April 27, 1948. R. M. WILDER 2,440,561

OPERATING MECHANISM FOR OVERHEAD OPENING DOORS

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Fig. 1.

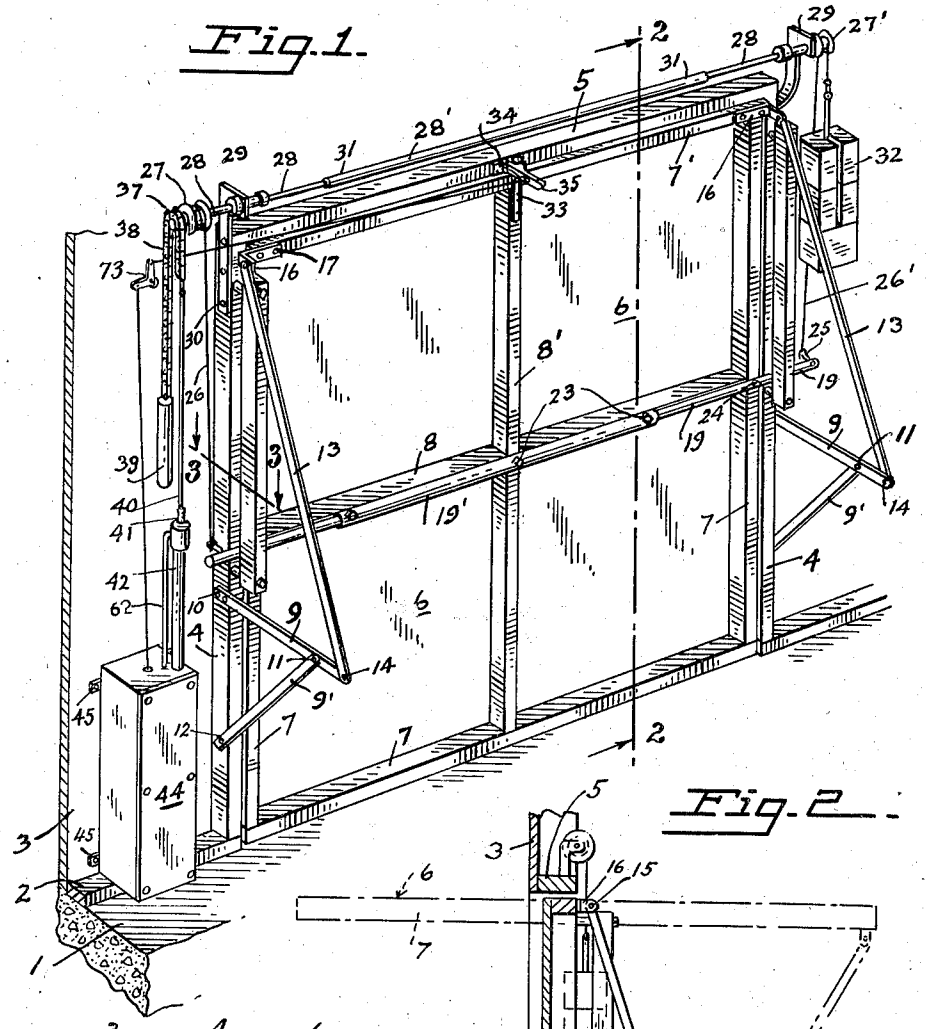
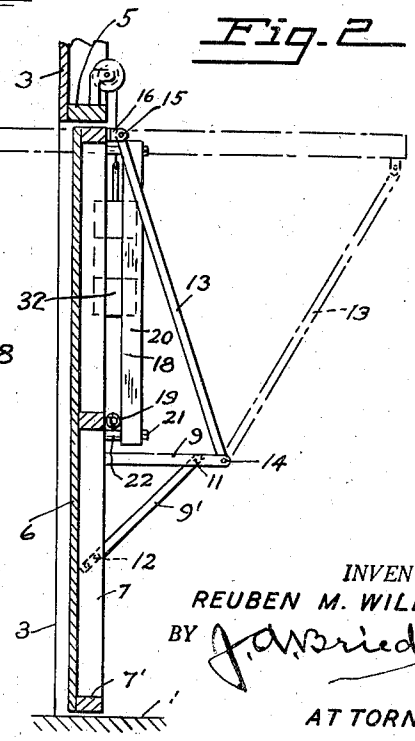


Fig. 2.



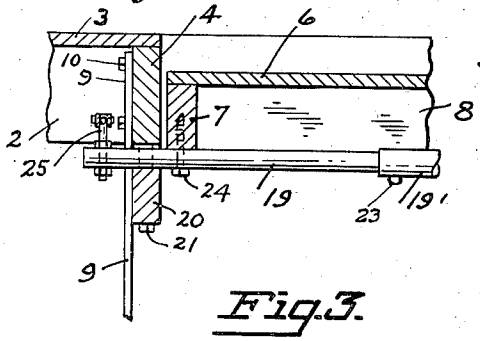


Fig. 3.

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Fig. 4.

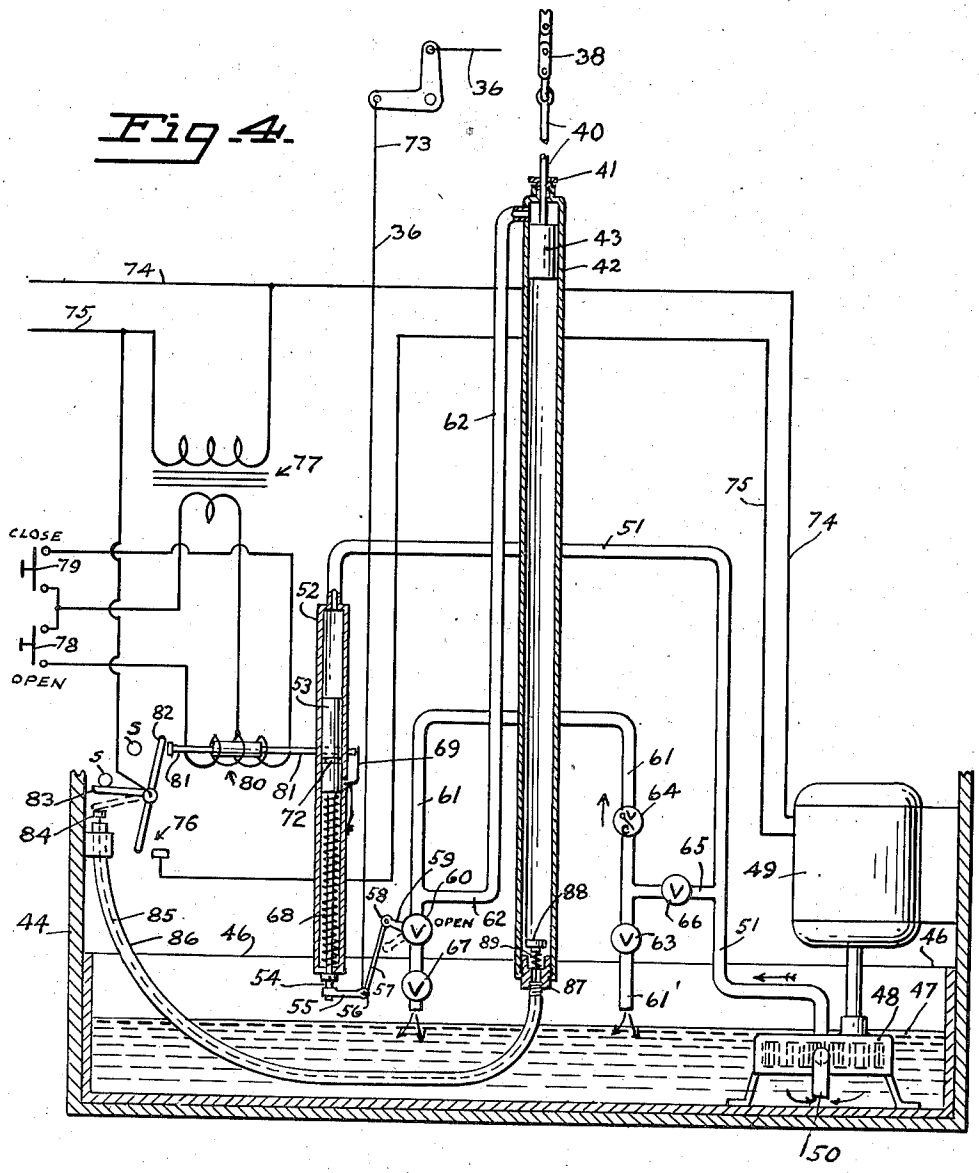
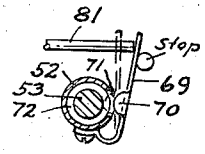


Fig. 5.



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Patented Apr. 27, 1948

2,440,561

UNITED STATES PATENT OFFICE

2,440,561

OPERATING MECHANISM FOR OVERHEAD OPENING DOORS

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Application June 4, 1945, Serial No. 597,558

6 Claims. (Cl. 268—30)

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This invention relates to power operated doors, particularly overhead opening garage doors as used for garages, warehouses, and other buildings.

The principal objects of the invention are to provide improvements in a power operated door of the type mentioned which will be relatively simple to make and install, and will be safe and certain in operation and not be apt to get out of order, tho if it should it may be manually operated.

Other features and advantages of the invention will appear in the following description and accompanying drawings.

In the drawings:

Fig. 1 is a perspective view of my improved power opening overhead door as seen from inside of a building and with the door closed.

Fig. 2 is a vertical cross section of Fig. 1 taken from the line 2—2 thereof.

Fig. 3 is an enlarged cross sectional detail of Fig. 1 taken along the line 3—3 of Fig. 1.

Fig. 4 is an enlarged somewhat diagrammatic layout in elevation showing the operating mechanisms.

Fig. 5 is an enlarged cross sectional detail along the line 5—5 of Fig. 4.

Before taking up the drawing figures in detail it may be stated:

First, that in its preferred construction the entire overhead door mounting as well as its power operating shaft are all carried by the two vertical door jambs or studs at opposite sides of the doorway and requires no attachment to the walls or ceiling of the garage or other buildings of any kind, and thereby makes the installation of the door and its operating shaft an extremely simple matter.

Second, that the door panel tho light is especially braced to make it rigid and is suspended from opposite edges and likewise operated from opposite edges so that no twisting strains are developed in it.

Third, the mechanical operation of the door is done hydraulically to assure positive smooth operation and impossibility of falling, and is controlled electrically by push buttons to open and close, and carries its own liquid pressure pump to make it independent of any city water pressure or sewer connection, as it preferably uses oil as the hydraulic medium, and cannot lose a drop as it all gravitates back to the oil pump for use over again.

In the drawings 1 indicates the concrete or other floor of a building, say a garage; 2 is the wall sill; 3 is the front wall; 4 are the vertical

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jambs or joists constituting the doorway, and 5 the overhead jamb or lintel.

The door is shown as a light panel 6 which may be of sheet metal or laminated wood, or other material, and it is made rigid by a rearwardly projecting marginal frame 7 along all edges and preferably crossing both ways across the center of the panel both vertically as at 8' and horizontally as at 8.

The door is suspended within the door opening by means of brackets having horizontally and rearwardly extending members 9 secured at their forward ends to the outer sides of the vertical door jambs or joists 4 as by bolts or lag screws 10, and angularly braced from below as by brace members 9' secured at their rearward ends to member 9 as at 11 and to their lower and forward ends to the outer sides of the jambs as at 12. A pair of strut rods or arms 13 pivoted at their lower ends to the rear ends of brackets 9 as at 14 and pivoted at their upper ends to the upper inner corners of the door as at 15 or rather to an angle plate 16 in turn secured as at 17 to the upper marginal door frame member 7' carry the weight of the door and provide its pivotal mounting to swing from vertical closed position shown in Figs. 1 and 2 to the overhead position shown dotted in Fig. 2.

To guide the door properly in such overhead swinging movement a pair of vertical guiding slots 18 are provided at the rear edge of both vertical jambs 4 and through which slots guiding pins or rods 19 project rigidly from the door.

To form the guiding slots 18 I preferably bolt a thick strip of wood 20 at opposite ends to the vertical jambs as by bolts 21 and have a spacing collar or block 22 around each bolt between the jamb and the strip to provide the vertical guiding slots 18. It is of course evident that a metal bar may be used in place of the wooden strip 20 but wood gives out no noise, and is cheaper.

Rods 19 preferably telescope into an intermediate pipe section 19' rigidly secured to the central frame member 8 as by lag screws 23 and the telescopic ends 19 are each likewise secured adjacent their ends as by a screw or bolt 24. By this construction a continuous metal rod or pipe is provided horizontally across the central portion of the door to additionally reinforce the same, and the telescopic feature makes it adaptable to any width of ordinary garage doors in use and thereby greatly simplifies installation.

Projecting forwardly from the outer ends of guide rods 19 at the outer sides of jambs 4 are eyebolts 25 to the forward ends of which chains

or cables 26, 26' are attached and which pass upwardly and over a winding drum 27, 27' carried near the end of an overhead power shaft 28, 28' extending horizontally above the upper lintel 5 and rotatably supported by bearing brackets 29 which are preferably L-shaped and each with the long leg secured to the outer side of the jamb 4 as by nails or screws 30.

The central section 28' of the overhead power shaft is preferably a pipe into which the end section 28 telescopes so as to be adjustable for any width of door and after adjustment are rigidly secured to the pipe section as by through pins or bolts 31.

The rope or chain 26 passes around winding drum 27 a couple of times and is secured at its end thereto so that when the overhead shaft is turned the rope will be wound up onto the drum to lift the door. The other rope or chain 26' similarly extends upward to its winding drum 27' and after a turn or two is preferably secured thereto and then given a few more turns and with counterweights 32 attached to its free end so that as the rope 26' is wound up onto the drum to lift the door the counterweights will descend and vice versa. Thus when the overhead shaft is turned the door will be lifted with guide rods 19 riding in the vertical guiding slots 18 and pivoted arms 13 will cause the door to inwardly swing to the horizontal overhead position as dotted in Fig. 2 with the guide rods 19 at the top of the slots.

The suspension of the door from the forward ends of pins 25 keeps the center of gravity of the door back of the points of suspension so that the moment a strain is put upon ropes 26, 26' to open the door it automatically tends to rock backwardly at its upper end into the garage under guiding control of pivoted arms 13.

When the door is closed the rods 19 may rest on lower spacers 22 to preserve desired floor clearance, tho a vertically extending latch bar 33 secured to the door frame member 7 contacts a latch plate 34 secured to the lintel 5 and functions as a stop to hold the door vertical when closed, tho additional stop strips may be provided from lower portion of the jambs, or an inner floor sill may be provided to form rigid stops against inward or rearward swinging of the lower edge of the door, all as well understood and requiring no illustration.

As the door approaches closed position its upwardly projecting latch bar 33 engages a spring actuated latch 35 pivoted to the latch plate 34 and locks the door closed. A wire, cord, or chain 36 extends from the spring latch for releasing it before the door is opened as will later be explained.

To revolve the overhead shaft 28 to assist counterweights 32 in opening the door a sprocket wheel 37 is secured to the end of one of the shaft sections 28 adjacent the drum 27 and extending over it is a chain 38 to one end of which is secured a small counterweight 39 to hold it in firm contact with the sprocket, while the other end is secured to the upper end of a small piston rod 40 which extends through a stuffing box 41 and into a vertically disposed hydraulic power cylinder 42 and carries at its lower end a piston 43 operatively fitting in the cylinder and in which the piston is forced downward by oil pumped in from above to open the door, and the piston is raised to eject the oil under control of a valve by the weight of the door (in excess of the counterweights 32) to close the same.

The oil pump and controls are positioned in a box 44 secured to the floor of the garage or to the wall as indicated at 45 and comprises the arrangement of parts shown in Fig. 4 as follows:

At the bottom of the box is a tray 46 forming an oil sump and containing oil 47 to function as the hydraulic fluid, and immersed in the oil is a positive type of pump 48 driven by an electric motor 49, taking in oil at 50 which when the pump is running passes from the pump under pressure through a pipe 51 to the upper end of a small cylinder 52 to act against the upper end of a piston 53 having a piston rod 54 extending out of a free hole in the lower end of the cylinder and there provided with a laterally extending arm 55 pivoted at 56 to an upwardly extending link or arm 57 in turn pivoted at its upper end at 58 to a valve arm 59 of a plug shut-off valve 60 mounted in a run of pipe 61 which has a branch 62 taking off above valve 60 and extending to the top of the main power cylinder 42 above its piston 43 when in uppermost position.

Pipe 61 extends laterally and downwardly to finally vent at 61' into the oil sump under control of a by-pass valve 63, while spaced above the by-pass valve on pipe 61 is a check valve 64 permitting flow in direction of the arrow only, and between valves 63 and 64 is a pipe 65 connecting pipe 61 with pipe 51 and provided with a flow control valve 66. The opposite end of pipe 61 below valve 60 is also vented to the oil sump, but under control of a valve 67 which regulates the closing speed of the door.

Piston 53 in cylinder 52 is normally urged upward to position shown in Fig. 4 by a coiled compression spring 68 located within the cylinder to hold valve 60 closed, and when forced down will open the valve and the piston will be latched down by a spring latch 69 which is formed with a latching lip 70 which springs inward through a groove 71 cut through the wall at cylinder 52 and into a groove 72 cut around piston 53.

The cord or chain 36 which extends from the door latch 35 passes over a pulley or by way of a bell crank 73 downward to and secures to the arm 55 of piston rod 54 so that the downward movement of the piston 53 will open the door latch as it closes valve 60. To operate the door by push button or any other type of electric switch I provide the circuit and electric elements shown in Fig. 4 and wherein 74 and 75 are the house voltage wires going to the motor 49, 76 is the motor switch, 77 is a step-down transformer for the push button control circuit, 78 is the door "opening" switch or push button, 79 is the door "closing" switch or button, and 80 is a solenoid with a movable core rod 81 which forcibly moves either to the left or right respectively as the opening or closing push button is momentarily pressed, and will of course be passive for moving in either direction when both push buttons are released and both coils of the solenoid are deenergized.

With the above arrangement, and assuming the parts are as shown in full line in Fig. 4 and with the door closed and motor 49 stopped, the operation is as follows:

Momentary pressure on push button 78 energizes left coil of solenoid and core rod 81 moves to the left and strikes operating arm 82 of motor switch 76 to start motor and pump and at same time the opposite end of rod 81 moves away from spring latch 69 so that latch is free to snap into groove 72 of piston 53 when it is pushed down against spring 68 by pressure of liquid from pipe

51. Valve 60 is thus closed and locked closed by latch 69, and thereby diverts flow of oil from pump through pipe 65, pressure (or speed) regulating valve 66, check valve 64, pipes 61 and 62 to the top of cylinder 42 to force power piston 43 down to thereby revolve shaft 28 and open the door. However, when piston 53 was first forced downward, door latch line 36 was pulled to release door locking latch 35, and this happens just before piston 43 begins to move, due to the fact that valve 60 was open at the start also control valve 67 partially open, and valve 66 was turned partway to slow down the flow in pipe 61 while pipe 51 was wide open.

When the solenoid rod moved switch arm 82 to the left to the stop S indicated, it also moved another arm 83 of the switch down over the end button 84 of a Bowden wire 85 which extends slidably through a tube 86 and through a bearing 87 secured to the lower end of cylinder 42 and there provided with a head 88 normally urged upward by a small compression spring 89 to position shown in Fig. 4, all so that when power piston 43 is forced down to the bottom of cylinder 42 to bring the door to the open position shown dotted in Fig. 2, the piston will push head 88 down and consequently urge the outer end button 84 of the wire 85 upward and move motor switch arm 83 from dotted to full line position and thus break the motor circuit and stop the motor and pump.

The door will therefore be hydraulically locked in open position as valve 60 and check valve 64 will both be closed.

To close the door a momentary pressure on closing button 79 energizes the right-hand coil of the solenoid 80 and throws the core rod to the right to strike latch lever 69 and release piston 53 so that spring 68 moves piston 53 upward and bleeding the fluid from cylinder 52 by way of pipes 51, 65, valve 66, by-pass valve 63 and from 61' into the tank or sump 46, and as piston rod 54 rises it opens valve 60 to permit discharge of fluid from power cylinder 42 under the excess weight of the door over the counterweights 32. The speed of closing of the door being controlled by the setting of control valve 67 permitting escape of the oil back to the tank or sump 46.

Should it be desired to operate the door manually at any times this may readily be done by first pulling the latch cord, or blocking it unlatched, and merely pushing the lower part of the door outward and upward as it opens, but in such case it is desirable to place an additional weight or two on the counterweight to substantially balance the door, whereas with the hydraulic opener it is required that the door be overweight with tendency to close so as to force the liquid out of the power cylinder.

In actual installations the push button switches may be in lock boxes accessible only with a key, or any type of key switches may be used instead. Also it is manifest that for hand operated doors the latch 35 may be omitted and any kind of key operated door lock accessible lower down may be used.

Having thus described my improved overhead opening door and its modes of operation, what I claim is:

1. In an overhead opening door of the character described, means for raising said door comprising flexible strands secured to opposite edges of the door, an overhead shaft about which said flexible strands are arranged for winding, a wheel secured to said shaft with a flexible device arranged therearound for turning the shaft when one end is pulled, a hydraulic power cylinder with power piston and means connecting the piston to said flexible device for pulling the same upon admission of liquid under pressure to said power cylinder, an electric motor driven pump with oil sump and pipe to supply oil under pressure to said power cylinder, an electric control circuit for starting said motor, and means operated by the power piston at the end of its door opening stroke breaking the motor circuit to stop said motor, a valve locking the liquid in said power cylinder with the door open, and electric controlled means arranged for bleeding said hydraulic power cylinder to said sump for permitting the gravity closing of said door.

2. In an overhead opening door of the character described, means for raising said door comprising flexible strands secured to opposite edges of the door, an overhead shaft about which said flexible strands are arranged for winding, a wheel secured to said shaft with a flexible device arranged therearound for turning the shaft when one end is pulled, a hydraulic power cylinder with power piston and means connecting the piston to said flexible device for pulling the same upon admission of liquid under pressure to said power cylinder, an electric motor driven pump with oil sump and pipe to supply oil under pressure to said power cylinder, an electric control circuit for starting said motor, and means operated by the power piston at the end of its door opening stroke breaking the motor circuit to stop said motor, a valve locking the liquid in said power cylinder with the door open, and electric controlled means arranged for bleeding said hydraulic power cylinder to said sump for permitting the gravity closing of said door including a hydraulic pilot cylinder with spring returned piston therein and piston rod projecting therefrom, means connecting said piston rod to the power cylinder bleeding means whereby the bleeding means will normally be open, and closed when liquid under pressure is applied to move the pilot piston, latch means locking the pilot piston in moved position against its return spring force, an always open pipe from said pump to said pilot cylinder, and valve means for regulating the flow of oil to the power cylinder supply pipe, electric control means for starting said motor and pump for opening said door and automatically breaking the motor circuit when the door is open, and electric control means for releasing the pilot piston latch for thereby opening the power cylinder bleeding means to control closing of said door.

3. In an automatic closing electric controlled hydraulically opened door of the character described, a hydraulic power cylinder with power piston therein, means connecting the power piston with the door for forcibly opening the door as the power piston is moved, an electric pump for supplying oil under pressure to said power cylinder, a hydraulic pilot cylinder with spring returned piston therein and piston rod projecting therefrom, a latch latching the pilot piston in hydraulically moved position against its return spring, an oil pipe from the pump to said pilot cylinder with a branch pipe extending to the power cylinder check valved against return, a flow-control valve on said branch pipe between the check valve and the pump, a bleeder valve on the power cylinder pipe, a connection from the pilot piston rod to said bleeder valve arranged for opening same when the pilot piston is hydraulically moved and vice versa, an electric circuit to the

motor with motor switch, and a control circuit including a reversible solenoid controlled by two momentary switches to give either direction of movement of the core, said core arranged upon one-way movement to close said motor switch, and upon opposite way movement to trip the pilot piston latch, and means operated by final hydraulic movement of said power piston opening said motor switch.

4. In a structure as set out in claim 1, a flexible strand connected to pilot piston rod arranged to operate a latch on the door upon hydraulic movement of the pilot piston.

5. In a structure as set out in claim 1, an outlet valve on said branch pipe between said check valve and said flow-control valve, and an oil receiver arranged to hold a supply of oil for said pump and to receive oil bled from said power cylinder and said outlet valve, and all oil which may leak from any of the oil filled parts above set out.

6. In an overhead opening door of the character described, means for raising said door comprising flexible strands secured to opposite edges of the door, an overhead shaft about which said flexible strands are arranged for winding, a wheel secured to said shaft with a flexible device arranged therearound for turning the shaft when one end is pulled, a hydraulic power cylinder with

power piston and means connecting the piston to said flexible device for pulling the same upon admission of liquid under pressure to said power cylinder, an electric motor driven pump with oil sump and pipe to supply oil under pressure to said power cylinder, an electric control circuit for starting said motor, and means operated by the power piston at the end of its door opening stroke breaking the motor circuit to stop said motor, a valve locking the liquid in said power cylinder with the door open, and electric controlled means including a pilot cylinder with piston therein controlling said valve and the admission of the hydraulic liquid to and from the power cylinder, and a connection from the pilot cylinder piston for unlocking said door before movement of the power piston.

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