Sept. 21, 1943. W. ODENTHAL 2,330,006

HYDRAULICALLY OPERATED GARAGE DOOR

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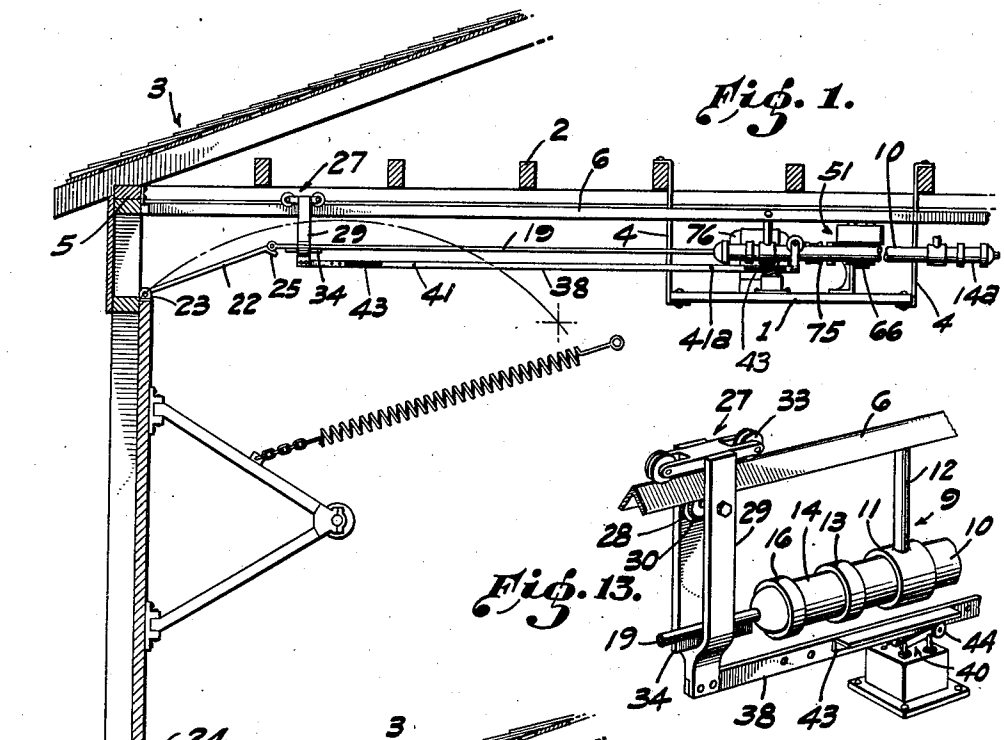


Fig. 1.

Fig. 13.

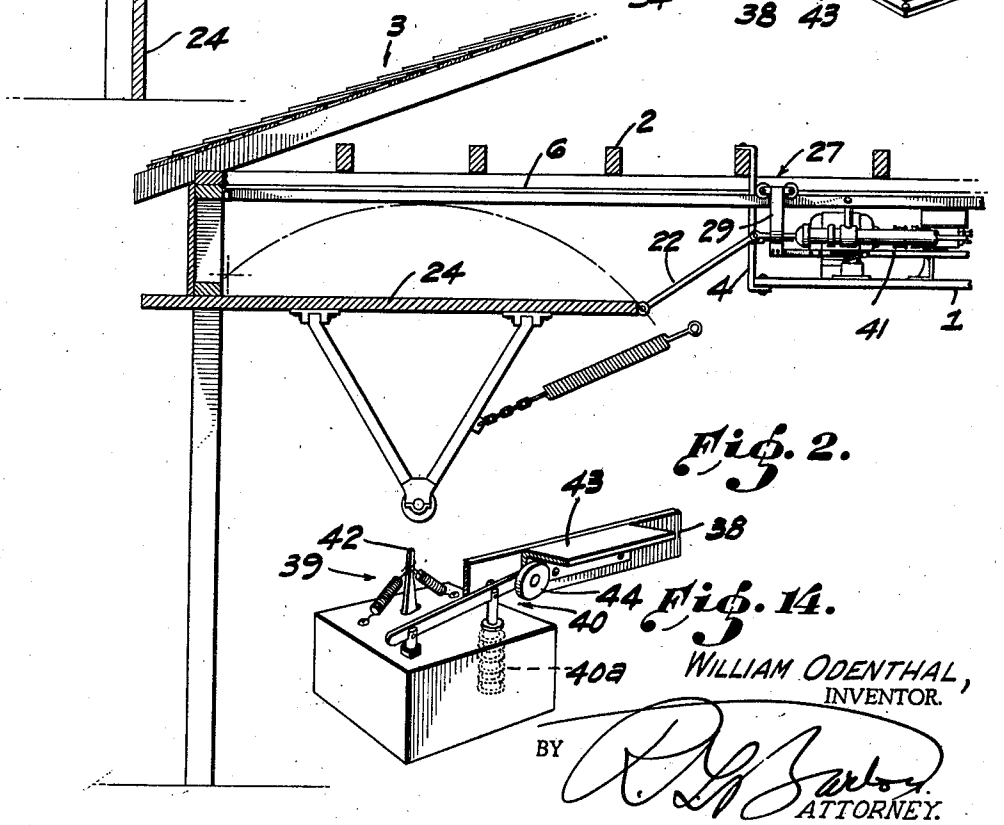


Fig. 2.

Fig. 14.

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Sept. 21, 1943. W. ODENTHAL 2,330,006

HYDRAULICALLY OPERATED GARAGE DOOR

Filed July 7, 1941 3 Sheets-Sheet 2

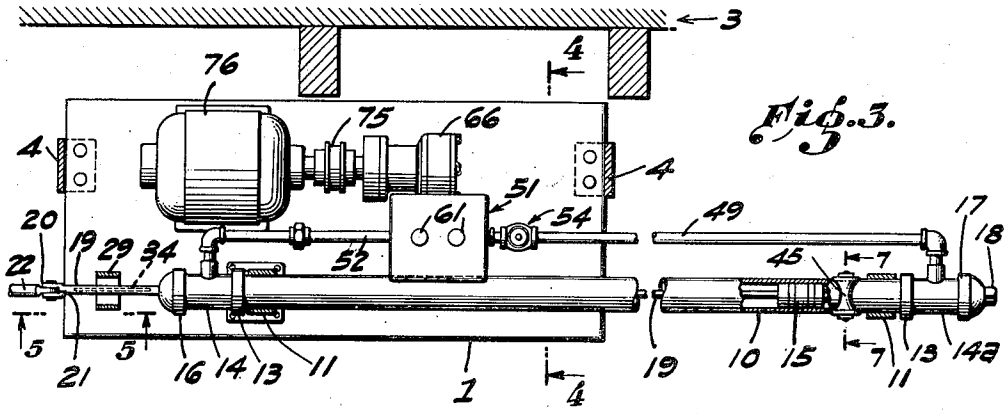


Fig. 3.

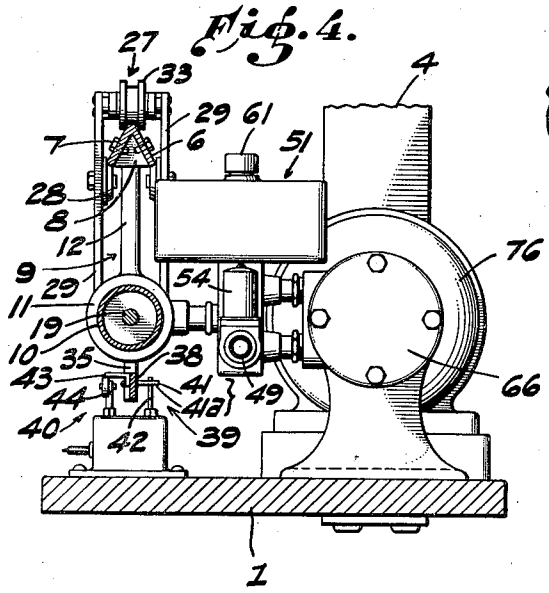


Fig. 4.

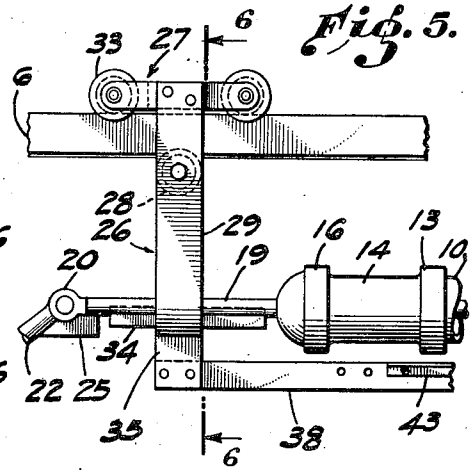


Fig. 5.

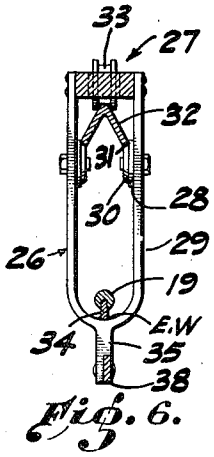


Fig. 6.

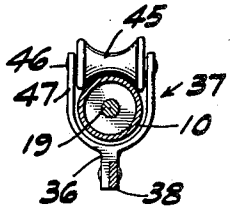
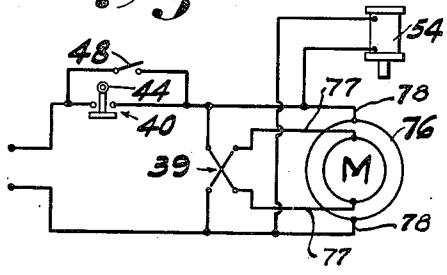


Fig. 7.

Fig. 8.



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Sept. 21, 1943. W. ODENTHAL 2,330,006

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Filed July 7, 1941 3 Sheets-Sheet 3

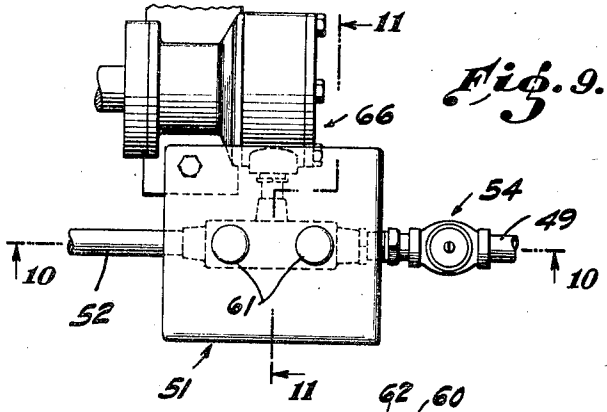


Fig. 9.

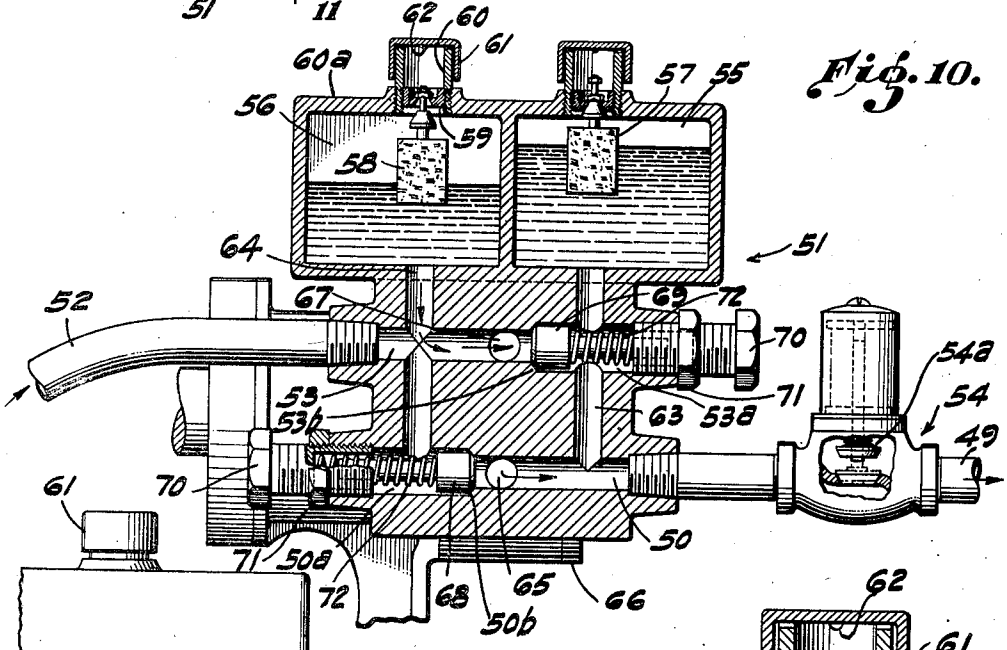


Fig. 10.

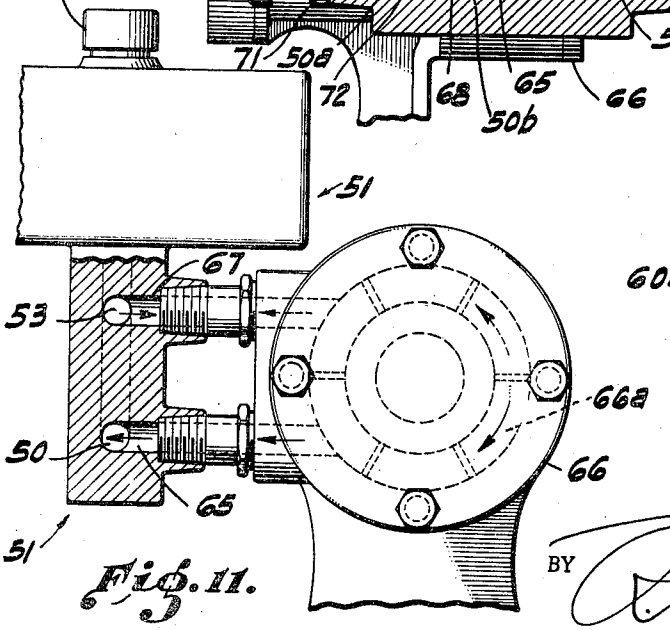


Fig. 11.

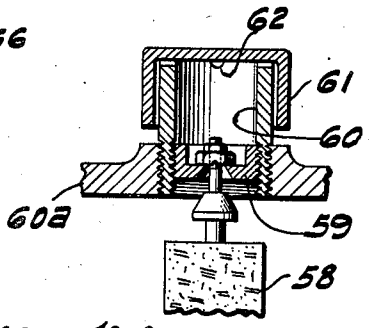


Fig. 12.

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Patented Sept. 21, 1943 2,330,006

UNITED STATES PATENT OFFICE

2,330,006

HYDRAULICALLY OPERATED GARAGE DOOR

William Odenthal, Los Angeles, Calif.

Application July 7, 1941, Serial No. 401,341

4 Claims. (Cl. 60—52)

The present invention relates to improvements in devices for operating closure members, particularly garage doors and the like.

One of the principal objects of this invention is to provide improved electrically controlled hydraulically actuatable mechanism for opening and closing garage doors, said mechanism embodying reservoirs for balancing the hydrostatic pressure required for operating the closure members in different directions when a predetermined operating power for that particular direction has been attained.

Another important object is to provide, in a door operating structure, means whereby a piston, actuated by hydraulic pressure to move in opposite directions, is reciprocated in a smoother, equalized manner, also, to provide more dependable, positive, and durable means for operatively connecting such piston with the parts to be actuated thereby.

A more specific object of the invention is to provide superior means for bypassing a portion of the liquid and for offsetting the obstructing action of atmospheric pressure, whereby all vacuum and back pressure is eliminated, and the piston is caused to operate in an unimpeded, more satisfactory manner.

Yet a further specific object is to provide improved means for setting the electrical actuating means in a position for operating the hydraulic operable means; and for providing improved means to produce predetermined periods of dwell, both for maintaining electrical actuation of parts in one direction and for placing such parts in position for re-actuation in the opposite direction.

With the foregoing and other objects in view, the invention resides in the novel arrangement and combination of parts and in the details of construction hereinafter described and claimed, it being understood that changes in the precise embodiment of the invention hereinafter described may be made within the scope of that which is claimed without departing from the spirit of the invention.

Referring to the drawings, wherein is shown a preferred embodiment of the invention as now reduced to practice, approved and being accepted in the trade,

Fig. 1 is a side elevation of the device as applied to a closed garage door, the garage structure being shown in longitudinal mid-section and parts of the device being broken away in order to contract the view.

Fig. 2 is a view similar to Fig. 1 except that the garage door is shown in the open position.

Fig. 3 is an enlarged plan view of the device with adjacent portions of the garage structure shown in section. In said view portions are broken away to contract the view and to disclose interior construction.

Fig. 4 is an enlarged sectional view taken on line 4—4 of Fig. 3.

Fig. 5 is a fragmentary elevation on an increased scale viewed from the line 5—5 of Fig. 3.

Fig. 6 is a section taken on line 6—6 of Fig. 5.

Fig. 7 is a section on an enlarged scale taken on line 7—7 of Fig. 3.

Fig. 8 is a wiring diagram.

Fig. 9 is a plan view of a portion of the mechanism shown in Fig. 3 on a somewhat larger scale, additional concealed parts being indicated by dotted lines.

Fig. 10 is an enlarged sectional view taken on line 10—10 of Fig. 9 with some parts in side elevation and others having a portion of their structure broken away.

Fig. 11 is an enlarged sectional view taken on angular line 11—11 of Fig. 9 with some parts appearing in side elevation.

Fig. 12 is an enlarged fragmentary section of certain liquid controlled valve parts appearing in Fig. 10.

Fig. 13 is a fragmentary perspective view of the reversing and limit switch controlled parts, and,

Fig. 14 is an enlarged perspective view of the switch mechanism and associated parts shown in Fig. 13, parts being cut away to avoid concealing of the structure.

Referring in detail to the drawings, in Figs. 1 and 2 in side elevation, and in Fig. 3 in plan, is shown a platform 1 supported in a subjacent relation to the ceiling joist 2 of a garage 3 by means of metal straps 4.

Suitably connected to the front plate rail 5 of the garage and a similar plate rail (not shown) in the rear of the garage, is a supporting member 6 which is V-shaped in cross section with the vertex of the V directed upwardly as shown in Figs. 4 and 6 to provide a trackway which is subjacent the joists 2 but is vertically spaced above the platform 1. Suspendingly mounted in the crotch portion of said V-trackway, by means of cap screws 7 (see Fig. 4), are the triangular heads 8 of the cylindrical carrying members 9, two of which are shown to support the piston cylinder 10. Each of said members 9 comprises a ring 11, through which the cylinder 10 extends, and a shank 12 uniting said ring 11 and head.

To the opposite ends of the cylinder 10 are fastened by means of couplings 13 the double function intake and discharge T's 14 and 14a for admitting a liquid under pressure to move the piston 15, slidably mounted within the cylinder, in opposite directions for the purpose later described. On the ends of the T 14 is provided a cap 16, and on the end of the T 14a is provided a cap 17, cap 17 being provided with a plug 18. Cap 16 is provided with an axial aperture through which extends the operating end of the piston rod 19 which is connected to the piston 15, the piston under pressure from the liquid applied to either end thereof moving the rod 19 longitudinally of the cylinder 10.

The operating end of the rod 19 is provided with a bifurcation 20, and in said bifurcation is pivotally mounted a tongue 21 (see Fig. 3), formed integral with the operating link 22 adjacent one of its ends. The other end of the link 22 is provided with an eyeletted part which in turn is pivotally mounted to a bifurcated bracket 23 fastened to the upper edge of the garage door 24. Adjacent said tongue 21 the link 22 is provided with a stop extension 25 adapted to abut the underside of the piston rod portion adjacent the bifurcation 20 when the garage door is in the open position as shown in Figs. 2 and 5. Thus when a pushing force is exerted on the link 22 to cause the garage door to pass over dead center, the stop extension 25 will initiate an immediate closing action without improper turning of the link on its pivot 20.

The protruding end of the rod 19 is movably supported by a tuning fork shaped bracket 26 rollingly mounted upon the trackway 6 by means of the trolley 27 as perspectively shown in Fig. 13. Guide rollers 28 are fastened to the prongs 29 of the bracket and are provided with annular shouldered flanges 30 to cooperatively engage the edges 31 of the flanges 32 forming the V to prevent an upward tilting of the rod 19 when the piston 15 is actuated in a direction to close the door 24, and at the same time maintain rolling contact of the wheels 33 of the trolley with the apex of the V-trackway 6. In order to advance the bracket 26 in a fixed relation to the rod 19, a key 34 is splined into the lower sides of the rod and the lower portion of said key is welded to the crotch portion of the bracket as shown in Fig. 6.

To what may be called the handle portion 35 of the bracket 26 is connected by riveting or otherwise one end portion of a longitudinally extending bar 38. To the opposite extremity of said bar 38 is secured the lower end of a bracket 37 shaped as an inverted stirrup, the forks 47 of which carry a cross shaft 46 which, in turn, supports the roller 45 which travels along cylinder 10. Said bar 38 carries the mechanism for actuating the reversing switch 39 and the limit switch 40 shown in Fig. 4 and more particularly designated in Figs. 8 and 14. Said reversing and limit switch actuating mechanism respectively comprises a pin 41, see Figs. 1 and 4, laterally extending from one side of the bar 38 which travels over and simultaneously actuates the trip lever 42 of the reversing switch and a longitudinally extending angle bar 43, see Figs. 1 and 4, detachably secured to the opposite side of said bar 38 at each end thereof, which over-rides the roller 44 of the normally closed limit switch to depress and maintain it depressed thereby deactuating it and subsequently bringing all moving parts promptly to a stop.

The bracket 37, see Fig. 7, is rollingly supported upon the cylinder 10 by means of a pulley 45, arcuated to the profile of the cylinder, and mounted upon a shaft 46 journalled in the forks 47 comprising the Y. Thus as the rod 19, under the urge of the piston 15, causes the bracket 26 to move in opposite directions, said bracket in turn also causes the bar 38 and mechanism carried thereby to move in reverse directions under the control of the momentary contact switch 48 shown in the wiring diagram.

Pipe line 49 supplies fluid from passage 50 opening out of one side of the balance reservoir 51 to the T 14a to actuate the piston 15 in one direction, and pipe line 52 supplies fluid from passage 53 opening out from the opposite side of said balance reservoir, to the T 14 to actuate the piston 15 in the opposite direction. In pipe line 49 is a normally closed, solenoid operated valve 54.

Balance reservoir 51 is provided with two similarly constructed juxtaposed chambers 55 and 56 occupying a superjacent relation thereto. In the top wall of chamber 55 is mounted a normally open float valve 57, and in the top wall of chamber 56 is mounted a similar float valve 58. Each of said valves is provided with a similar valve seat 59, see Fig. 12, screwed into a filling cup 60 which, in turn, is screwed into an opening provided for it in the top wall 60a overlying each chamber. Each cup is provided with a loosely fitting dust cap 61, there being a plurality of semicircular notches 62 formed in the top edge of each cup, thus providing vent means for each chamber.

Chamber 55 has a downwardly directed vertical passage 63 and chamber 56 has a downwardly directed vertical passage 64. Passages 50 and 53 are the longitudinally directed passages: they intersect with passages 63 and 64, and lie in the same vertical plane therewith. There is a lateral passage 65 leading from passage 50 to the lower side of the rotary pump 66, mounted on the platform 1, and there is a lateral passage 67 leading from passage 53 to the top side of said pump. Pressure relief valves 68 and 69 are located respectively in passages 50 and 53 to bypass fluid into passages 64 and 63 respectively when a predetermined operating pressure has been reached. The lower horizontal passage 50 is shown having an enlarged left hand end portion 50a thereby providing an annular valve seat 50b for the right end of the valve 68; and the intermediate horizontal passage 53 has a diametrically enlarged right hand end portion 53a, thus providing an annular valve seat 53b for the left end of the valve 69.

The valves 68 and 69 are both shown as being of the plunger type and have stems which slide in bores provided for them in the mounting bolts 70 which may be screwed into the casting varying distances, lock nuts 71 being provided to secure said bolts in their adjusted positions. Compression springs 72, coiled around the stems of the valves, act between the heads of the valves and the ends of the bolts 70, the extent to which the bolts are screwed in determining the pressure of the springs upon the heads of the valves.

Pump 66 is provided with a direct drive connecting it by means of a coupling 75 to the electric motor 76 also supported by the platform 1. The electric motor 76 and the wiring diagram shown in Fig. 8, pertain to a standard split-phase type of motor (one-phase electric motor), either 110 or 220 volt motor, including a starting wind-

ing 77 and running winding 78. Conventional motors of this type are provided with a centrifugal cutout switch connected in the starting winding, said switch being a part of the motor. At certain speeds, as for example, 1200 R. P. M., this centrifugal switch automatically cuts out the starting winding and permits the motor to operate on the running winding only. The reversing of the motor is brought about by the reversing switch 39, which is shown cut in on the starting winding circuit in Fig. 8.

In Figs. 10 and 11 the full line arrows indicate the direction in which the fluid is now operating, i. e. in a direction to close the door. Therefore we may consider, while the fluid is operating in this direction, that the lower side of the pump 66 is the high pressure side and fluid is flowing from chamber 56. Conversely, when the pump is operating in a direction in which the dotted arrows point, the top side of the pump may be considered the high pressure side and that fluid is being supplied from reservoir 55.

Preparatory to placing the device in operation, the elongated cylinder 10, pipe lines 49 and 52, the passages 50, 53, 63, 64, 65 and 67 of the reservoir 51, and the pump circulating space 66a are all filled with a circulating oil. There is also enough oil placed in the chambers 55 and 56 to operate one of the float valves to seat it, but not enough oil to at any one time simultaneously close valves 57 and 58.

When it is desired to move the door 24 from the open position shown in Fig. 2 to the closed position shown in Fig. 1, the momentary contact switch 48 is manually closed (normally closed limit switch 44 now being shown in the open position in Fig. 2, see also Fig. 13), whereupon the motor starts operating. As soon as electrical momentary switch contact is established, solenoid operated valve 54 is simultaneously actuated, moving the valve 54a from dotted line to full line position, thereby permitting flow of liquid from the chamber 56 in reservoir 51 in the direction of the full line arrows first into vertical passage 64, then into horizontal passage 53, transverse passage 67, whence it is passed through pump passage 66a, transverse passage 65 and through passage 50 and pipe line 49 into the cylinder against the head of the piston. The liquid is caused to flow in this manner because of the pump 66 having been put into rotation in the clockwise direction indicated.

The liquid pressure exerted on the head of the piston 15, opposite the piston rod side, causes it to move in a direction to close the door, the fluid in the cylinder 10 on the piston rod side flowing into passage 53 and being entrained into the intake passage 67 and out through the high pressure side discharge conduit 65 of the pump in the direction of the full line arrows.

As the hydrostatic pressure builds up on the head of the piston an equal pressure is simultaneously built up in chamber 55 until they are equalized, it being understood that, as soon as this cycle of operation is initiated, valve 57 is immediately closed.

However, the liquid being discharged through T 14 is insufficient to supply the full capacity needed for the liquid being entrained into T 14a on account of the inequality of liquid due to piston rod displacement on the piston rod side of the cylinder. Hence, in order to compensate for this insufficiency of liquid, chamber 56 is called upon to supply the extra need. In order that in supplying this extra liquid no vacuum be established in chamber 56, the chamber is provided with a vent whereby any such extra load on the motor is eliminated.

The momentary switch 48 is maintained closed until the part 43 has cleared and released the roller 44 after which period of dwell electrical circuit is again established through the normally closed limit switch 40. Immediately after this has occurred pin 41 trips the reversing switch lever 42 to reverse the starting winding circuit (which is now open due to the fact that the motor has attained full speed) and place the motor in readiness to operate in a reverse direction the next time the momentary contact switch is again actuated.

It is to be understood from the wiring diagram, manually closing switch 48 causes the motor to initially operate simultaneously on both the starting and running winding until it has once attained a speed of 1200 R. P. M., when the centrifugal switch with which the motor is provided automatically cuts out the starting winding circuit and permits the motor to operate on the running winding only.

As a safety feature in case an obstruction should get in the path of the moving door, pressure regulators 68 and 69 are set at a fraction above normal working pressure so that the liquid will be by-passed in an auxiliary cycle through the pump. In case such obstruction would occur in the movement just described the liquid would pass through the pump out through passage 65 into passage 50 depressing regulator 68 whereupon it would by-pass into vertical passage 64, from passage 64 into passage 53 and again into the pump. When the door is moving in the opposite direction and becomes obstructed in its further movement, a reverse cycle of the liquid takes place with pressure regulator 69 permitting the by-passing of the liquid from passage 53 into passage 63 in a manner which will be obvious from the operation just described.

As the door continues its closing movement the protruding end portion of the piston rod is supported by the bracket 26. Upon nearing the end of the closing movement, auxiliary pin 41a will pass over lever 42 of the reversing switch, and finally part 43 will over-ride the roller 44 depressing spring 40a and opening the circuit thereby bringing all moving parts to a stop. As soon as the motor stops, solenoid valve 54 is deactuated and serves as a lock for the door until the momentary switch is again closed and the electrification of the solenoid re-opens it.

It will be observed the part 43 is adjustably mounted (see Fig. 5) on the carriage bar 38 and is constructed of sufficient length to compensate for movement of the carriage bar due to inertia after the wheel 44 is first depressed.

When it is desired to open the door, the momentary contact switch 48 is again manually closed for a moment whereupon the motor starts operating. As soon as electrical contact is established, solenoid operated valve 54 is simultaneously actuated, moving the valve member 54a from dotted to full line position, thereby permitting flow of liquid from the chamber 55 in reservoir 51 in the direction of the dotted line arrows, first into vertical passage 63, then into horizontal passage 50, transverse passage 65, whence it passes through the pump passage 66a, transverse passage 67 and through passage 53 and pipe line 52 into the piston cylinder against the piston rod side of the piston. The liquid is caused to flow in this manner because of the

pump 62 having been put into counterclockwise rotation, in the dotted arrow direction indicated. It will be obvious from what has already been said, that this reverse movement of the piston will operate to open the door, thus restoring the parts to their original position.

However, if an obstruction of the door should occur, the pressure regulating valve 69, shown in Fig. 10, upon the pressure for which it is set being exceeded, will open and the liquid will be by-passed in a cycle through the pump in a direction opposite to that already described.

Owing to the flexibility of the pressure regulators 60 and 61 they may be set from no power up to 200 pounds, all depending upon the size of door to be operated. Thus it will be seen all reduction gearing is eliminated, there are no gears to strip, no parts to wear out, no accurate machine work to be done, and no extraneous valves to operate.

What is claimed is:

1. In a door operating mechanism of the kind described, a dual reservoir structure comprising juxtaposed chambers to contain liquid, a casting underlying said chambers, there being a vertical passage leading downwardly into said casting from each of said chambers, a lower passage leading from said casting and communicating with the lower ends of each of the first recited passages, an intermediate passage leading from said casting and intersecting both of the first recited passages, an elongated piston chamber, one end portion of which is in communication with one of said passages that leads from said casting, the opposite end of said piston chamber communicating with the other of the passages which lead from said casting, a piston having a head reciprocating in said piston chamber, door operating means connected with said piston, a rotary reversely operable pump communicating at one side with said intermediate passage and at its opposite side with said lower passage, pressure relief valves mounted in an operative relation to the passages of said casting, each of said valves opening at a predetermined liquid pressure to allow an idle recirculation of the liquid through the pump when the liquid pressure exceeds the predetermined amount, one of said relief valves controlling communication between said intermediate passage and one vertical passage, while the other valve controls communication between the lower passage and the other vertical passage, each of the aforesaid juxtaposed chambers having an atmospheric vent in its upper portion, and a float valve within each chamber to close said vent when the liquid in the chamber rises above a predetermined level.

2. In a door operating mechanism of the kind described, a dual reservoir structure comprising juxtaposed chambers to contain liquid, a casting underlying said chambers, there being a vertical passage leading downwardly into said casting from each of said chambers, a lower passage leading from said casting and communicating with the lower ends of each of the first recited passages, an intermediate passage leading from said casting and intersecting both of the first recited passages, an elongated piston chamber, one end portion of which is in communication with one of said passages that leads from said casting, the opposite end of said piston chamber communicating with the other of the passages which lead from said casting, a piston having a head reciprocating in said piston chamber, door operating means connected with said piston, a rotary reversely operable pump communicating at one side with said intermediate passage and at its opposite side with said lower passage, pressure relief valves mounted in an operative relation to the passages of said casting, each of said valves opening at a predetermined liquid pressure to allow an idle recirculation of the liquid through the pump when the liquid pressure exceeds the predetermined amount, one of said relief valves controlling communication between said intermediate passage and one vertical passage, while the other valve controls communication between the lower passage and the other vertical passage, each of said chambers having a threaded opening in the top wall thereof, a filling cup screwed into each said opening, there being a plurality of semicircular notches formed in the top edge of each cup, a valve seat screwed into each said cup, a normally open float valve in each of said chambers constructed and arranged to at times occupy a position on each said seat when the liquid in the chamber reaches a predetermined level, and a loosely fitting cap overlying the mouth of each cup.

3. In a door operating mechanism of the kind described, a piston cylinder, a piston having a head reciprocating within said cylinder, said piston having also a rod connected with a linkage whereby a door is operated, circulatory conduit means arranged to conduct liquid into and from opposite end portions of said cylinder to reciprocate said piston, said conduit means including a dual reservoir structure comprising juxtaposed chambers to contain liquid, a casting underlying said chambers, there being a vertical passage leading downwardly into said casting from each of said chambers and intersecting with an independent exit passage which leads from opposite sides of said casting, one of said exit passages being in communication with one end of said cylinder and the other exit passage being in communication with the other end portion of said cylinder, a rotary reversely operable pump having an intake and discharge passage in communication with said exit passages, by-pass passages in said casting interconnecting said vertical passages and said exit passages for by-passing the liquid through the pump only when the pressure of the liquid against either end of the piston reaches a predetermined amount, pressure relief valves mounted in an operative relation to said by-pass passages of said casting, each of said valves automatically opening when the predetermined pressure against either end of the piston has been reached to allow an idle recirculation of the liquid through the pump in the by-passing manner aforesaid, an electric motor operatively related to said pump, means to deliver electric current to said motor to rotate said motor and pump first in one direction and then in the opposite direction, each of the aforesaid chambers having an atmospheric vent in its upper portion, and a float valve within each chamber to close said vent when the liquid in the chamber rises above a predetermined level.

4. In a door operating mechanism of the kind described, a piston cylinder, a piston having a head reciprocating within said cylinder, said piston having also a rod connected with a linkage whereby a door is operated, circulatory conduit means arranged to conduct liquid into and from opposite end portions of said cylinder to reciprocate said piston, said conduit means including

a dual reservoir structure comprising justaposed chambers to contain liquid, a casting underlying said chambers, there being a vertical passage leading downwardly into said casting from each of said chambers and intersecting with an independent exit passage which leads from opposite sides of said casting, one of said exit passages being in communication with one end of said cylinder and the other exit passage being in communication with the other end portion of said cylinder, a rotary reversely operable pump having an intake and discharge passage in communication with said exit passages, by-pass passages in said casting interconnecting said vertical passages and said exit passages for by-passing the liquid through the pump only when the pressure of the liquid against either end of the piston reaches a predetermined amount, pressure relief valves mounted in an operative relation to said by-pass passages of said casting, each of said valves automatically opening when the predetermined pressure against either end of the piston has been reached to allow an idle recirculation of the liquid through the pump in the by-passing manner aforesaid, an electric motor operatively related to said pump, means to deliver electric current to said motor to rotate said motor and pump first in one direction and then in the opposite direction, said chambers each having a threaded opening in the top wall thereof, a filling cup screwed into each said opening, there being a plurality of semicircular notches formed in the top edge of each cup, thereby providing vent means for each chamber, a valve seat screwed into each cup, a normally open float valve in each of said chambers constructed and arranged to at times occupy a position on each said seat when the liquid in the chamber reaches a predetermined level, and a loosely fitting cap overlying the mouth of each cup.

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