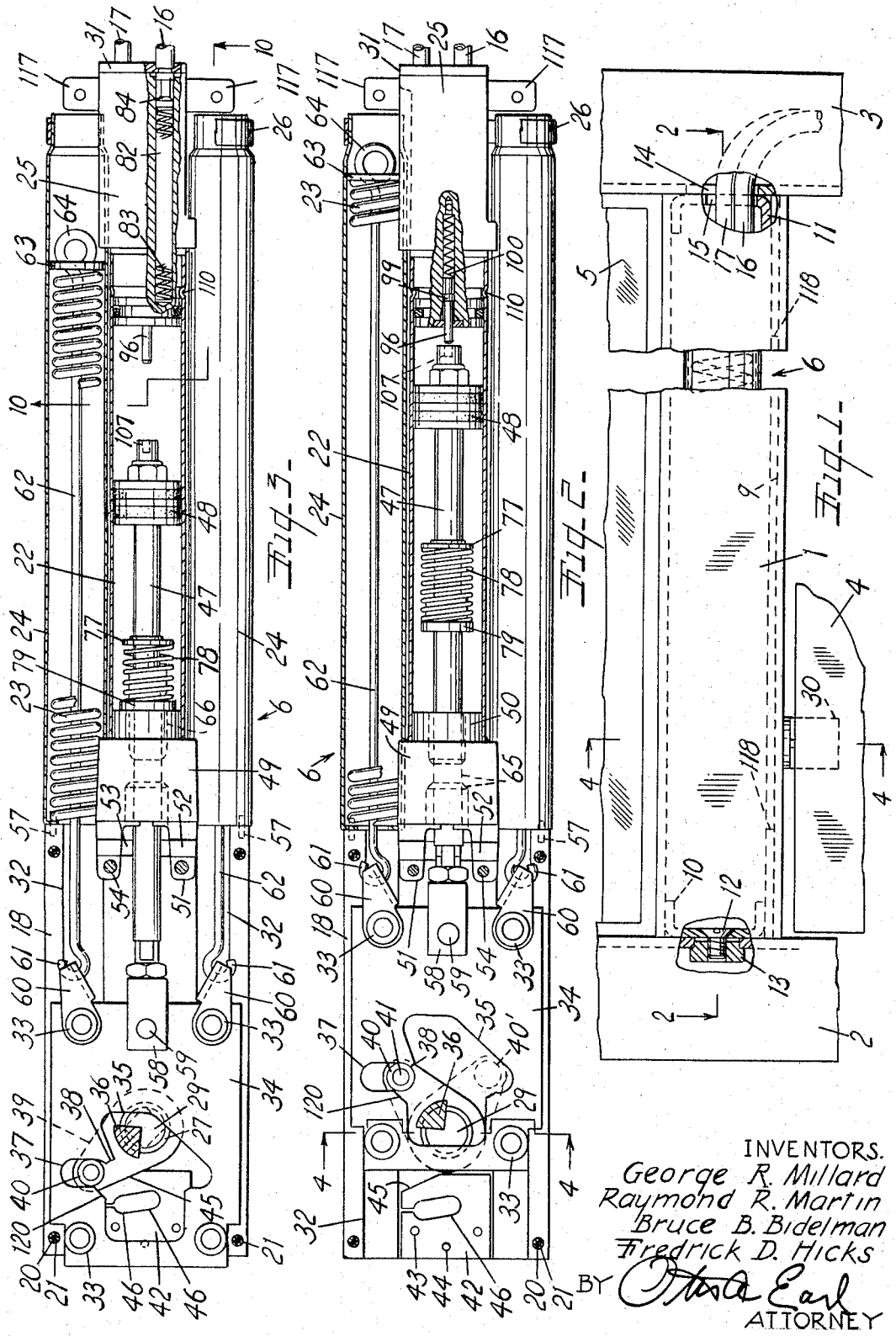
Feb. 20, 1968 G. R. MILLARD ETAL 3,369,323

POWER OPERATED DOOR OPENER

Original Filed July 2, 1964 3 Sheets-Sheet 1



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POWER OPERATED DOOR OPENER

Original Filed July 2, 1964 3 Sheets-Sheet 2

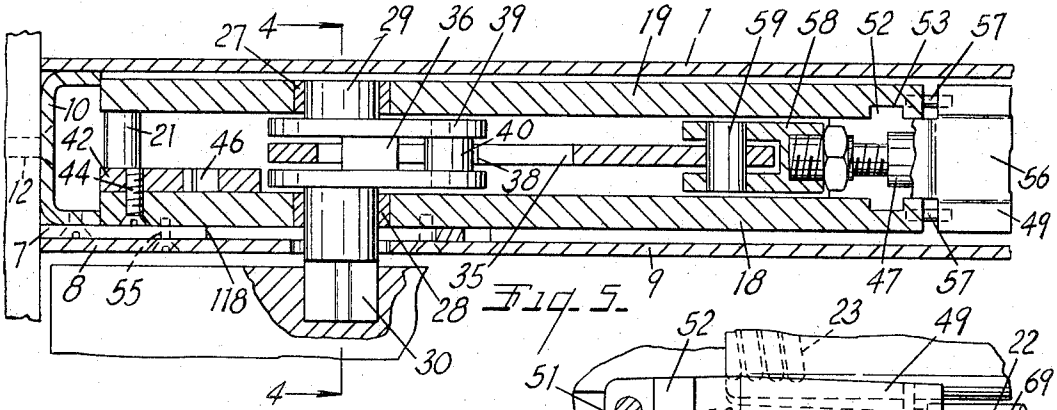


Fig. 5.

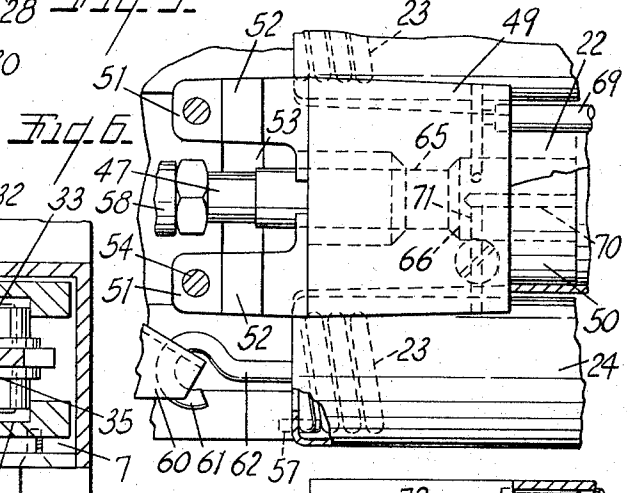


Fig. 6.

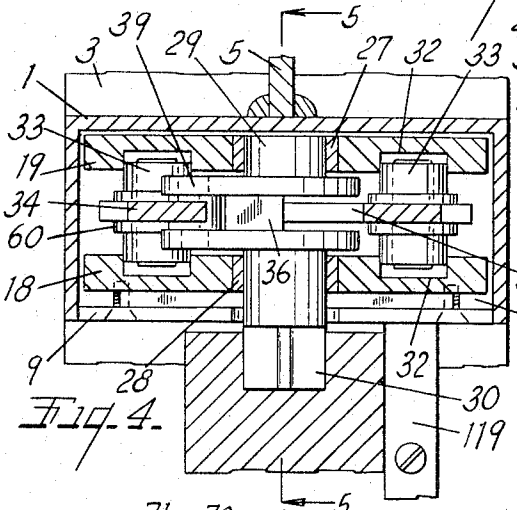


Fig. 4.

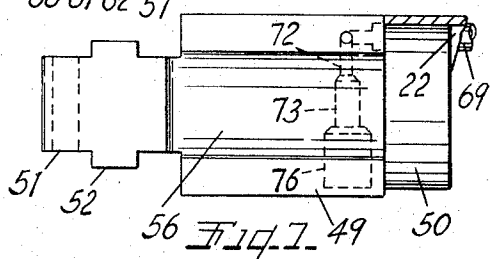


Fig. 7.

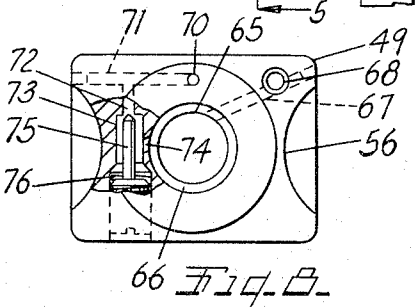


Fig. 8.

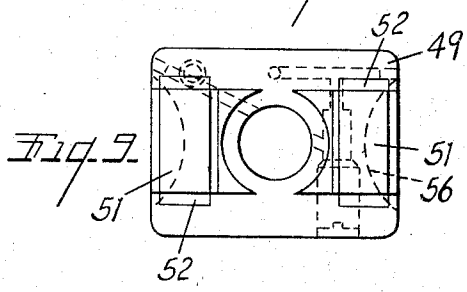


Fig. 9.

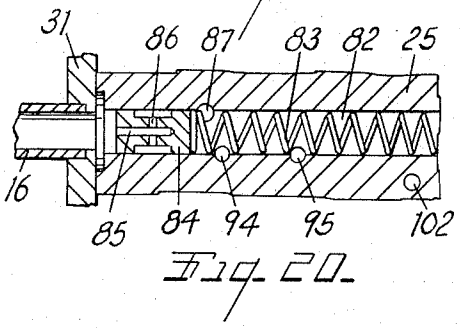


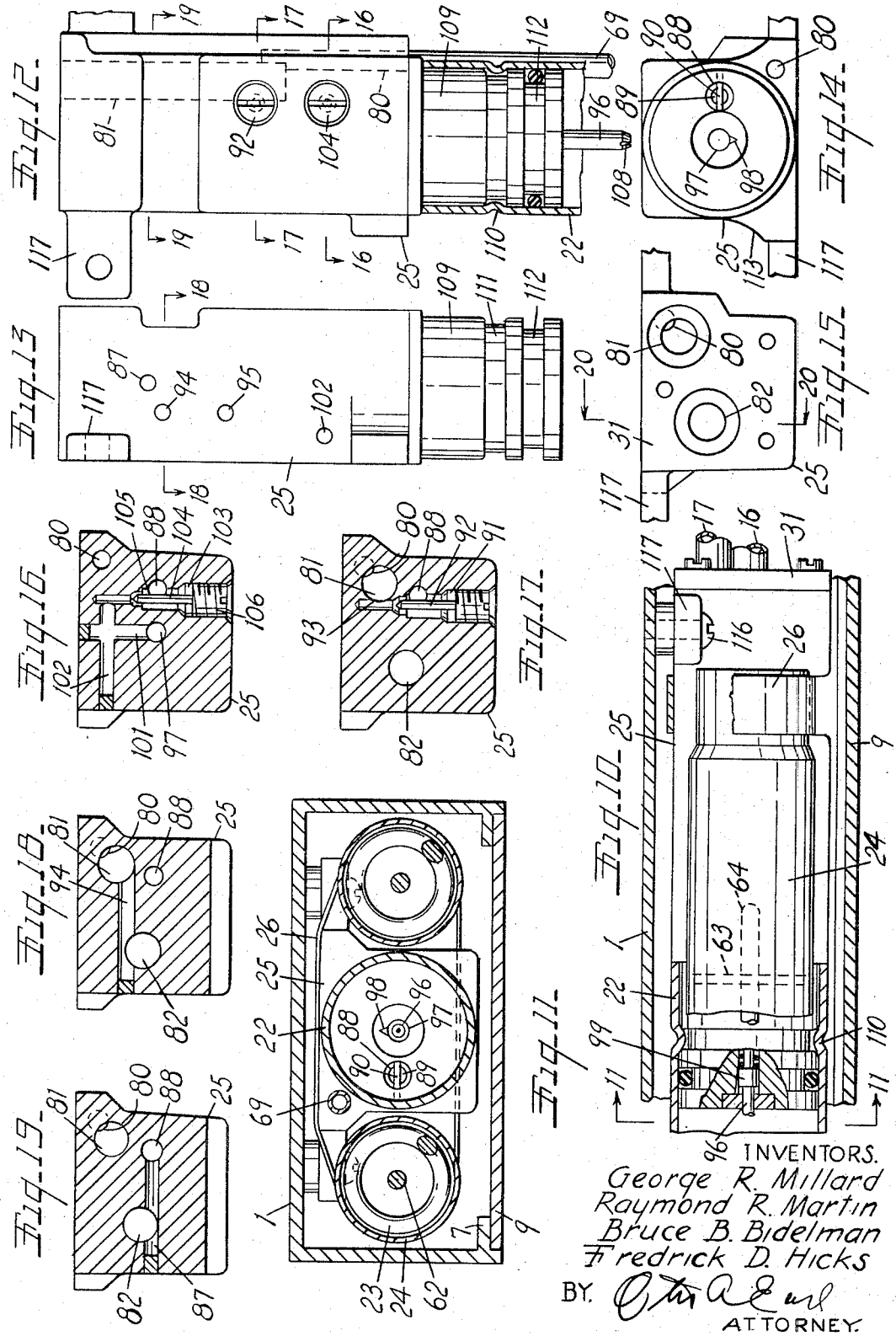
Fig. 20.

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POWER OPERATED DOOR OPENER

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POWER OPERATED DOOR OPENER

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Continuation of application Ser. No. 379,932, July 2, 1964. This application Mar. 22, 1967, Ser. No. 625,270
16 Claims. (Cl. 49—137)

ABSTRACT OF THE DISCLOSURE

A hydraulic cylinder and piston rod connected to reciprocate a cam, a crank connected to the door and actuated by the cam, springs arranged to close the door; hydraulic valves connected to the ends of the cylinder and to each other, coacting closure parts on the valves and piston, and passages in the valves to provide full flow followed by restricted flow at the end of the door opening motion, and full flow followed by progressively restricted flow at the end of the door closing motion of the piston; and fluid recirculating passages with a spring pressed bypass valve providing constant hold open pressure on the door. A mechanical connection between the cam and crank permits emergency opening of the door.

This application is a continuation of copending application Ser. No. 379,932, filed July 2, 1964, now abandoned.

Objects and advantages of the invention will be apparent from a consideration of the following description and claims. The drawings, of which there are three sheets, illustrate a highly practical form of the door operator.

FIG. 1 is a fragmentary outside elevational view partially broken away in section of the top of a door and door frame header having the power operator of the invention mounted therein.

FIG. 2 is a fragmentary cross sectional view through the door operator mechanism taken along the plane of the line **2—2** in FIG. 1 and showing the door operator in door closed position.

FIG. 3 is a fragmentary cross sectional view similar to FIG. 2 but showing the door operator in full door opening position.

FIG. 4 is a fragmentary transverse cross sectional view taken along the plane of the lines **4—4** in FIGS. 1, 2 and 5.

FIG. 5 is an enlarged fragmentary vertical longitudinal cross sectional view taken along the plane of the line **5—5** in FIG. 4.

FIG. 6 is a fragmentary top plan view partially in section of the anchor connections to the outer or left end of the door operator cylinder and the door closing springs as these parts would be viewed in looking downwardly at the top side of the installations in FIGS. 4 and 5.

FIG. 7 is a fragmentary side elevational view of the cylinder anchoring member shown in FIG. 6 with a portion of the cylinder connected thereto.

FIG. 8 is an inner or right end elevational view of the cylinder anchor and valve body shown in FIGS. 6 and 7.

FIG. 9 is an outer or left end elevational view of the cylinder anchor and valve body shown in FIGS. 6 to 8.

FIG. 10 is an enlarged fragmentary vertical cross sectional view taken along the plane of the broken line **10—10** in FIG. 3 showing the inner or right hand end of the cylinder and return spring anchor and valve body.

FIG. 11 is a fragmentary transverse cross sectional view taken along the plane of the line **11—11** in FIG. 10.

FIG. 12 is an enlarged bottom plan view of the inner valve body and cylinder anchor with a portion of the operator cylinder connected thereto as the body would be viewed looking upwardly from the bottom of FIG. 1.

FIG. 13 is a projected side elevational view of the inner valve body shown in FIG. 12.

FIG. 14 is an inner or left end elevational view of the inner valve body projected from FIG. 12.

FIG. 15 is a fragmentary outer or right elevational view of the right valve body relative to the cylinder shown in FIGS. 12 to 14.

FIG. 16 is a transverse cross sectional view taken along the plane of the line **16—16** in FIG. 12 looking in the direction of the arrows.

FIG. 17 is a transverse cross sectional view taken along the plane of the line **17—17** in FIG. 12 looking in the direction of the arrows.

FIG. 18 is a cross sectional view taken along the plane of the line **18—18** in FIG. 13 looking in the direction of the arrows.

FIG. 19 is a transverse cross sectional view taken along the plane of the line **19—19** in FIG. 12 looking in the direction of the arrows.

FIG. 20 is a fragmentary longitudinal cross sectional view taken along the plane of the line **20—20** in FIG. 15 looking in the direction of the arrows.

The door operator or opener of the invention as shown in FIG. 1 is designed to be mounted in a transom or header member **1** of a door frame having a left upright **2** and right upright **3** with a door **4** swinging inwardly of the plane of the picture from the right side. The frame members illustrated are extruded aluminum sections and a fragment of a glass panel **5** is illustrated above the door. The operator mechanism indicated generally by the numeral **6** is enclosed in the header **1** which is of downwardly opening channel shaped cross section with inwardly projecting ribs **7** near the lower ends of the side walls for supporting bottom closure plates **8** and **9** (see FIGS. 5 and 11) as will be described presently. The same door operator may be installed in doors of varying widths and the header **1** is mounted between the side frame members **2** and **3** by U-shaped clips **10** and **11**.

The clips are secured to the side frame members by screws **12** engaged in blocks or nuts **13** on the inner sides of the side frame members and the side frame members are provided at the proper height with openings **14** through which the nuts **13** may be pressed into position. The U-shaped end clips **10** and **11** are provided with central openings **15** of substantial size through which access may be had to the openings **14** and the nuts **13** and through which a supply pipe or conduit **16** and a return pipe or conduit **17** from a suitable remotely located pump or source of hydraulic pressure may be passed.

The pump may be started by any suitable means such as a pressure mat switch positioned on both sides of the door for automatic operation as is common or when multiple doors are installed in a single position the pump may be operated continuously and the supply of hydraulic liquid to each door may be controlled by a valve actuated by the mat switch or other control. Details of the pump, switch or valve form no part of the present invention and so are not illustrated.

The door operator **6** as shown in FIGS. 2 and 3 consists generally of a pair of outer or left end support plates **18** and **19** which are secured together in vertically spaced relation by screws **20** passed through spacers **21** at the corners of the plates. For the purpose of description, the left or pivoted edge of the door will be considered as the outer edge, to which the outer end of the door opener extends, as distinguished from the inner end of the opener which may be located at an indeterminate distance inwardly of this edge in wider doors. The plates **18** and **19**, of which the plate **18** is the lower, constitute

anchoring or mounting means for the central hydraulic cylinder 22 which opens the door, and a pair of coiled compression springs 23 enclosed in the cylindrical casings 24 which close the door. At the right or inner end of the door operator the cylinder 22 is mechanically connected and sealed to a first or inner valve body 25 and the spring casings 24 are retained against the sides of the valve body by an annular band 26. The plates 18 and 19 constitute anchoring means for the cylinder 22 and for journals or bearings 27 and 28 for a crank member 29. The crank member has lower noncircular end 30 nonrotatably and drivingly engaged in the door 4 so that rotation of the crank by the operator as will be described rotates the door in an opening and closing motion. The inlet or supply conduit 16 and return conduit 17 are connected to the inner valve body 25 through a connecting plate 31.

Turning first to the mechanical opening and closing mechanism at the left end of the door operator as shown in FIGS. 2 to 9 it will be noted that the spaced guide plates 18 and 19 have opposed guide slots 32 on their opposed inner sides extending longitudinally of the header and constituting guides for eight rollers 33 positioned at the corners of a cam plate 34. The cam plate defines a central aperture or opening 35 through which the segmentally shaped center portion 36 of the crank 29 extends.

The plate 34 has a laterally opening slot 37 formed therein and opening from the side of the central aperture 35 with a slightly outwardly projecting nose 38 at the transversely and longitudinally inner end of the slot. The crank 29 has spaced parallel arms 39 connected to the ends of the segmental central portion 36 positioned on opposite sides of the cam plate 34 and projecting radially from the axis of the crank which coincides with the swinging axis of the door. The swinging ends of the crank arms support a follower in the form of a roller 40 carried by a pin 41 extending between the crank arms and the roller which is sized to fit closely within the slot 37.

Outward extension of the cam plate to the left as shown in FIG. 3 engages the longitudinally inner side edge of the slot 37 with the follower roll 40 to swing the crank arms 39 approximately 90° to the door opening position. Conversely inward retracting motion of the cam plate to the right causes the longitudinally outer edge of slot 37 to swing the crank clockwise as viewed in FIGS. 2 and 3 to close the door. To limit and cushion the opening motion of the door the bottom guide plate 18 is provided with a stop block or plate 42 located by dowels 43 and secured by a screw 44. The stop block has an abutment surface or edge 45 against which the lower crank arm 39 abuts in the open position of the door as appears in FIG. 3. The stop plate or block has an opening or slot 46 formed therein behind the abutment 45 so that the abutment may yield slightly and cushion the stop of the opening motion.

The cam plate 34 is actuated by the piston rod 47 extending from the piston 48 in the cylinder 22. The outer or left end of the cylinder 22 is mechanically anchored and sealed to a second or outer valve body 49 having a cylindrical inner projection 50 to which the cylinder is welded. At its outer or left end the valve body 49 has tongues 51 with ribs 52 on their upper and lower sides. The ribs fit within transverse slots or grooves 53 formed in the inner sides of the anchor plates 18 and 19 and screws or bolts 54 further secure the valve body to the anchor plates. The anchor plates are in turn secured to the inwardly projecting flanges 7 of the header by screws 55 (see FIG. 5) so that the cylinder and outer valve body 49 are fixed relative to the header.

The sides of the outer valve body 49 have concave side surfaces 56 which receive the sides of the spring casings 24 and dowel pins 57 projecting from the inner ends of the mounting plates form sockets which retain the outer ends of the spring casings against the sides of the valve body.

Compression in the spring 23 holds the spring casings against the inner ends of the mounting and guide plates. The outer end of the piston rod 47 is connected to a yoke 58 pinned to the inner end of the cam plate at 59. The pins supporting the inner corner guide rollers 33 on the cam plate support U-shaped yokes 60 which are engaged by hooks 61 on pull rods 62 projecting through the coil springs 23. Washers 63 at the inner ends of the pull rods and springs engage eyes 64 on the pull rods so that left or outward extension of the cam plate 34 by the piston rod 47 compresses the springs 23. Release of pressure by the piston 48 on the piston rod 47 permits springs 23 to expand retracting the pull rods 62 and the cam plate 34 inwardly or to the right.

The outer or left valve body 49 defines a central sealing journal 65 for the piston rod 47 with an annular enlarged space 66 therearound on the inner end of the valve body. A first radial port or passage 67 plugged at the outer end communicates between the annular space 66 and an axially extending bore 68 opening from the inner end of the valve body 49 externally of the cylinder 22. A return connecting pipe 69 connects the port 68 with the inner valve body as will be described presently. The outer valve body also defines an axially extending port or bore 70 which is continuously open within the cylinder 22 and which communicates through the bore 71 with a vertical bore 72 formed upwardly from the bottom of the valve body. The bore 71 is blocked at its outer end. The bore 72 is enlarged at 73 and communicates with the annular passage 66 through a port 74 which may be a continuation of the port 67. A needle valve 75 threaded adjustably in the further enlarged outer end 76 of the port 73 variably adjusts the opening between the port 73 and the port or bore 70.

The piston rod 47 carries an abutment 77 within the cylinder backing up a coil spring 78 which in turn yieldably forces a closure member or valve 79 outwardly upon extension of the piston and piston rod. Thus during initial opening motion of the door, oil within the left or outer end of the cylinder passes freely through the annular recess 66, port 67 to the port 68 and return pipe 69. Rapid opening motion of the door is thus assured. As the closure or valve 79 engages the end of the outer valve body, it closes off the annular passage 66 as appears in FIG. 3 and the only remaining passage for escape of oil from behind the piston is through the port 70 and bores 71, 72, past the needle valve 75 and port 74. Adjustment of the needle valve in the threaded bore 76 accordingly determines the speed of the final opening movement of the door.

The connecting or return pipe 69 extends to the outer face of the inner valve body 25 and connects thereto externally of the cylinder 22 to a bore 80 at the outer face of the valve body relative to the inner end of the operator. The bore 80 extends approximately half way through the body 25 and intersects and communicates with the larger return bore 81 to which the liquid return pipe or conduit 17 connects. A free return or flow of oil between the outer valve block and the return conduit 17 is thus open at all times. The delivery or supply conduit 16 opens into a valve bore 82 which extends to a dead end in the valve body 25 and contains a coil spring 83 positioned behind and biasing a spool-like control valve 84 outwardly of the bore 82 (inwardly of the operator toward the inner end of the inner valve body). The spool valve 84 has a central axial bore 85 communicating with radial bores 86 which open to the annular space in the center of the spool valve. Moving progressively inwardly of the bore 82 toward the cylinder 22 from the outward position of the valve in the bore, the valve body 25 has a first cross bore 87 plugged at its outer end and communicating between the bore 82 and an inlet passage 88. The inlet passage 88 is bored from the inner face of the valve body relative to the cylinder (see FIG. 14) to open into the cylinder and is enlarged at its inner end to receive a ball check valve 89 retained in the bore by a pin

90. Thus as pressure developed in the inlet or delivery conduit 16 builds up, the spool valve 84 is forced inwardly until the annular reduced center of the spool and the bore 85 communicate with the cross bore 87 and the axial bore or inlet passage 88 so that oil under pressure passes freely around the check valve 89 and into the inner end of the cylinder 22 forcing the piston 48 and piston rod 47 to extend and open the door.

To control the opening speed of the door, inlet passage 88 communicates, intermediate of its length at section and FIGURE 17, with the intermediate section of a stepped bore 91 bored upwardly from the bottom of the valve body. The bore 91 adjustably receives the threaded needle valve 92, the reduced inner end of which coacts with the reduced inner end of the bore. Valve 92 constitutes a door opening speed control valve. The reduced inner end of the bore 91 intersects the return bore 81 at 93 so that opening of valve 92 bleeds off part of the oil and pressure, which would otherwise actuate the piston, directly to the return conduit 17. The speed of the initial opening movement of the door is thus controlled by adjustment of the valve 92. Note that the by-passed oil also effects the volume and speed of the oil that can be expelled from the outer end of the cylnider through the connecting pipe 69. As the door nears open position, valves 79 and 73 in the outer valve body assume control of the opening speed of the door as previously described.

When the door is fully opened with crank arm 39 against stop surface 45 of plate or block 42, the resistance to displacement of oil builds up pressure on spool valve 84 so that the spool moves inwardly of bore 82 until the annular reduced center portion of the spool also uncovers a transverse passage 94 bored from the side of the body 25 and plugged at its outer end and extending across the body to return passage 81 (see FIG. 18). The reduced annular center of spool valve 84 opens to both passages 87 and 94 so pressure is maintained on piston 48 to hold the door open while excess oil is recirculated through passages 94 and 81 to the return conduit 17. A third cross passage 95 having the same connections as passage 94 bleeds oil from behind spool valve 84 so the valve can operate freely under the influence of spring 83 and pump pressure.

When the control (mat switch, push button or other) shuts off the pressure by stopping the pump or closing a control valve, pressure on the spool valve 84 and piston 48 is removed. Spring 83 moves spool valve to close off passages 87 and 94. Springs 23 start to retract the piston and close the door. Check valve 89 closes the inner end of inlet passage 88.

Oil trapped in the inner end of cylinder 22 escapes initially through a hollow needle valve 96 slidable in a bore 97 formed in the outer face of body 25 coaxial with the cylinder. Oil may also flow through a V-shaped notch 98 in the end of the bore past a collar 99 on the needle valve. The needle valve is biased inwardly of the cylinder by a spring 100 (see FIG. 2). The expelled oil flows through bore 97 to an intersection with a vertical bore 101 drilled down from the top of the body and plugged at its outer end. The bore 101 intersects a cross bore 102 also plugged at its outer end and communicating with the inner end of a second stepped bore 103 formed upwardly from the bottom of the valve body. A second needle valve 104 coacts with the small end of stepped bore 103 to regulate the flow of oil into the intermediate section of the bore that intersects passage 88 at 105. Passage 88 thus becomes an outlet passage to return pipe or conduit 17. Valve 104 is adjustable from the bottom of the valve body in threads 106 and constitutes a door closing speed control valve.

As the door approaches closed position, piston 48 approaches the inwardly projected position of needle valve 96. A socket 107 in the inner end of the rod 47 receives the end of the tubular needle valve and cuts off the major portion of the flow through the needle, slowing the closing motion. Some flow continues through a groove or notch 108 in the outside of the needle valve that is not closed off by the wall of the socket. Other flow continues through the notch 98 around the collar on the needle valve but the flow of expelled oil and the closing speed of the door is reduced. As the piston retracts further, needle valve 96 is pushed out of the cylinder against spring 100 and collar 99 moves out past the notch 98 so flow through the notch is cut off, further reducing the closing speed of the door. The final closing motion under the force of springs 23 is positive but gentle as the last of the oil escapes through notch 108.

The circulating flow of oil through the several passages, to and from both ends of the cylinder to the pump prevents oil in the operating system from cooling or varying substantially in temperature from the temperature of oil in the pump. The operation of the door operator is thus uniform and reliable under different weather conditions.

The door operator unit is relatively inexpensive to assemble and install. The connections of the outer ends of the cylinder and the spring casings to the outer valve body have been described. The inner valve body 25 has a cylindrical projection 109 over which the inner end of the cylinder is sleeved, and secured by rolling or crimping a bead 110 into the groove 111 in the projection. Groove 112 holds a liquid seal or packing for the end of the cylinder. The sides of the inner valve body are concave at 113 to receive the sides of the spring casings 24. A tie band 26 holds the spring casings to the valve body 25. Dowel pins 57 (see FIGS. 4 and 5) hold the outer ends of the cylindrical spring casings 24 against concave sides 56 of the outer valve body 49. The compression of spring 23 holds the springs and casings against the guide plates 18 and 19.

While all the cooperating loads and forces of the operator are localized, supported and resisted by the connection of the plate 18 to the flange 7 of the header and abutment of the plates 18 and 19 against the left header supporting clip or bracket 10, the weight of the inner end of the operating unit may be supported by screws 116 passed through ears 117 on the inner valve body and tapped into holes in the top of the header or transom. This takes all load off of the connections to the supply and return pipes 16 and 17. The operator may be installed in other headers or below threshold plates of a doorway frame as will be understood.

The inwardly projecting flanges 7 are cut away in the center as at 118 so that the operator may be assembled as a complete unit and lifted into the header. After the valves 75, 91 and 104 are adjusted to obtain the desired speed of operation, the bottom closure plates 8 and 9 are secured in place to conceal the operator and provide a neat appearing header.

Should building codes or regulations require emergency opening capabilities in the opposite direction from the powered open position of the door, outward pressure on the door will turn the crank 30, 36 and arms 39 to move the follower roll 40 over the nose 38 by pressing the cam plate 34 and piston 48 slightly to the right. Pressure developed in the right or inner end of the cylinder by this slight movement is transmitted through valve body 25 behind valve 84 to return pipe 69. The crank arms 39 are then free to swing the follower roll in the cam opening 35 to the emergency open position shown in dotted lines at 40' in FIG. 2 without resistance from the springs 23 or pressure in the cylinder. If emergency opening is desired the usual door stop strip 119 must be of a breakaway type, several of which are well known.

The inclined edge 120 at the longitudinally outer side of the slot 37, urged against the follower roll 40 by inward extension of the springs 23 is approximately perpendicular to the crank arms 39 in the closed position of the door, thus effectively resisting wind pressure tending to open or rattle the door.

The outwardly curved contour of the side edge of nose

38 brings the initial opening motion contact of the cam plate approximately perpendicular to the radius of the crank arms and motion of the follower roll for maximum mechanical advantage of the cam plate and piston in starting the opening motion of the door. As the follower 40 moves out in the slot 37, the pressure from the cam plate remains approximately perpendicular to the radius of the crank arm. This reduces the power requirements for operating one or more operators from a single pump. The initial, door closed, position of the crank arms 39 can be varied by corresponding variation of the position or shape of the slot 37 as will be understood. The direction of powered operation of the piston 48 and cam plate 34 may also be reversed by suitable reversal of the valve blocks and positioning of the cam plate and crank arms, without departing from the theory of the invention as defined in the following claims.

What is claimed as new is:

1. A power operated door opener adapted to be connected to a source of hydraulic pressure and including a crank engageable with a door along the swinging axis of the door, and coacting cylinder and piston rod members movable in door opening direction under hydraulic pressure, and spring means connected between said cylinder and piston rod members to return the members in door closing direction,

said opener being characterized by fixed guide means attachable to a door frame member adjacent said crank,

means anchoring one of said members to said guide means,

coacting cam and follower means connected to said crank and the other of said members and guided by said fixed guide means to swing said crank to door open position upon opening motion of said other of said members,

first and second valve bodies connected to and closing the ends of said cylinder member with said piston rod member extensible in sealing relation through the first of said valve bodies,

a piston on said rod member within said cylinder member,

a first passage formed through one of said valve bodies with its ends opening interiorly and exteriorly of the cylinder member,

a closure yieldably carried by said piston rod and movable therewith into closing relation with the interiorly opening end of said first passage near the end of the door opening motion of said members,

a second passage formed in said one valve body with one end opening to the interior of said cylinder and unobstructed by said closure and with its other end opening to said first passage intermediate of the ends of the first passage,

a fluid return passage extending through the other of said valve bodies and having a fluid return connection to a pressure source connected to one end,

means forming a fluid connection between the exteriorly opening end of said first passage and the other end of said return passage,

a valve bore formed in the other of said valve bodies and having a closed inner end,

a pressure supply conduit connected to the open outer end of said valve bore,

a valve slidable in said valve bore and biased to the outer end of the bore by a spring in the inner end of the bore,

an inlet passage formed in said other of said valve bodies and having one end opening to the interior of the other end of said cylinder member and its other end opening to said valve bore at a point inwardly of the spring biased position of said valve,

a check valve in said inlet passage seating against escape of fluid from said other end of said cylinder,

a pressure relief passage formed in said other valve body and having one end opening to said valve bore at a point spaced inwardly of the bore relative to the opening of said inlet passage to the valve bore,

the other end of said relief passage opening to said return passage,

an outlet passage formed in the other of said valve bodies with one end opening to the interior of the other end of said cylinder member and with its other end opening to said inlet passage at a point outwardly of said check valve relative to the interior of said cylinder member,

a flow reducing valve coacting with the end of said outlet passage and movable to flow restricting position by relative movement of said piston rod and cylinder members to adjacent door closing position,

spring means biasing said flow reducing valve toward open nonrestricting position and against relative door closing motion of said piston and cylinder members,

and means forming a reduced flow passage from the interior of the other end of said cylinder member to said outlet passage as said flow reducing valve is moved to restricting position by final door closing motion of said members.

2. A door opener as defined in claim 1 in which there is a bypass passage formed in the other of said valve bodies between said inlet passage and said return passage.

3. A door opener as defined in claim 2 in which there is an adjustable opening speed control valve in said bypass passage.

4. A door opener as defined in claim 3 in which there is a second adjustable closing speed control valve in said outlet passage.

5. A door opener as defined in claim 4 in which there is a third adjustable opening speed control valve in said second passage in said one of said valve bodies.

6. A door opener as defined in claim 5 in which said flow reducing valve is reciprocably mounted in said outlet passage with one end projecting into the path of closing motion of said rod member.

7. A door opener as defined in claim 1 in which said one of said piston rod and cylinder members anchored to said guide means is the cylinder member, and the coacting cam and follower means are connected to the piston member.

8. A door opener as defined in claim 7 in which one of said valve bodies having said first and second passages formed therethrough is said first valve body through which said rod member projects, and the other of the valve bodies is the second valve body to which the fluid return connection and supply conduit are connected,

the rod member of the opener being extended from the cylinder member to open the door.

9. A door opener as defined in claim 8 in which the cam of said coacting cam and follower means is connected to said rod member and guided by said guide means, with the follower connected to said crank.

10. A door opener as defined in claim 9 in which said guide means are spaced plates having bearings therein for said crank and parallel tracks on their opposed faces,

said cam means being formed in a cam plate connected to said rod member,

and rollers on the corners of said cam plate guidingly engaged between said tracks.

11. A door opener as defined in claim 10 in which said cam means is an opening formed through said cam plate with a slot extending from one edge of the opening, transversely of the lines of said tracks,

said follower means being a roller carried by said crank and closely fitting in said slot.

12. A door opener as defined in claim 11 in which there is a reentrant curved nose at the intersection of the edge of said slot and the opening at the side of the slot located closest to said cylinder member,

the opening in said cam plate inwardly of said nose being large enough to receive said follower roll upon manual opening of the door in a direction opposite to the opening motion of the door by said piston rod.

13. A door opener as defined in claim **12** in which there is a surface at the intersection of said opening and the opposite side of said slot from said cylinder member, which surface is generally parallel to the arm of said crank and engageable with said follower roll in the closed position of the door.

14. A door opener as defined in claim **11** in which there is a stop plate secured to one of said guide plates and having an edge engageable with said crank in the opened position of said door,

said stop plate having a slot formed therein to yieldably oppose final opening motion of said door.

15. In combination with a door frame having a hollow header and a door swingably mounted therein with supply and return conduits extending to said header, a powered door opener comprising,

a guide plate secured within one end of said header,

a crank member journaled in said guide plate and having a depending end rotatably drivingly engaged with the upper edge of said door along the swinging axis of the door,

a cam plate slidably and guidingly engaged for longitudinal motion relative to said guide plate,

a cam opening formed in said cam plate and through which said crank member extends,

said cam opening having a transversely extending slot opening from one side thereof with a reentrant curved nose on the inner side and end of said opening relative to the longitudinal path of said cam plate,

a follower on said crank member engageable in said slot,

spring rods secured to the longitudinally inner end of said cam plate and extending longitudinally inwardly therefrom,

compression coil springs surrounding said rods and abutted at their longitudinally outer ends against the inner end of said guide plate,

a first valve body having one end fixedly secured to the inner edges of said guide plate,

a second valve body positioned between said compression springs at their longitudinally inner ends,

compression members on the longitudinally inner ends of said rods to compress said springs upon longitudinal outward motion of said cam plate,

a hydraulic cylinder extending between and sealingly connected to said valve bodies,

a piston reciprocable in said cylinder and having a piston rod connected thereto and extending in sealing relation through said first valve body and connected to the inner end of said cam plate,

a first liquid return passage formed in said first valve body from within said cylinder,

a liquid return pipe connected to said first return passage and extending to a return passage formed in said second valve body and communicating with said return conduit from said pump,

an inlet valve bore formed in said second valve body and connected to said supply conduit,

an inlet passage formed in said second valve body and communicating between said valve bore and the inner end of said cylinder with a check valve therein closing toward said valve bore,

a first valve member slidingly mounted in said valve bore and spring biased toward said supply conduit into closing relation with said inlet passage,

a pressure relief passage formed between said inlet valve bore and said return passage in said second valve body on the opposite side of the inlet passage from said supply conduit,

a bleed passage formed between said valve bore and said return passage on the opposite side of the opening of said pressure relief passage to said valve bore to vent said bore behind said first valve,

a bypass passage formed in said second valve body and opening between said return passage and said inlet passage,

an outlet passage formed in said second valve body opening to said cylinder and communicating with said inlet passage on the opposite side of said check valve from said cylinder,

an axially yieldably mounted second valve element mounted in coacting relation to said outlet passage between said piston and said second valve body and forming a first outlet opening from said cylinder,

said second valve element defining a second outlet opening closed in the yieldably displaced position of the second valve element,

said piston and said second valve body coacting to displace said second valve element to obstruct said second outlet opening in the inwardly retracting position of said piston,

an adjustable restricting valve in said bypass passage in said second valve body,

and another adjustable valve in said second valve body positioned to restrict the outlet passage therein.

16. A powered door opener in the combination as defined in claim **15** in which there is

a stop plate secured to said guide plate and having an edge engageable with said crank in the door open position of the crank,

said stop plate having a slot formed therein whereby the stop plate yields under door opening motion of said crank.

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