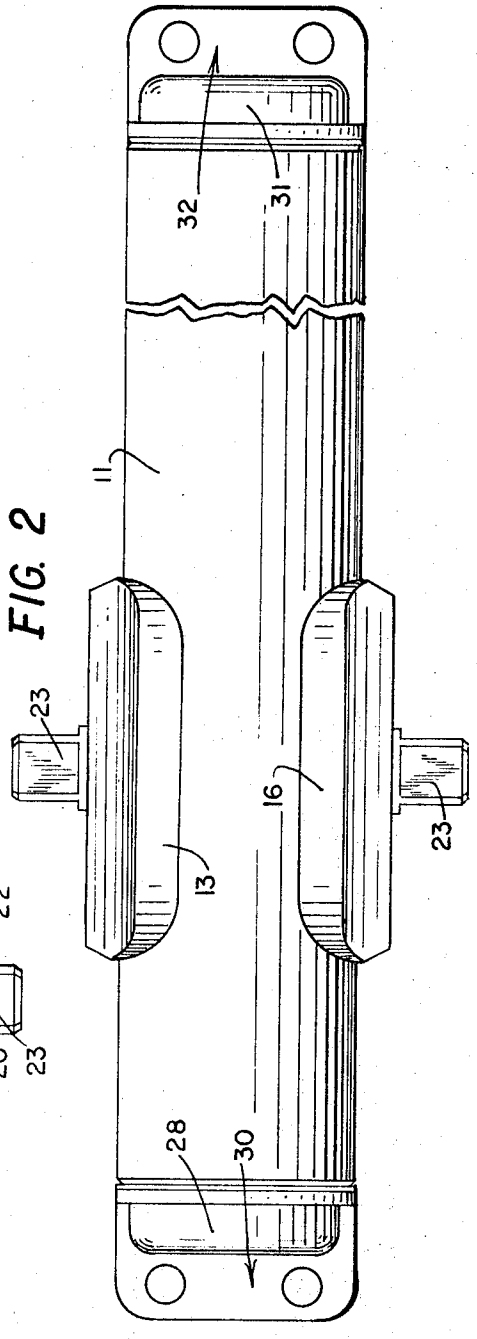


FIG. 2

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DOOR CLOSER MECHANISM

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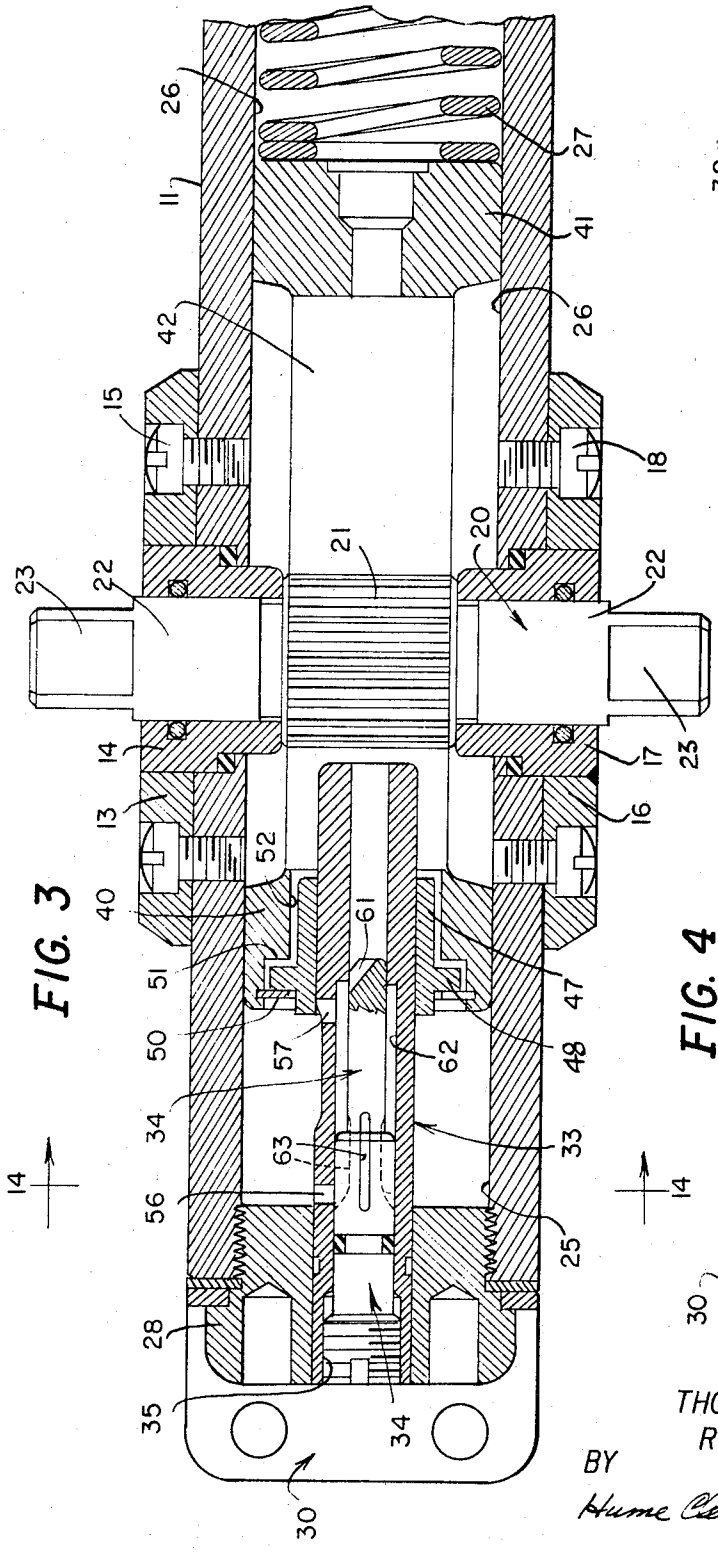


FIG. 3

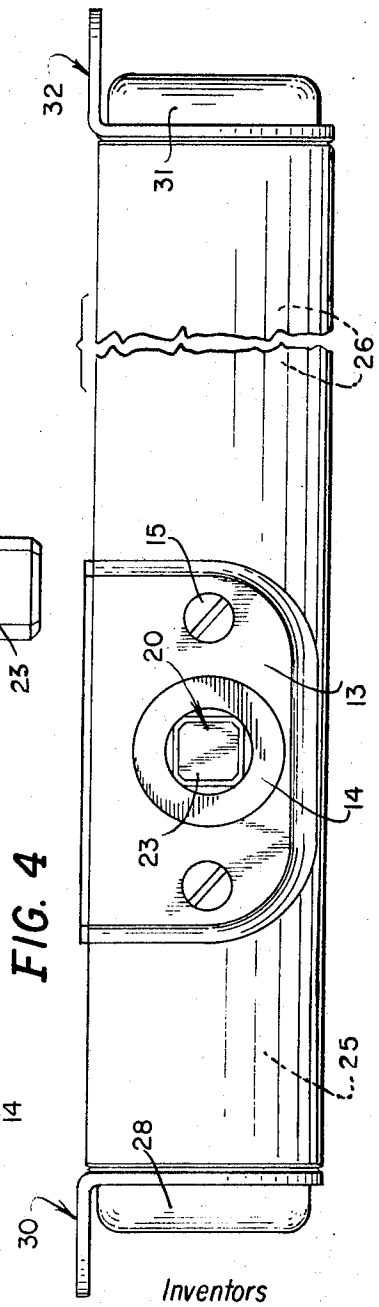


FIG. 4

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DOOR CLOSER MECHANISM

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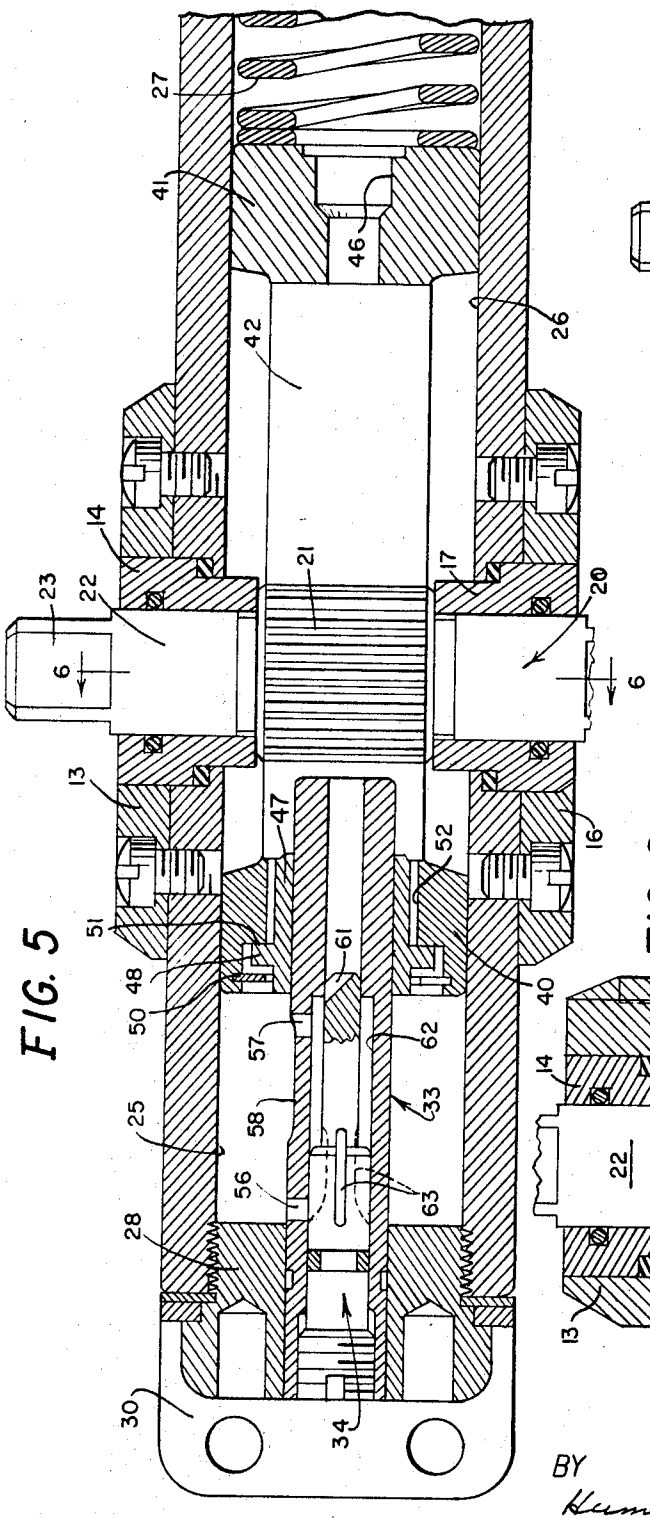


FIG. 5

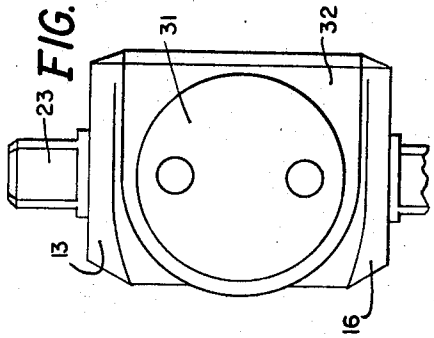


FIG. 7

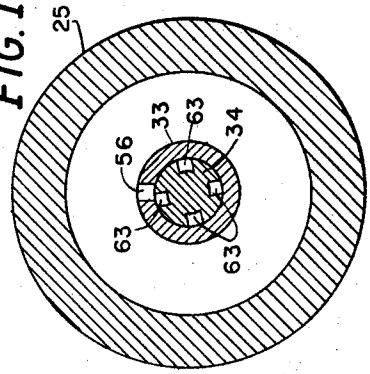


FIG. 14

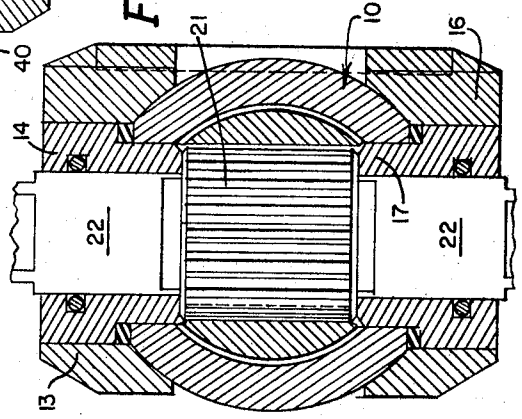


FIG. 6

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DOOR CLOSER MECHANISM

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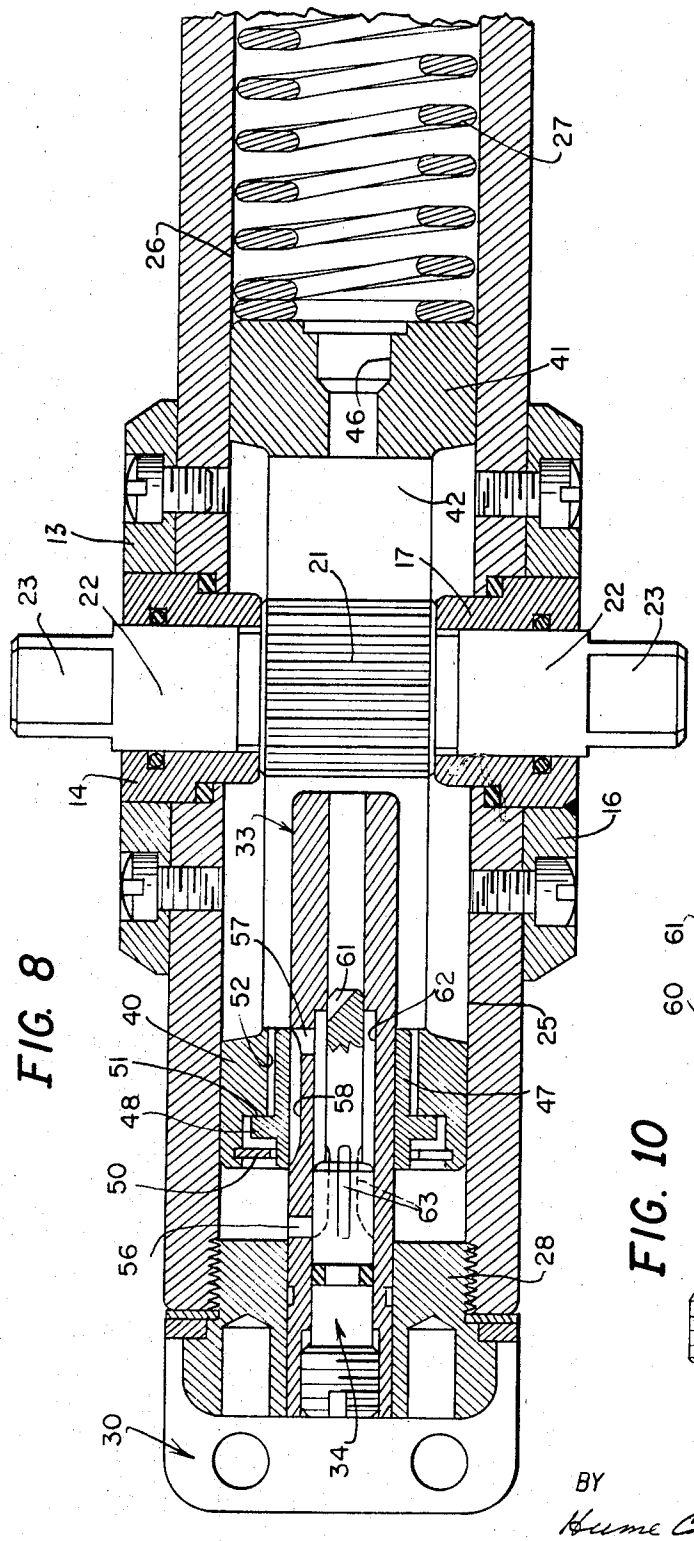


FIG. 8

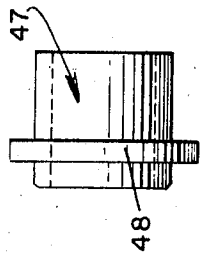


FIG. 12

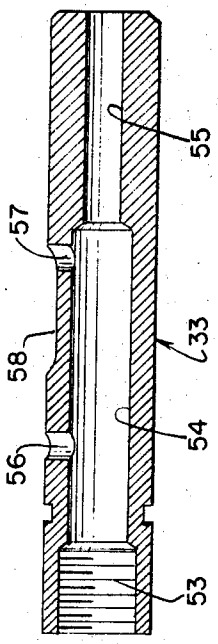


FIG. 11

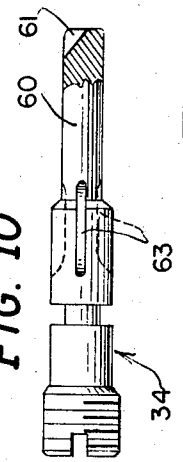


FIG. 10

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DOOR CLOSER MECHANISM

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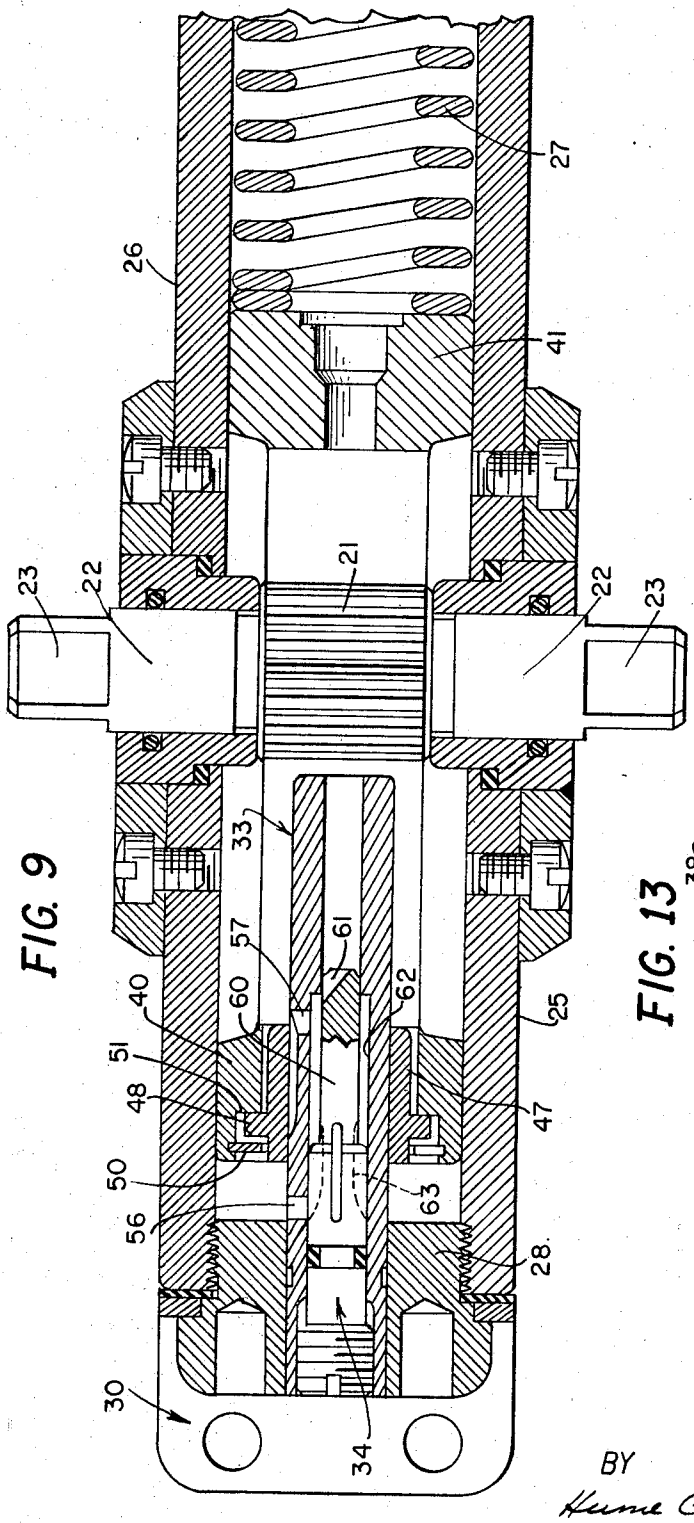


FIG. 9

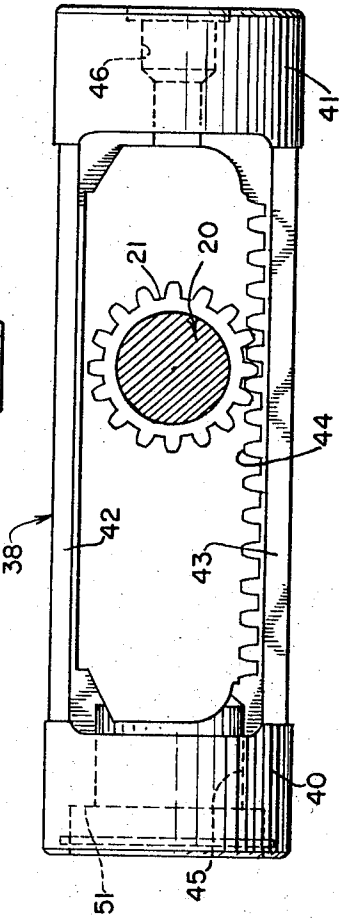


FIG. 13

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United States Patent Office 3,426,383
Patented Feb. 11, 1969

3,426,383

DOOR CLOSER MECHANISM

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Filed June 28, 1967, Ser. No. 654,306
U.S. Cl. 16—62 7 Claims
Int. Cl. E05f 3/04

ABSTRACT OF THE DISCLOSURE

In the present door checking mechanism a piston reciprocates within a cylinder. A fixed valve stem is mounted internally at one end of the cylinder. The piston reciprocates in telescoping relationship to said fixed valve stem. Coacting parts between said piston and valve stem control the rate of flow of fluids during the checking operation.

The invention relates to door checking mechanism of the hydraulic type employing a reciprocating piston for forcing an hydraulic fluid to flow through one or more restricted passageways during the closing action of the door, and more particularly to novel valve systems in door checking devices.

Heretofore in hydraulic door checking devices, the body portion of the device customarily was formed of cast materials. The valving system for the checking operation was contained in passageways provided in the body portion. The passageways were formed in the cast body by casting techniques and by machining. This was expensive and complicated.

Accordingly it is one of the objects of the present invention to provide door checking mechanism which employs a valve system at a location separately from the body portion.

It is a still further object of the invention to provide a door checking device having a valve system which does not require the complicated machining operations associated with locating the valving system within the body portion.

It is a further object of the invention to provide a valving system which is adjustable for regulating the speed of the checking operation.

It is still another object of the invention to provide a door checking system which is more economical in its manufacture.

Another object of the invention is to provide door closing mechanism having a check valve located in one end of the reciprocating piston with the piston and check valve having telescoping relation with a fixed and inwardly extending valve body, the said parts coacting automatically as the piston reciprocates to control the flow of the hydraulic fluid through the said end of the piston.

With these and various other objects in view, the invention may consist of certain novel features of construction and operation as will be more fully described and particularly pointed out in the specification, drawings and claims appended thereto.

In the drawings which illustrate an embodiment of the device and wherein like reference characters are used to designate like parts—

FIGURE 1 is a longitudinal section view taken through a door closing device constructed in accordance with and embodying features of the present invention, the said figure showing the piston in a door closed position;

FIGURE 2 is a front elevational view of the door closing device shown in FIGURE 1;

FIGURE 3 is a fragmentary sectional view on a scale somewhat enlarged over FIGURE 1 and showing the parts with the piston travelling in a direction toward the right for opening action of the door;

FIGURE 4 is a top plan view of the door closing device;

FIGURE 5 is an enlarged fragmentary sectional view similar to FIGURE 3 but showing the piston travelling in a direction towards the left for initially closing the door at normal speed;

FIGURE 6 is a vertical sectional view taken substantially along line 6—6 of FIGURE 5;

FIGURE 7 is an end elevational view of the door closer;

FIGURE 8 is an enlarged fragmentary sectional view similar to FIGURE 5 but showing the piston as having a position on the valve body for effecting a slow latching speed of the door;

FIGURE 9 is an enlarged fragmentary sectional view similar to FIGURE 8 but showing the piston in position on the valve body for effecting a fast latching speed of the door;

FIGURE 10 is an elevational view of the regulating screw;

FIGURE 11 is a view showing the valve body in longitudinal section;

FIGURE 12 is an elevational view of the check valve;

FIGURE 13 is a sectional view taken through the pinion shaft but which shows the reciprocating piston in elevation; and

FIGURE 14 is a sectional view taken substantially along line 14—14 of FIGURE 3 and illustrating the angular adjusted position of the regulating screw.

The door checking device which has been selected for illustrating the present invention is shown in longitudinal section in FIGURE 1, wherein the parts have the position which they assume when the door is closed. The housing **10** includes metal tubing **11** which is provided with journalling means for the pinion shaft **20**. The top journalling means includes the plate **13** having a flat top surface and an arcuate undersurface so as to fit the curvature of the tubing **11**. The plate **13** retains the bearing ring **14** and which is additionally retained by interfitting with the tubing. The plate is fixed to the tubing by securing screws **15**. The bottom plate **16** is similar in shape to the plate **13** and said bottom plate retains the bearing ring **17** and the same is fixedly secured in place on the tubing by the screws **18**. The pinion shaft **20** provides the pinion **21** and said shaft has spaced bearing portions **22** located in the bearing rings **14** and **17**, respectively. Each end of the pinion shaft is formed as at **23** for receiving an arm for connecting the door with the door closer. The particular end of the pinion shaft to which the arm is connected depends on whether the door is hinged on the left or on the right.

The housing unit **10** by means of the tubing **11** provides a cylinder with a pair of aligned chambers **25** and **26**, the chambers having location on opposite sides of the pinion shaft. Chamber **26** on the right side of the shaft is longer than chamber **25** and this feature in the construction of the housing unit has been selected so that power spring **27** can be located in the chamber **26**. The closing plug **28** is threadedly secured to the end of the chamber **25** for sealing this end. The said plug clamps one leg of the right angled bracket **30** to the metal tubing, thus fixedly securing the bracket to the housing unit. It will be understood that the bracket provides one of the mounting elements for mounting the door closing device. In a similar manner the end of cylinder **26** is closed and sealed by the plug **31** and the right angled bracket **32** is clamped by said plug to thus fixedly secure the other mounting element for the device to the housing unit. As best shown in FIGURE 4 the journalling plates **13** and **16** are shaped

to provide a flat rear surface on approximately the same plane as the brackets **30** and **32** for engagement with the same mounting surface, thus improving the mounting stability of the device.

The plug **28** is centrally apertured for receiving a stem **33** which forms the valve body of the present mechanism. The valve body has a press fit in the plug **28** and said valve body in turn receives a regulating screw **34** which is threadedly secured at **35** within the member at the left hand end thereof. The combination valve body and regulating screw closes the aperture in the plug **28** so that said plug thus seals the end of chamber **25** to prevent the escape of hydraulic fluid. Plug **31** closes the end of chamber **26**.

The double ended piston **38** as shown in FIGURE 13 is located within the tubing **11** and as said piston is caused to reciprocate it forces the hydraulic fluid back and forth between chambers **25** and **26**. The forward piston head **40** is joined to the rear piston head **41** by the connecting portions **42** and **43**. Said portions are sufficiently spaced for location on respective sides of the pinion **21**, and as will be observed in said figure, the inside surface of connecting portion **43** is provided with the rack teeth **44** having meshing relation with the teeth of the pinion **21**.

The forward piston head **40** is centrally bored to provide an opening **45** of special shape for accommodating a check valve **47** which will be presently described in detail. An opening **46** is also provided in the piston head **41**, but the shape of this opening is not critical since the opening is only necessary to permit flow of hydraulic fluid from one side of the piston head to the other as the piston reciprocates.

A coil spring **27** is confined between the rear piston head **41** and the rear plug **31**. The coil spring is compressed by the opening action of the door and the energy thus stored in the spring functions to move the piston in a direction towards the left, FIGURES 5, 8 and 9, for closing the door. The checking of the closing action of the door is effected by causing the hydraulic fluid in the housing and within the chamber **25** to flow through the restricted passages provided for the purpose, thus allowing the piston to travel in a controlled manner into the extreme left hand position of FIGURE 1, which is the position the parts assume when the door is closed.

As shown in the drawings the check valve or floating valve member **47** is carried by the piston head so as to ride on the valve body **33** as the piston reciprocates. The floating valve member **47** functions as a check valve. It will be observed that the check valve and also the piston head have telescoping relation with the fixed valve body **33**. The valve body **33** is in the form of a hollow stem which projects inwardly within the chamber **25**. The check valve **47** which is substantially cylindrical in shape, has an intermediate flange **48**, FIGURE 12, and is located within an opening **45** in the piston head **40**. The floating valve member coacts with the piston head so as to perform a one-way checking function, and the same is retained in place within the piston head by the split retaining washer **50**. A shoulder **51** is formed in the opening **45** of the piston and the flange **48** of the check valve, due to the pressure of the hydraulic fluid, is caused to contact shoulder **51** when the piston head moves toward the left in the closing of the door. When the piston head moves toward the right the flange **48** is caused to contact the retainer washer **50**. As previously mentioned the check valve is free to move easily on the valve body **33**, and the check valve is smaller than the opening **45** so as to form the circular passage **52**. When the flange **48** is in contact with the retainer washer **50**, as in FIGURE 3, the hydraulic fluid will flow freely through this passage **52**, around the flange **48** and through the opening in the split retaining washer **50** to be discharged into the chamber **25**. However, when the flange is in contact with the shoulder **51**, flow of hydraulic fluid through this passage cannot take place.

Since flow of the hydraulic fluid through the passage **52** is prevented when the piston moves to the left in the closing of the door, it is obviously necessary to provide other passages which will permit such flow. These other passages are formed by the coaction of the regulating screw **34** with the valve body **33**. Screw **34** is a regulating screw, and the same is adjustable as regards its position within the valve body. Accordingly, the size of these restricted passages can be varied to more or less restrict the flow of the hydraulic fluid through the same. The valve body is tubular as shown in FIGURE 11 and the same has a bore which is threaded at **53**. The bore is reduced in diameter at **54** intermediate the length of the valve body, and the bore is further reduced in diameter at **55** at the right hand end of the member. Openings **56** and **57** are formed in the wall of the valve body in spaced relation and the openings are so disposed as to communicate with the intermediate part **54** of the bore. Also, it will be observed that a portion of the peripheral wall of the valve body is flattened at **58**, the said flattened portion being disposed transversely and having one end thereof communicating with the opening **57**. The flattened portion **58** extends to the left as shown in FIGURE 11 but the same terminates short of the other opening **56**. The regulating screw when located within the valve body forms certain restricted passages therewith and the flattened portion **58** of the valve member forms an additional restricted passage with the check valve. These passages and the flow of the hydraulic fluid through the same as the piston reciprocates will now be described.

The end of stem portion **60** of the regulating screw **34** is grooved at **61** on an angle, for example, of approximately 45 degrees, and depending on the position of the screw within the valve body variable sized openings of a restricted nature are provided leading to the annular passage **62** between the stem part of the screw and the internal bore in the valve body. The annular passage **62** is supplied and also vented by the openings **56** and **57**. Whereas the opening **57** is in direct communication with the passage **62**, the opening **56** connects with the passage **62** through one of the four angularly disposed slots **63**, FIGURES 8 and 14. Also as regards the opening **57** it will be seen that the flattened or milled portion **58** on the valve body forms an entrance to or continuation of the opening **57**. Although the check valve may be located partly over the flattened portion the hydraulic fluid will flow to the opening **57**, and flow will continue until the position of FIGURE 8 is reached.

At the start of the closing cycle, the door is allowed to move under control at a normal speed. In the art this is known as the general speed. When the door approaches relatively close to the door frame, a second or latching speed takes over. This speed may be faster or slower as the conditions require. The door closing and checking mechanism automatically effects the transition to the second speed, and both speeds are fully adjustable.

FIGURE 3 shows the position which the parts assume in the opening of the door as the piston moves towards the end of its reciprocating stroke in a direction towards the right. Here check valve **47** is against the split retaining ring **50** and hydraulic fluid flows directly through the circular passage **52**, around the flange **48**, through the opening in the split retaining washer **50**, to be discharged into the chamber **25**.

In FIGURE 5 the piston has reached the end of its reciprocating stroke and has reversed its direction for closing the door under the power to be expended by the coil spring **27**. The shoulder **48** of check valve **47** has moved into contact with the shoulder **51** and the passage **52** is accordingly closed. However, flow of hydraulic from chamber **25** to the rear of the piston head **40** will take place through the openings **56** and **57**, the passage **62**, and the restricted openings formed by the groove **61**, and by the angular position of a slot **63** with respect to the opening **56**, FIGURE 14.

The initial closing of the door takes place at the general or normal speed and the same continues until the door is relatively close to the door frame. When the piston head **40** reaches the position as shown in FIGURE 8, opening **57** is closed and a second speed control takes over. This may be either faster or slower than the general speed and is controlled by the angular position of a slot **63** with respect to the opening **56**, FIGURE 14. When regulated for a slower speed, the opening made by the coaction of slot **63** with opening **56** is smaller than that of the groove **61** and thus only a restricted flow is permitted through opening **56**, slot **63**, the angular passage **62**, and groove **61** to the chamber behind the piston head. Although opening **57** is uncovered again as in FIGURE 9, the restricted flow continues and this controls the closing speed.

When the door checking mechanism is regulated for a faster second speed, one of the slots **63** of the regulating screw **34** is adjusted to create a larger opening with respect to opening **56** than exists at the groove **61**. As the piston head **40** moves to the left of its position as shown in FIGURE 8 to the position shown in FIGURE 9, the opening **57** is uncovered and the flow through opening **56**, slot **63**, passage **62** and opening **57** bypasses the slower regulation of the groove **61** and the closing of the door speeds up. The speed of the final closing action of the piston and the door continues until the piston reaches its extreme position in the left hand direction as shown in FIGURE 1 wherein the door is completely closed.

From the foregoing it will be understood that the general or normal speed in the closing action of the door is controlled by the size and longitudinal positioning of the groove **61** with respect to the annular passage **62**, and that the second or latching speed in the closing of the door is controlled by the size of the restricted passage formed by the angular position of a slot **63** with respect to opening **56**. Both speeds are controllable through the adjustments of the regulating screw **34**.

The invention is not to be limited to or by details of construction of the particular embodiment thereof illustrated by the drawings, as various other forms of the device will, of course, be apparent to those skilled in the art without departing from the spirit of the invention.

What is claimed is:

1. In door checking mechanism, the combination with a housing providing forward and rearward opposed chambers, of a piston having reciprocating movement within the housing as a result of opening and closing action of the door, said piston including a forward piston head located within the forward chamber, a valve body in the form of a hollow stem fixed to the end wall of the forward chamber and extending inwardly of the chamber, an adjusting screw within the valve body, said screw forming with the valve body a longitudinal passageway having communicating relation with certain openings in the valve body, said screw at one end also having a slot to form a restricted passage between the passageway and one of said openings, a check valve carried by the forward piston head and riding on the valve body in telescoping relation therewith as the piston reciprocates, said check valve forming a passage with the piston head and which extends through the head, said check valve controlling flow of an hydraulic fluid through said passage by automatically opening to permit such flow only during the opening action of the door, and said restricted passage controlling flow of the hydraulic fluid through the passageway and openings in the valve body during certain closing periods of the door wherein the openings in the valve body include a pair of openings in the cylindrical wall of the valve body having location at respective ends of the longitudinal passageway, and wherein the adjusting screw is adjustable both longitudinally and angularly within the valve body to vary the size of the restricted passage.

2. In a door closing and checking mechanism the combination with a housing providing forward and rearward chambers, of a piston having reciprocating movement within the housing as a result of opening and closing movement of the door, said piston including a forward piston head located within the forward chamber, a hollow stem fixed to the end wall of the forward chamber and extending inwardly to form a valve body, an adjustable screw within the valve body, said screw forming with the valve body a longitudinal passageway, said screw at its inward end having a groove to form a first restricted passage between the open end of the valve body and the longitudinal passageway, a pair of openings in the cylindrical wall of the valve body at respective ends of the passageway and which communicate with the forward chamber and with the passageway, said screw also having at least one slot therein at the opposite end of the longitudinal passageway and which is angularly positioned for coaction with one of said openings in the valve body to form a second restricted passage, a check valve carried by the forward piston head and riding on the valve body in telescoping relation therewith, said check valve forming a passage through the piston head and which is closed by the check valve during closing action of the door and opened by said check valve during opening action of the door, and said check valve having coacting relation with the said openings in the valve body as the piston and check valve reciprocate within the forward chamber during opening and closing movements of the door, whereby the restricted passages control the flow of an hydraulic fluid through the passageway and openings in the valve body during the closing movement of the door and during which period the said check valve is maintaining the passage through the piston closed.

3. A door closing and checking mechanism as defined by claim **2**, wherein the adjusting screw is longitudinally adjustable for varying the size of the first restricted passage, and is also angularly adjustable for varying the size of the second restricted passage.

4. A door closing and checking mechanism as defined by claim **3**, wherein the first restricted passage controls the closing speed of the door during the initial closing movements of the same, and wherein the second restricted passage controls the latching speed as the door moves into a closed position.

5. In a door closing and checking mechanism the combination with a housing providing forward and rearward chambers, of a piston having reciprocating movement within the housing as the result of opening and closing action of the door, said piston including a forward piston head located within the forward chamber, a hollow stem fixed to the end wall of the forward chamber and extending inwardly to form a valve body, means within the valve body forming a longitudinal passageway with the valve body and also forming a restricted passage between the open inward end of the valve body and the longitudinal passageway, a pair of openings in the cylinder wall of the valve body at respective ends of the passageway and which communicate with the passageway, a check valve carried by the forward piston head and riding on the valve body in telescoping relation therewith, said check valve forming a passage through the piston head and which is closed by the check valve during closing action of the door and opened by said check valve during opening action of the door, said valve body having a flattened portion on its cylindrical wall adjacent one of said pair of openings, said restricted passage controlling flow of an hydraulic fluid through the openings in the valve body and through the passageway during initial closing action of the door and while the check valve is located rearwardly of the flattened portion to effect a normal closing speed, and said check valve when located forwardly of the flattened portion effecting a latching speed of the door since the said opening adjacent the flattened portion is thus rendered operative to flow the hydraulic fluid from the passageway and discharge the same to the rear of the forward piston head, thus bypassing the restricted passage.

6. In a door closing and checking mechanism, the combination with a housing providing forward and rearward chambers, of a piston having reciprocating movement with

the housing as the result of opening and closing action of the door, said piston including a forward piston head located within the forward chamber, a hollow stem fixed to the end wall of the forward chamber and extending inwardly to form a valve body, an adjusting screw within the valve body, said screw forming a longitudinal passageway with the valve body, said screw at its inward end having a groove to form a restricted passage between the open end of the valve body and the longitudinal passageway, a pair of openings in the cylinder wall of the valve body at respective ends of the passageway and which communicate with the passageway, a check valve carried by the forward piston head and riding on the valve body in telescoping relation therewith, said check valve forming a passage through the piston head and which is closed by the check valve during closing action of the door and opened by said check valve during opening action of the door, said valve body having a flattened portion on its cylinder wall adjacent one of said pair of openings, said restricted passage controlling flow of an hydraulic fluid through the openings in the valve body and through the passageway during initial closing action of the door and while the check valve is located rearwardly of the flattened portion to effect a normal closing speed, and said check

valve when located forwardly of the flattened portion effecting a latching speed of the door since the said opening adjacent the flattened portion is rendered operative to flow the hydraulic fluid from the passageway and discharge the same to the rear of the forward piston head thus bypassing the restricted passage.

7. In a door closing and checking mechanism as defined by claim **6** wherein the said screw is longitudinally adjustable to vary the size of the restricted passage.

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J. L. KOHNEN, *Assistant Examiner.*

UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,426,383 February 11, 1969

Thomas R. Lasier et al.

It is certified that error appears in the above identified patent and that said Letters Patent are hereby corrected as shown below:

Column 4, line 70, after "hydraulic" insert -- fluid --.

Signed and sealed this 17th day of March 1970.

(SEAL)
Attest:

Edward M. Fletcher, Jr.
Attesting Officer

WILLIAM E. SCHUYLER, JR.
Commissioner of Patents