June 11, 1929. L. F. SCHOELKOPF 1,716,707

DOOR OPERATING DEVICE

Filed Jan. 13, 1927 3 Sheets-Sheet 1

Fig. 1.

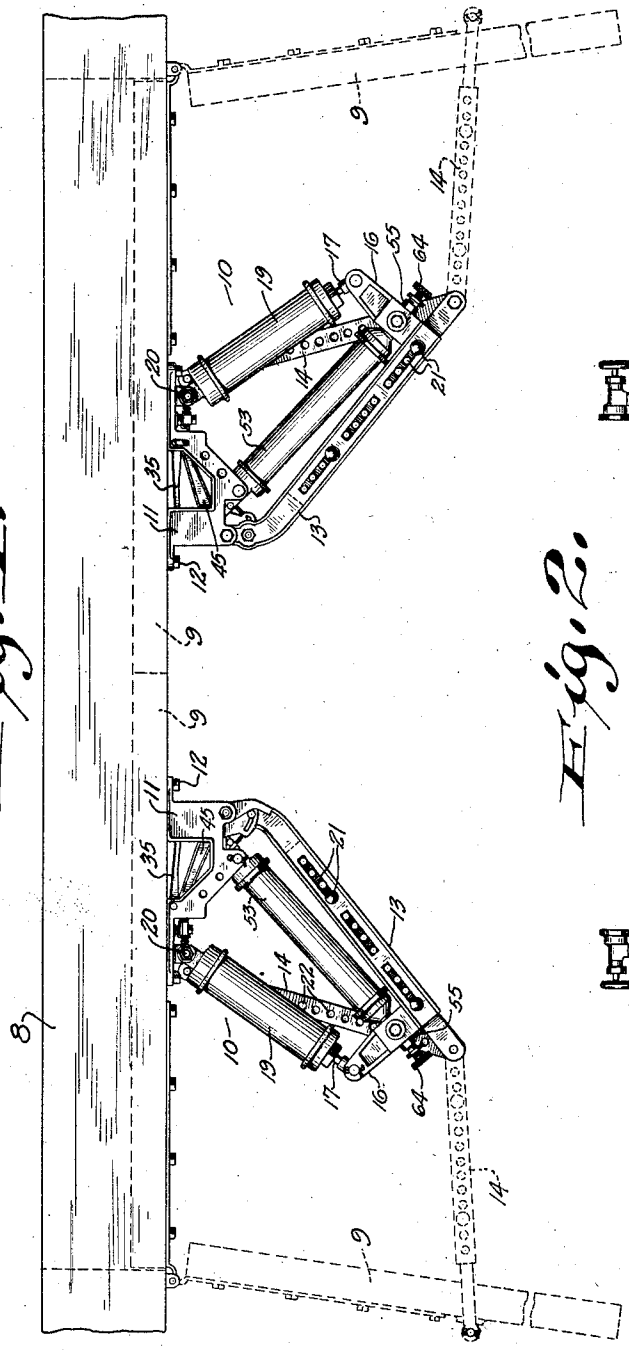
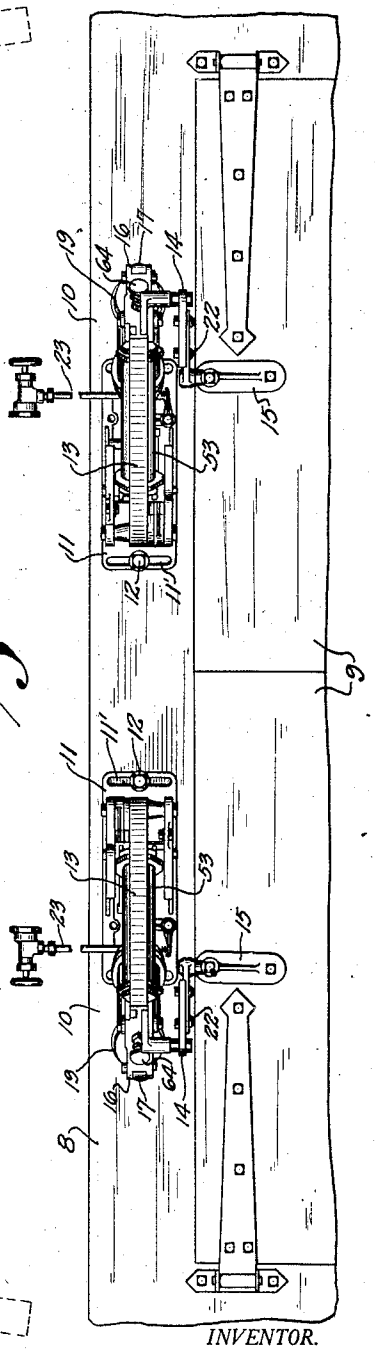


Fig. 2.



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DOOR OPERATING DEVICE

Filed Jan. 13, 1927 3 Sheets-Sheet 2

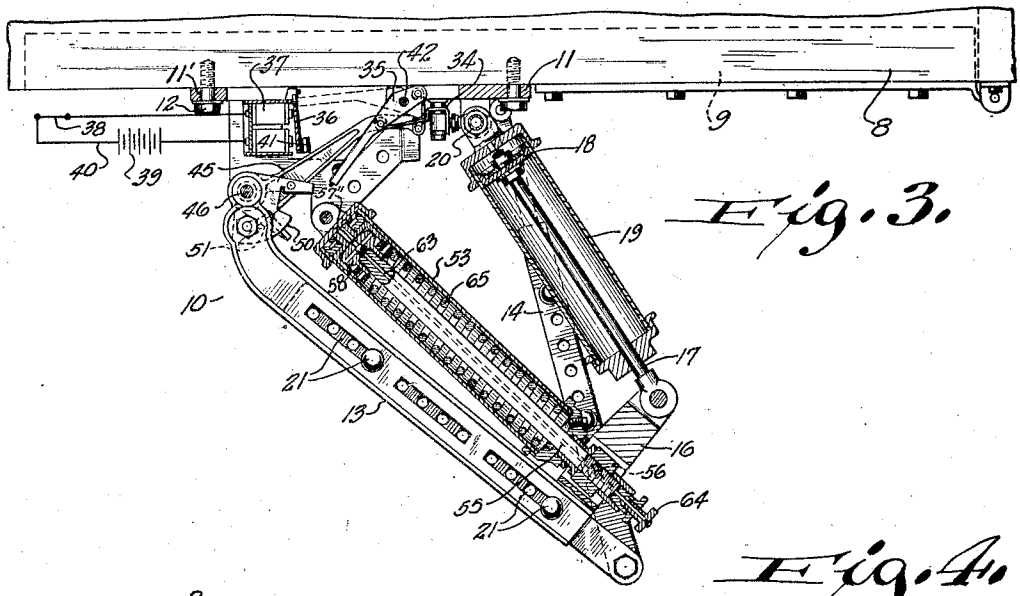


Fig. 3.

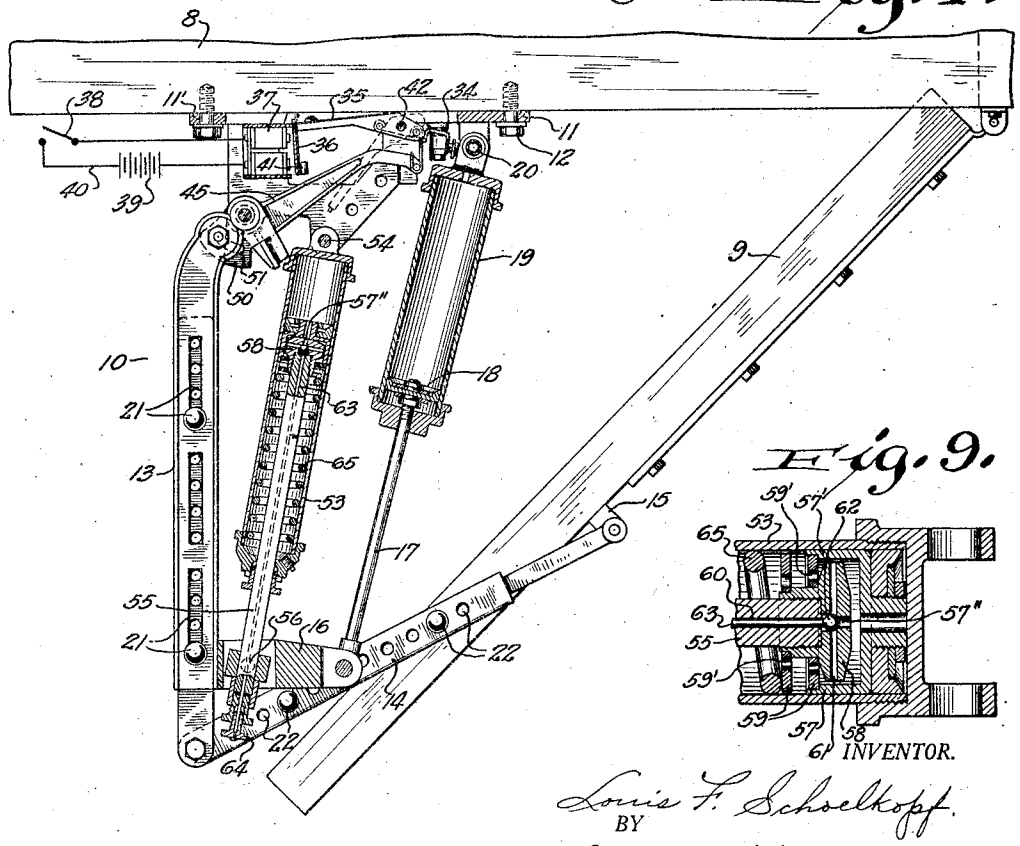


Fig. 4.

Fig. 9.

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DOOR OPERATING DEVICE

Filed Jan. 13, 1927 3 Sheets-Sheet 3

Fig. 5.

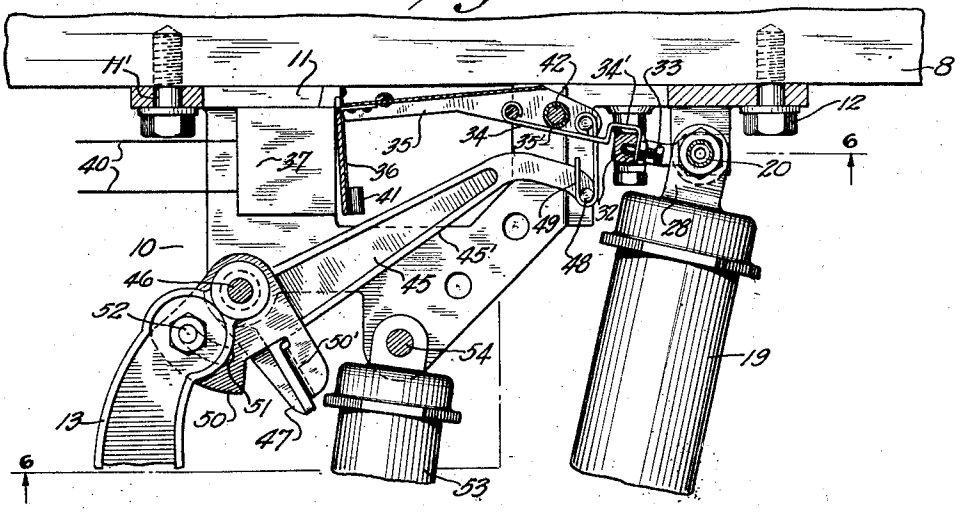


Fig. 6.

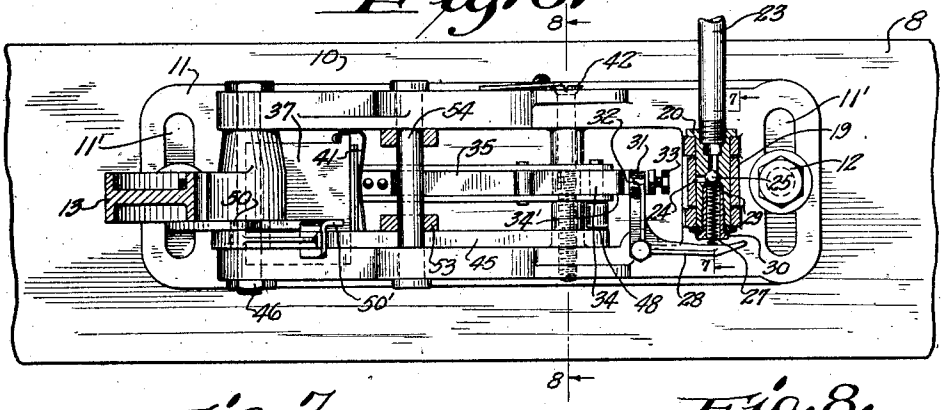


Fig. 7.

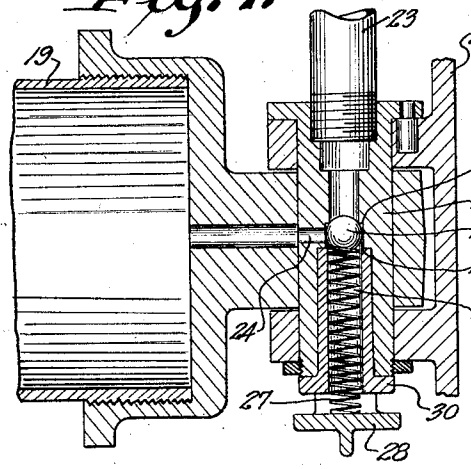
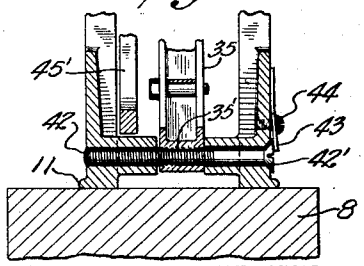


Fig. 8.



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Patented June 11, 1929. 1,716,707

UNITED STATES PATENT OFFICE.

LOUIS F. SCHOELKOPF, OF MADISON, WISCONSIN.

DOOR-OPERATING DEVICE.

Application filed January 13, 1927. Serial No. 160,885.

This invention relates to improvements in door operating devices.

It is one of the objects of the present invention to provide a door operating device having a remote control which may be easily operated to open or close the doors.

A further object of the invention is to provide a door operating device which is actuated pneumatically and mechanically, and is controlled electrically from one or more remote points.

A further object of the invention is to provide a door operating device in which approximately one-half of the door opening or closing operation is actuated by means of compressed air, while the remaining half of the operation is actuated by a spring means which is initially put under tension by the compressed air.

A further object of the invention is to provide a door operating device which, while operating to open or close the door automatically, does not prevent the manual opening or closing of the door when desired.

A further object of the invention is to provide a door operating device with an oil check to cushion the opening and closing of the door and to prevent the door slamming.

A further object of the invention is to provide a door operating device in which the air control mechanism, electromagnets, etc., are located in the base portion of the device instead of forming a separate unit.

A further object of the invention is to provide a door operating device which may be used for other purposes than for opening and closing doors.

A further object of the invention is to provide a door operating device which is of simple construction, is strong and durable and is well adapted for the purpose described.

With the above and other objects in view, the invention consists of the improved door operating device and its parts and combinations as set forth in the claims, and all equivalents thereof.

In the accompanying drawings, in which the same reference characters indicate the same parts in all of the views:

Fig. 1 is a top view of a pair of door operating devices shown connected to a pair of hinged doors and the door frame, the view also showing in dotted lines, the doors in open position;

Fig. 2 is an inner side view of the doors and the operating devices;

Fig. 3 is a horizontal sectional view of one of the devices and a door on a larger scale, the door being shown in closed position;

Fig. 4 is a horizontal sectional view similar to Fig. 3, with the door swung to a half-open position;

Fig. 5 is a top detail view of a portion of one of the devices, parts being shown in section to illustrate interior construction;

Fig. 6 is a vertical sectional view taken on line 6—6 of Fig. 5;

Fig. 7 is a vertical sectional detail view on a larger scale taken on line 7—7 of Fig. 6;

Fig. 8 is a sectional detail view of the bell crank lever pivotal connection; and

Fig. 9 is a sectional detail view of the oil cylinder and piston.

Referring to the drawings, the numeral 8 indicates a door frame having two inwardly swinging hinged doors 9 of ordinary construction. The improved operating devices 10 are mounted on the door frame above the doors and have parts connected to the doors, and as both devices are similar in construction except that parts are reversed to form right and left hand openers, a description of one opener will suffice. Each device comprises an angular bracket or main frame 11 having elongated slots 11′ and bolts 12 for adjustably mounting the bracket frame 11 upon the door frame 8. A two-part lever arm 13 pivotally connected at its inner end to the bracket frame extends outwardly therefrom, and at its outer end is pivotally connected to the outer end of a two-part link 14, and the inner end of said link is pivotally connected to a bracket member 15 which is bolted to the door 9. The outer end portion of the lever arm 13 is formed with an arm 16 projecting approximately at right angles therefrom, and to the outer end of this arm a piston rod 17 is pivotally connected. The inner end of the piston rod carries a piston 18 which reciprocates in a cylinder 19 alined with the rod 17, and said cylinder at its inner end is pivotally connected to the bracket frame 11 by a tubular pivot sleeve 20. The two parts of the

lever arm 13 are adjustably connected together by the bolt and slotted connection 21, while the two parts of the link 14 are adjustably connected together by the bolt and aperture connection 22 to fit doors which vary in swing and position.

The tubular sleeve 20 is connected to a valved air supply tube 23 and the pivot sleeve 20 is provided with a transverse air port 24 extending from the bore of the sleeve to the end of the cylinder to supply air under pressure thereto from the supply pipe 23 to move the piston outwardly. A ball valve 25 is positioned within the bore of the sleeve 20 at its intersection with the ports 24 and engages the valve seat 26 to close off the air to the cylinder, and a coiled spring 27 yieldingly holds the valve up to its seat, and the lower end of the spring bears upon one end portion of a bell crank lever 28 which is pivotally connected to the bracket frame 11. The tubular sleeve 20 is also provided with another valve seat 29 engaged by the ball valve 25 to close off the exhaust portion 20′ of the sleeve while air is being admitted to the cylinder 19. This second valve seat is formed by a removable inner sleeve 30 extending into the bore of the tubular sleeve 20. As thus arranged, and when the bell crank lever is swung downwardly to release pressure on the coiled spring, the pressure of the air will move the ball valve downwardly to the seat 29 and close the exhaust bore while air is admitted into the cylinder, and as soon as the bell crank lever is moved upwardly to increase the pressure on the spring, the ball valve will be moved upwardly to its other seat to close the supply and open the exhaust to the cylinder.

The other arm 31 of the bell crank lever 28 is formed with a socket 32 into which extends the end portion of a screw or bolt 33 to form a loose connection therebetween. The screw 33 is carried by one end portion of an angular link 34 which at its opposite end is pivotally connected to the medial portion of a trip lever 35. The socket end portion of the bell crank lever 28 extends into a U-shaped or recessed end portion 34′ of the link 34 to prevent the lever from disengaging the end of the screw 33 while maintaining the parts loosely connected to prevent the parts binding in turning. The opposite end of the trip lever 35 is arranged to snap under the edge of the armature 36 of an electromagnet 37 mounted on the frame 11. The electromagnet is controlled by a remotely positioned switch 38 connected to a battery 39 by wires 40. The trip lever 35 is normally held in engagement with the edge of the armature, as clearly shown in Figs. 5 and 6, and when in said position tension is placed upon the spring 27 to cause it to close the valve 25 against the pressure of the air. When the magnet armature releases the trip lever, the coiled spring 27 will force said lever to the position shown in Fig. 3.

A spring 41 connected to the magnets, and extending around the armature, limits the outward swing of said armature.

To retard the outward swing of the trip lever 35 and to prevent rebound, a screw 42 extends through the main frame 11 and is threaded through a medial portion 35′ of the trip lever, and the head 42′ of the screw is clamped in adjusted position by a plate 43 engaged by a clamping screw 44. The plate engages the head and when the screw is tightened the screw 42 will be maintained in adjusted position. In adjusting the screw 42, the side portion of the lever is drawn close to the side of the frame so that as the screw serves as the fulcrum of the lever, the upward swing of the lever will cause the lever to move laterally by the thread and bind against the side of the frame and thus prevent rebound and stop the outward movement of the lever. In moving inwardly or to armature engaging position, the thread will cause the lever to move away from the side portion of the frame and be free to swing inwardly to armature engaging position. By adjusting the screw 42 to position the trip lever nearer to or farther from the side portion of the frame, the trip lever may be retarded and stopped at any desired point.

The compressed air when admitted to the cylinder will force the lever 13 and the link 14 outwardly and swing the door from a closed position to a half-open position or from an open position to a half-closed position, while another means now about to be explained completes the opening or closing movement.

A bell crank lever 45 positioned alongside of and fulcrumed on the hub of the lever arm 13 which surrounds the pin 46, is formed with a long arm 45′ and a short arm 47. The long arm 45′ extends towards the trip lever 35 and at its inner end is provided with a projecting pin 48 which is pivotally connected by a link 49 to the trip lever 35, so that when the lever arm 13 is swung outwardly, the trip lever 35 will be swung inwardly to engage the inner edge of the armature 36, as shown in Fig. 5. The formation of the pivotal connection between the pin 48 and the link 49 is in the form of a slot and pin connection to permit independent inward movement of the bell crank lever 45.

To provide for adjusting the period of return of the trip lever to armature engaging position, a small bell crank lever 50 is pivotally mounted on the hub of the lever arm 13 between the lever arm 13 and the bell crank lever 45, and is formed with an angu-

lar portion 50 which projects in the path of movement of the short arm 47 of the lever 45. This bell crank lever 50 is formed with a segmental slot 51 for receiving a bolt 52 which extends through the slot and is threaded into the lever arm 13 to adjustably connect the said small bell crank lever 50 to said lever arm. As thus arranged the trip lever 34 may be swung inwardly to engage the inner edge of the armature at any point of the movement of the lever arm 13 by clamping the small bell crank lever 50 to the said lever arm 13 at the point desired.

As before mentioned, compressed air in the cylinder 19 will swing the door to slightly less than half open or half closed position, and the momentum of the movement will swung the door over the dead center line, and in order to complete the opening or closing operation, a cylinder 53 pivotally connected at its inner end to the frame 11 by the pivot pin 54 extends outwardly therefrom, and carries a tubular piston rod 55 which is pivotally connected at its outer end to part 16 of the lever arm 13 by pivot pins 56, as clearly shown in Fig. 4. A piston 57 positioned within the cylinder 53 and surrounding the inner headed end 58 of the piston rod 55 has a loose connection with said rod. The headed end 58 fits into the sleeve portion 57′ of the piston and is formed with hexagonal sides to provide spaces between the head and the sleeve of the piston, and the sleeve portion is provided with collars 59 spaced a short distance from the head to permit a slight independent reciprocation of the piston rod and head. The collars 59 have openings 59′ to permit oil to flow therethrough and the spaces between the head 58 and the piston sleeve 57′ permit oil to flow therebetween. The bore 60 of the piston rod extends through the head of said rod and is intersected by a transverse bore 61 leading to the periphery of the head. A ball valve 62 positioned at the intersection of the bores 60 and 61 controls the flow of oil through the piston head bore 60 by means of a valve rod 63 which extends through the bore 60 from the ball valve 62 to the outer end of the piston rod 55 and is provided with a threaded head 64 for convenience in adjusting the rod to limit the movement of the ball valve away from its seat. The piston 57 is also provided with a bore 57″ which is in alinement with the bore 60, and the piston rod head 58 also serves as a valve to close said bore 57″ to the extent of preventing the oil from passing from said bore to the space between the piston and the inner end of the rod head when the head is in engagement with the inner part of the piston 57. As thus arranged, the first one-sixteenth of an inch outward movement of the piston rod and head will be away from the piston, and this movement will open the space between the piston and the rod head and permit the oil to freely flow through the openings 59′ and between the periphery of the head and the piston and through the piston bore 57″. After this one-sixteenth movement, the rod head 58 engages the inner collar 59 and pulls the piston 57 outwardly to the outward end of the stroke. On the return stroke, the piston rod head moves inwardly one-sixteenth of an inch and closes the side flow of the oil from the piston bore 57″, so as to give the desired resistance to motion inwardly. After this independent movement of the piston rod and head, the piston is moved inwardly by the head, and the oil between the piston and the inner end of the cylinder will flow through the bore 57″ and the portion of the bore 60 controlled by the ball valve 62, and then through the transverse bore 61 and between the periphery of the rod head and the piston sleeve, and then through the collar openings 59′ into the outer end portion of the cylinder. In moving inwardly, the speed of travel of the piston is controlled by the adjustment of the ball valve by the valve rod 63.

A coiled spring 65 positioned within the cylinder 53 and surrounding the tubular piston rod and interposed between the piston and the outer end of the cylinder is adapted to complete the remaining half movement of the swing of the door towards open or closed position.

Assuming that the door is to be opened, the switch 38 is closed sufficiently long to complete the circuit to the magnets and release the armature, which will through the intermediary of the parts described, open the compressed air valve to the air cylinder and cause its piston to move outwardly and swing the door to slightly less than half open position. In thus moving to said position, the spring 65 will be compressed by the outward movement of the piston 57. As soon as the door reaches this half position, the trip lever 35 will be moved inwardly to close the compressed air valve and to again engage the inner edge of the armature. The momentum of the half swing of the door will carry it by the dead center line and the spring 65 will exert its pressure to swing the door to open position. To close the door, the switch is again closed to release the trip latch and permit the compressed air to enter the cylinder 19 and actuate the piston to swing the door to approximately a half-closed position, and at this point the trip latch is released to close the air valve. In swinging to the half-way position, the spring in the cylinder 53 is again compressed, and when the door swings over the dead center line by momentum, the spring will exert its pressure to continue the movement and completely close the door, with

the parts in position to be again operated to open the door.

From the foregoing description, it will be seen that the fluid pressure means is used to swing the door from a closed or open position to a half open or closed position, and that in each instance a spring means is used to complete the movement in either direction.

For the work performed, the device is of very simple construction and is well adapted for the purpose described.

What I claim as my invention is:

1. The combination with a door and its frame, of a means for opening and closing the door, comprising a bracket member connected to the frame, a lever arm pivotally connected at one end to the bracket, a link member pivotally connected at one end to the door and at its other end to a medial portion of the lever arm, a cylinder pivotally connected to the bracket, a piston within the cylinder and having a rod which is pivotally connected to the outer end portion of the lever arm for moving the door approximately one-half of its movement towards open or closed position, an electromagnetic means carried by the bracket and controlled from a distant point for controlling the flow of pressure fluid to the cylinder, an oil cylinder pivotally connected at its inner end to the bracket, a piston within the cylinder and having a bore, a piston rod pivotally connected to the lever arm and extending into the cylinder and having a head on its inner end which movably extends into the piston and serves as a valve to partly close the bore of the piston, said head having a bore closed by a check valve, and a coiled spring within the oil cylinder and surrounding the piston rod for moving the piston inwardly to complete the opening or the closing movement of the door in the direction in which it is moving.

2. The combination with a door and its frame, of a means for opening and closing the door, comprising a bracket member connected to the frame, a lever arm pivotally connected at one end to the bracket, a link member pivotally connected at one end to the door and at its other end to a medial portion of the lever arm, a cylinder pivotally connected to the bracket, a piston within the cylinder and having a rod which is pivotally connected to the lever arm for moving the door approximately one-half of its movement towards open or closed position, an electromagnetic means carried by the bracket and controlled from a distant point for controlling the flow of pressure fluid to the cylinder, an oil cylinder pivotally connected at its inner end to the bracket, a piston within the cylinder and having a bore, a piston rod pivotally connected to the lever arm and extending into the cylinder and having a head on its inner end which movably extends into the piston and serves as a valve to partly close the bore of the piston, said head having a bore closed by a check valve, means controlling the movement of said check valve to open position, and a coiled spring within the oil cylinder and surrounding the piston rod for moving the piston inwardly to complete the opening or the closing movement of the door in the direction in which it is moving.

3. The combination with a door and its frame, of a means for opening and closing the door, comprising a bracket member connected to the frame, a lever arm pivotally connected at one end to the bracket, a link member pivotally connected to the door and to the lever arm, a cylinder pivotally connected to the bracket, a piston within the cylinder and having a rod which is pivotally connected to the lever arm for moving the door approximately one-half of its movement towards open or closed position, an electromagnetic means carried by the bracket and controlled from a distance point for controlling the flow of pressure fluid to the cylinder, an oil cylinder pivotally connected at its inner end to the bracket, a piston within the cylinder and having a bore, a piston rod pivotally connected to the lever arm and extending into the cylinder and having a head on its inner end which movably extends into the piston and serves as a valve to partly close the bore of the piston, said head having a bore closed by a check valve, a valve rod engaging the check valve and extending through the piston rod and having a part in threaded engagement with the piston rod to adjust the movement of said valve to open position, and a coiled spring within the oil cylinder and surrounding the piston rod for moving the piston inwardly to complete the opening or the closing movement of the door in the direction in which it is moving.

4. The combination with a door and its frame, of a means for opening and closing the door, comprising a bracket member connected to the frame, a lever arm pivotally connected at one end to the bracket, a link member pivotally connected to the door and to the lever arm, a cylinder pivotally connected to the bracket, a piston within the cylinder and having a rod which is pivotally connected to the lever arm for moving the door approximately one-half of its movement towards open or closed position, an electromagnetic means carried by the bracket and controlled from a distant point for controlling the flow of pressure fluid to the cylinder, an oil cylinder pivotally connected at its inner end to the bracket, a piston within the cylinder and having a bore, a piston rod pivotally connected to the lever arm and extending into the cylinder and having a

head on its inner end which movably extends into the piston and serves as a valve to partly close the bore of the cylinder, said head having a bore closed by a check valve, said head also having a transverse bore which intersects the first mentioned bore adjacent the check valve to permit the flow of oil through the bores of the piston and the head and the transverse bore to the opposite side of the piston when the piston is moving inwardly, a valve rod engaging the chech valve and extending through the piston rod and having a part in threaded engagement with the piston rod to adjust the movement of said valve to open position, and a coiled spring within the oil cylinder and surrounding the piston rod for moving the piston inwardly to complete the opening or the closing movement of the door in the direction in which it is moving.

5. The combination with a door and its frame, of a means for opening and closing the door, comprising a bracket member connected to the frame, a lever arm pivotally connected at one end to the bracket and having a projecting portion, a link member pivotally connected to the door and to the lever arm, a cylinder pivotally connected to the bracket by a tubular pivotal connection through which air under pressure is supplied to the cylinder, a valve within said pivotal connection for controlling the flow of air to the cylinder, a bell crank lever yieldingly controlling the valve, an electromagnetic means carried by the bracket and having a remote control and an armature, a trip lever releasably engaging the armature and pivotally connected to the bell crank lever, a threaded member forming the pivotal connection of the trip member to move the trip member laterally into braking engagement with the bracket to retard the movement of said trip lever, a piston within the cylinder and having its rod connected to the projection of the lever arm, an oil cylinder pivotally connected to the bracket, a piston within the oil cylinder and having a sleeve and a central bore, a piston rod pivotally connected to the projection of the lever arm and extending into the oil cylinder and having headed end which reciprocally engages the piston sleeve and also moves said piston, said headed end also serving as a valve to partly close the bore of the piston and also having longitudinal and transverse bores, a valve controlling said longitudinal bore, a rod extending through the oil cylinder piston rod and engaging the valve, the outer end of the valve rod having a threaded engagement with the piston rod to adjust the opening of said valve, and a coiled spring surrounding the oil cylinder piston rod and interposed between the piston and the outer end portion of the oil cylinder.

6. The combination with a door and its frame, of a means for opening and closing the door, comprising a bracket member connected to the frame, a lever arm pivotally connected at one end to the bracket and having a projecting portion, a link member pivotally connected to the door and to the lever arm, a cylinder pivotally connected to the bracket by a tubular pivotal connection through which air under pressure is supplied to the cylinder, a valve within said pivotal connection for controlling the flow of air to the cylinder, a bell crank lever yieldingly controlling the valve, an electromagnetic means carried by the bracket and having a remote control and an armature, a trip lever releasably engaging the armature and pivotally connected to the bell crank lever, a threaded member forming the pivotal connection of the trip member to move the trip member laterally into braking engagement with the bracket to retard the movement of said trip lever, a bell crank lever engaged by the lever arm for returning the trip lever to its armature engaging position, a piston within the cylinder and having its rod connected to the projection of the lever arm, an oil cylinder pivotally connected to the bracket, a piston within the oil cylinder and having a sleeve and a central bore, a piston rod pivotally connected to the projection of the lever arm and extending into the oil cylinder and having a headed end which reciprocally engages the piston sleeve and also moves said piston, said headed end also serving as a valve to partly close the bore of the piston and also having longitudinal and transverse bores, a valve controlling said longitudinal bore, a rod extending through the oil cylinder piston rod and engaging the valve, the outer end of the valve rod having a threaded engagement with the piston rod to adjust the opening of said valve, and a coiled spring surrounding the oil cylinder piston rod and interposed between the piston and the outer end portion of the oil cylinder.

7. The combination with a door and its frame, of a means for opening and closing the door, comprising a bracket member connected to the frame, a lever arm pivotally connected at one end to the bracket, a link member pivotally connected to the door and to the lever arm, a cylinder pivotally connected to the bracket, a piston within the cylinder and having a rod which is pivotally connected to the lever arm for moving the door approximately one-half of its movement towards open or closed position, an electro-magnetic means carried by the bracket and controlled from a distant point for controlling the flow of pressure fluid to the cylinder, means moved by the lever arm for setting the pressure fluid means in operative position, and a yielding means con-

nected to the bracket and to the lever arm and put under tension by the pressure fluid for completing the opening or closing movement of the door in the direction in which it is moving.

8. A door operating device, comprising a bracket, a lever arm pivotally connected at one end to the bracket, a link member pivotally connected to a medial portion of the lever arm and having means for pivotal connection with a door, a fluid pressure means connected to the lever arm and to the outer end portion of the bracket for moving the lever arm a certain distance, electromagnetic means carried by the bracket for controlling the flow of fluid pressure to the fluid pressure means, and a yielding means connected to the bracket and to a medial portion of the lever arm and put under tension by the fluid pressure means for completing the movement of the lever arm in the direction it is moving.

9. A door operating device, comprising a bracket, a lever arm pivotally connected at one end to the bracket, a link member pivotally connected to a medial portion of the lever arm and having means for pivotal connection with a door, a fluid pressure means connected to the lever arm and to the outer end portion of the bracket for moving the lever arm a certain distance, electromagnetic means carried by the bracket for controlling the flow of fluid pressure to the fluid pressure means, means actuated by the lever arm for setting the pressure fluid means in operative relation to the electromagnetic means, and a yielding means connected to the bracket and to the lever arm and put under tension by the fluid pressure means for completing the movement of the lever arm in the direction it is moving.

10. A trip lever brake and stop means for a door operating device, comprising a support, a screw member carried by the support, and a trip lever threaded on the screw and turnable thereon to frictionally engage the side portion of the support carrying the screw to retard and stop the movement of the trip lever at a predetermined point.

11. A trip lever brake and stop means for a door operating device, comprising a support, a screw member revolubly adjustably carried by the support, means for holding the screw member in adjusted position, and a trip lever having a threaded fulcrum engagement with the screw member, said threaded engagement causing the lever when turned to move laterally on the screw member and impinge against the side portion of the screw support to retard and stop the turning movement of the trip lever.

In testimony whereof, I affix my signature.

LOUIS F. SCHOELKOPF.