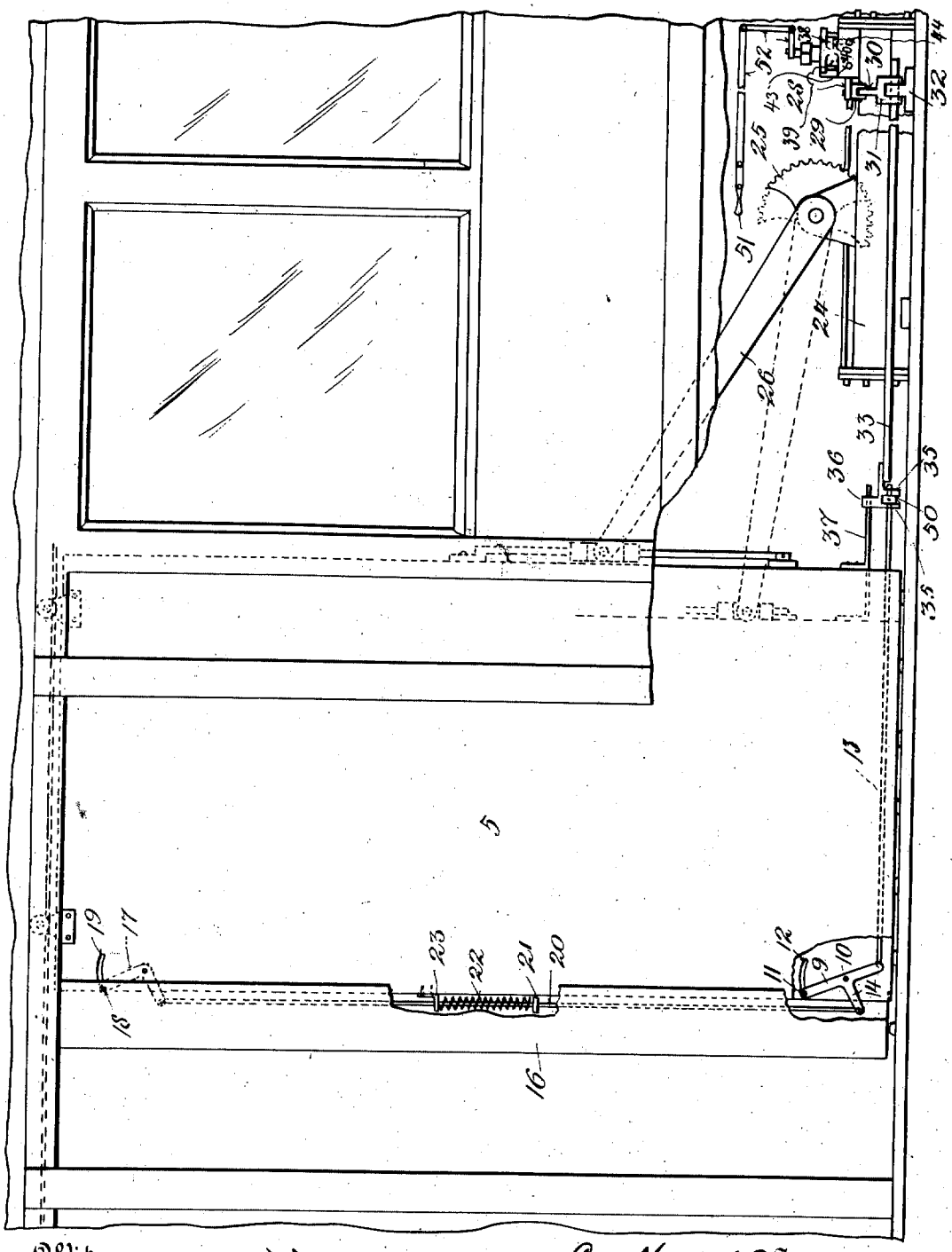
H. ROWNTREE & P. R. FORMAN.

SAFETY MECHANISM FOR POWER OPERATED DOORS.

APPLICATION FILED DEC. 13, 1909.

1,001,990. **Patented Aug. 29, 1911.**

2 SHEETS—SHEET 1.



Witnesses:
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Fig. 1.

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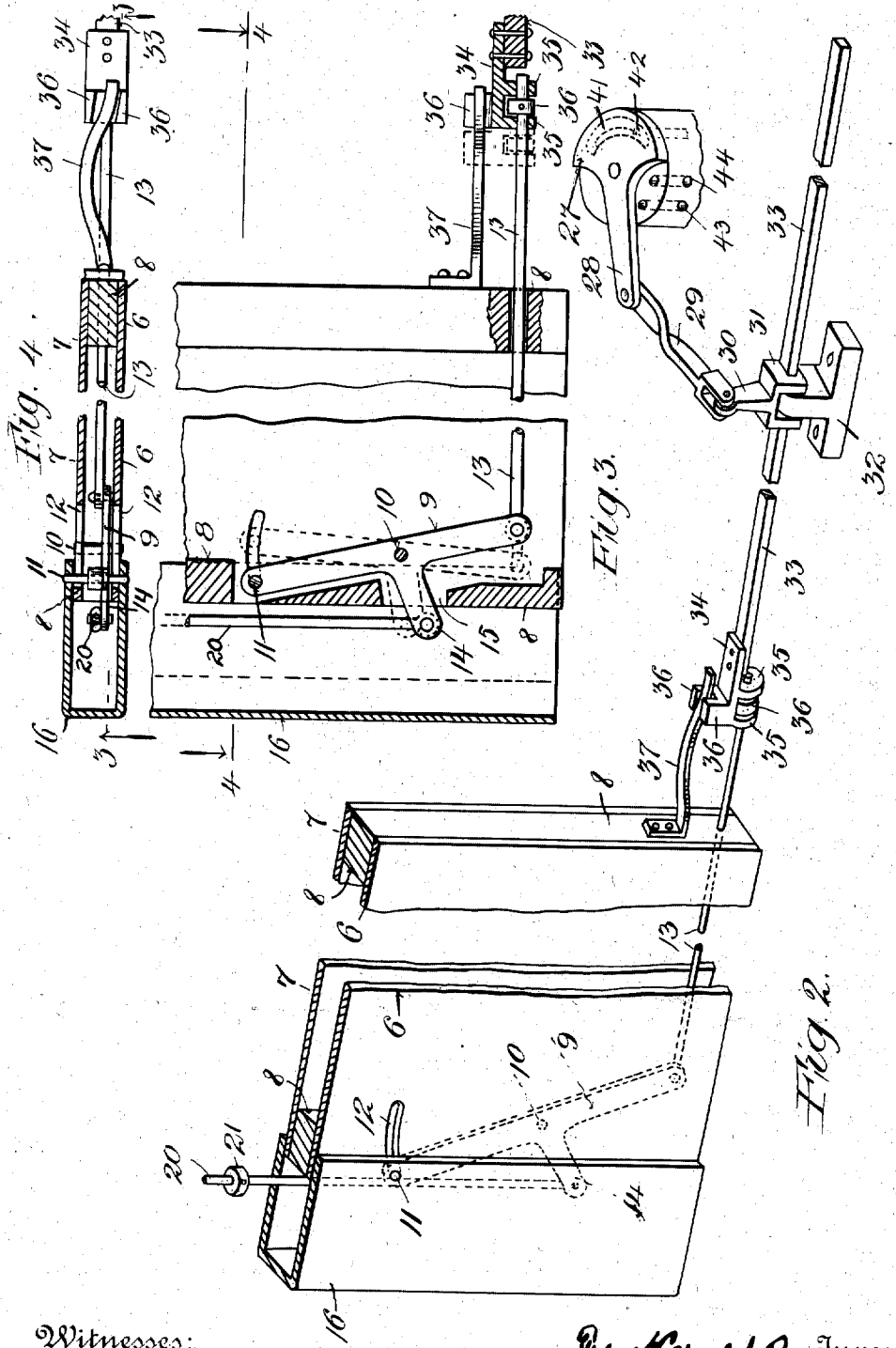

Fig. 4.

Fig. 3.

Fig. 2.

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UNITED STATES PATENT OFFICE.

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SAFETY MECHANISM FOR POWER-OPERATED DOORS.

1,001,990. Specification of Letters Patent. Patented Aug. 29, 1911.

Application filed December 13, 1909. Serial No. 532,756.

To all whom it may concern:

Be it known that we, HAROLD ROWNTREE and PARIS R. FORMAN, citizens of the United States, residing at Chicago, county of Cook, State of Illinois, have made a certain new and useful Invention in Safety Mechanism for Power-Operated Doors, of which the following is a specification.

This invention relates to safety mechanism for power operated doors, and particularly, to means for shutting off the supply of power to the door operating means in case the door should meet an obstruction in closing.

The object of the invention is to provide means which are simple and efficient whereby, in case a power operated door encounters an obstruction, in closing, the supply of power is shut off.

A further object of the invention is to provide means of the character referred to wherein the operation of shutting off the power in case the door, in closing, encounters an obstruction, is effected automatically.

A further object of the invention is to provide means whereby, in case a power operated door, in closing, meets an obstruction the door is arrested, but when the obstruction is removed, the door automatically takes up its closing movement.

Other objects of the invention will appear more fully hereinafter.

The invention consists substantially in the construction, combination, location and relative arrangement of parts, all as will be more fully hereinafter set forth, as shown in the accompanying drawings, and finally pointed out in the appended claims.

Referring to the accompanying drawings, and to the various views and reference signs appearing thereon,—Figure 1 is a view in side elevation parts broken off, and parts broken out, showing a safety mechanism embodying the principles of our invention, as applied to a car door and its power operated means. Fig. 2 is a broken view, parts in section, showing in diagrammatic perspective our safety appliances, and their relation to the door. Fig. 3 is a broken view, in vertical section, of the door on the line 3, 3, Fig. 4, and showing the means employed to effect the shutting off of the power when the door encounters an obstruction in closing. Fig. 4, is a view in horizontal section of the door on the line 4, 4, Fig. 3.

The same part is designated by the same reference sign wherever it occurs throughout the several views.

In the operation of doors by power mechanism, it is desirable to provide means for automatically arresting the door in the closing movement thereof in case the front edge of the door encounters an obstruction. While this is desirable generally with power operated doors, it is especially the case with doors employed on street, surface, subway or elevated cars, or passenger cars, and particularly when employed in districts or places where there is heavy traffic. In such cases it is not always the case that the passengers are enabled to get on or off the car before the door closing mechanism is put into operation, as, for instance, at stations or corners where the traffic is particularly heavy. The result, frequently, is that the door, in closing, catches an arm or a hand, or other part of the body of a passenger between its front edge and the opposing door jamb, and, consequently is liable to suffer injury. With the advent of power operated doors, therefore, the necessity arises for providing safety means for preventing injuries in such cases as above noted. Where the door moving means are operated by compressed air or other elastic fluid pressure medium, an arrest of the door closing movement after the pressure medium has been applied to effect the closing of the door, causes the pressure medium to build up behind the door closing mechanism with the result that when the obstruction is removed the increased power of the pressure medium causes the door to complete its closing movement with an objectionable slam or jar, while if the arrest of the closing movement of the door is caused to disconnect the door from its power driven mechanism, after the removal of the door arresting means it is necessary to again put in operative connection the door and its power mechanism or else wait until the disconnected power mechanism completes its cycle of operation to the point where it may again be connected to the door, causing an objectionable delay in either case.

It is among the special purposes of our present invention to avoid the objections

noted, and in carrying out our invention we propose to provide means operated by the door encountering an obstruction in closing for automatically arresting the door, as, by shutting off the supply of pressure medium from the door operating mechanism, but so arranged that the instant the obstruction is removed the pressure medium is again and automatically supplied to the operating mechanism thereby enabling the door to take up its closing movement and to complete the same smoothly and easily and without slam or jar, and without any increase in the pressure of the operating medium.

Many specifically different constructions and arrangements may be devised for accomplishing the results stated without departure from the spirit and scope of our invention as defined in the claims. While, therefore, we have shown, and will now describe one construction and arrangement for accomplishing the objects and purposes in view, we do not desire to be limited or restricted thereto.

In the drawing reference sign 5 Fig. 1 designates a door which may be of any desired construction and employed in any desired situation where a door or device having similar function and operation is required. In the particular form shown, we employ a door having the two side panels 6, 7, separated from each other by the spacing members 8, this being the ordinary or usual construction of sheet steel or metal doors. Within the interior of the door structure is a rocking lever 9, pivotally mounted, as at 10, to the side panels 6, 7. At one end this lever is provided with a cross pin 11, having its ends extended through the sides of the shoe 16, to form a support therefor and working in curved slots 12, formed in the door panels, and struck on an arc having the pivotal point 10 of the lever as a center, whereby said lever is free to rock or swing relative to the door. To the other end of lever 9, is connected a rod 13, which is arranged to extend rearwardly through the rear edge of the door. The lever 9, is provided with an arm 14, arranged to project through an elongated slot 15, in the front edge of the door. Telescoped over the front edge of the door is a U-shaped frame or shoe 16. This shoe is normally but yieldingly maintained distended or projected away from the front edge of the door but is capable of telescoping over the said front edge of the door when a pressure is applied thereto sufficient to overcome the yielding means which hold it normally away from the door. A simple arrangement is shown wherein a bell crank lever 17, is pivotally mounted on the door preferably between the door panels 6, 7, and near the upper edge of the door, one arm of said lever being connected by a cross pin 18, to the sides of the shoe 16, and working through curved slots 19, in the door panels, see Fig. 1. The other arm of the bell crank lever is arranged to extend through the front edge of the door and a rod 20, connects said arm of the bell crank lever 17, and the arm 14, of lever 9. A collar 21, is mounted on this rod, and a spring 22, is interposed between this collar and an abutment 23, connected to the front edge of the door. The tension of spring 22 is exerted on said rod 20, in a direction to move the same endwise downwardly, thereby rocking the bell crank lever 17 in a direction to force the shoe 16 laterally away from the front edge of the door, and also rocking lever 9, in a direction to project rod 13 endwise, outwardly through the rear edge of the door, while at the same time, when a sufficient pressure is exerted against the front edge of the shoe 16, as, for instance, in case the door, in closing, encounters an obstruction, the tension of spring 22, is overcome and the shoe 16 is caused to telescope upon or over the front edge of the door, thereby rocking bell crank lever 17, pulling upwardly and endwise the rod 20, and hence rocking the lever 9, in a direction to draw the rod 12, endwise into the door. Thus it will be seen that in effect, the levers 9, and 17, and rod 20, constitute toggle levers or connections by which the shoe 16 is supported on the door in position to move laterally toward and away from the front edge of the door, but is yieldingly held pressed away from the said front edge. In its telescoping movement the shoe moves very slightly up and down and a sufficient clearance to permit this movement should be provided as by making the shoe somewhat shorter than the vertical height of the door.

We have shown our invention as applied to a door of the sliding type, and while various arrangements of power operated mechanism may be employed for moving the door, we have shown a pneumatic pressure operated mechanism of familiar type, wherein a power cylinder 24, is employed to operate a segment gear 25, to which is connected in suitable manner an arm 26, having connection with the door.

The operation of the door toward opened or closed position may be controlled in any suitable or well known way, as, for example, by a valve within the valve box 38, the valve being operated to the required positions by the guard or door attendant, through suitable connections. These connections may be mechanical, electrical or pneumatic, or any other well known form, wherein the guard moves a handle to one position to cause the door to open, and to another position to cause the door to close. In the drawings I have indicated connec-

tions 52, operated by handle 51, for operating the main control valve.

The pipes 39, 40, designate respectively, the supply and exhaust pipes which are controlled by the main control valve in casing 38. In the usual and normal arrangement pipe 39 is open to the pressure supply and pipe 40 is open to the exhaust, the position of the main control valve in valve box 38 as controlled by the guard or door attendant, determining whether the operating mechanism is opening or closing the door, or is holding the door open or closed. If desired, a movement of the main control valve in casing 38, may be effected automatically by the operation of the door moving mechanism in order to secure a cushioning effect and enable the door to complete its movement smoothly and easily. Devices for this purpose are, however, well known in the art, and form no essential part of the present invention.

In accordance with the present invention the supply connection 39, to the main control valve is controlled by a second valve mechanism, which, in accordance with the principles of our invention, includes a valve 27, having an operating arm 28, to which is connected one end of a link 29, the other end of said link being connected to a rock arm 30, and we provide means to automatically rock said arm in case the door encounters an obstruction in closing, that is, when shoe 16 is telescoped over the front edge of the door, thereby operating the valve 27, into position to shut off the supply of pressure medium to the power cylinder, and open the power cylinder through the connection 39 to exhaust, thereby instantly liberating and removing the closing pressure that was previously being applied to the door, and maintaining such medium supply shut off until the arm 30 is again rocked, that is until the obstruction is removed from in front of the front edge of the door, and the shoe 16 is enabled to again resume its normal or distended position. That is, the lateral movements of the shoe 16, toward and from the door effect the desired rocking movement of arm 30, and hence, also, of the valve 27, and thereby shut off the power medium supply, in the one case, or turn it on again in the other case. The action of the auxiliary valve 27, in shutting off the pressure supply and in liberating the pressure in the cylinder when actuated by the shoe is as follows. In the normal position of the auxiliary valve the recess 41 therein occupies a position over port 42, which is open to the exhaust. Port 43, which leads to the interior of the auxiliary valve vasing is open at all times to the pressure supply. Port 44, is in communication with pipe connection 39, which latter delivers to the main control valve casing 38. In the normal position of the shoe 16, therefore, and of the auxiliary valve, the pressure from the source of supply enters the casing of the auxiliary valve through port 43, and thence passes through port 44, and pipe 39, to the main valve casing 38. The movement, however, the shoe 16, is moved toward the door and the operating arm 28, of the auxiliary valve 27, is moved so as to bring the recess 41, of the auxiliary valve into position to establish communication between ports 44, and 42, the pressure supply from port 43, is cut off from port 44, and hence, also, from the power cylinder 24, and the pressure already in the power cylinder 24, is instantly liberated to exhaust through pipe 39, port 44, recess 41, and port 42. The moment the shoe 16, is again free and regains its normal position the auxiliary valve 27, is again restored to its normal position, thereby shutting off the port 44, from exhaust, and opening the same to the pressure supply, and hence supplying the pressure medium again to the door operating cylinder, and consequently the door again automatically takes up its movement in the same direction in which it was moving when the shoe 16 was operated. The action is therefore entirely automatic as it is unnecessary for the guard or door attendant to touch his control lever or to manipulate the same in any way in order to cause the safety mechanism to operate or to cause the door to complete its movement after the safety mechanism has operated and the encountered obstruction has been removed.

Since the door itself must be moved toward open or closed positions, means must be provided for effecting such movements without interfering with the automatic operation of the valve 27, as effected by the telescopic movements of the shoe 16, which shoe, as above explained, moves with the door as well as having a movement independent of, or relative to the door. In other words, the automatic operation of the valve due to the collapsing or telescopic movement of shoe 16, must not be interfered with by the door movements. We have shown a simple arrangement for accomplishing this, wherein the arm 30, which effects the automatic operation of the valve, is carried by a block 31, pivotally mounted on a standard 32, and through which block is arranged to slide a bar 33 of rectangular or other angular shape in cross section, said bar sliding through a correspondingly shaped opening in block 31, whereby said bar is free to slide endwise through the block 31, without rocking said block, but when said bar is axially rocked, said block 31 is also rocked thereby actuating the valve. At its front end the bar 33, is connected to a coupling 34, having lugs 35, on the under side thereof between which is arranged a collar 36, carried on the rear end

of rod 13, said rod extending through said lugs 35. With this arrangement whenever rod 13 is moved endwise in one direction or the other, the coupling 34, is moved with it and consequently the bar 33 is moved endwise, while at the same time the coupling 34, and with it the bar 33, is permitted to rock or move axially about the rod 13. On its upper side the coupling 34, is provided with a pair of ears 36, between which rides a cam arm 37, carried by and fixed to the rear edge of the door. Thus it will be seen that the whole structure of the door, the telescoping shoe, rods 13, bar 33, and their coupling 34, may move together during the normal operation of the door to open or close the same, and in such case the angular bar 33 slides idly through the block 31, without effecting a rocking movement of the arm 30, or an actuation of the valve. If, however, there is a relative movement of the shoe 16, and door, as would be the case if the door encountered an obstruction in its path in closing the coupling 34, is drawn toward the rear edge of the door, thereby causing cam shaped arm 37, to impart a rocking movement to said coupling, and hence axially rocking bar 33, and hence rocking arm 30, and actuating the valve to shut off the supply of operating medium to the power cylinder. When, however, the encountered obstruction is removed and the shoe 16, is returned to its normal distended position, such movement, through lever 9, and rod 13, causes coupling 34, to move away from the rear edge of the door, whereby the cam arm 37, rocks coupling 34, causing axial movement of bar 33, in the opposite direction and hence actuating the valve to again supply pressure medium to the power cylinder, and hence enabling the door to resume and complete its closing movement without slam or jar, and without any increase in the application of the pressure of the power medium over that which is ordinarily required to operate the door.

It will be observed that when the door is in its fully closed position the operating arm 26 is in nearly horizontal position and hence forms, in effect, a lock to hold the door closed, so that whether the pressure medium is shut off or not while the door is fully closed, the arm will hold the door positively in its closed position and hence the danger of unauthorized opening of the door is avoided. By this arrangement the shoe 16, at the front edge of the door may be moved or telescoped toward or over the front edge of the door to its fullest extent after the door is completely closed, thereby opening the power cylinder to exhaust, and still the door will remain locked in its closed position. This never occurs in the normal operation of the door, as, when fully closed in the normal operation the shoe is not completely collapsed or telescoped to its fullest extent so as to open the power cylinder to exhaust. But, through malicious interference, or otherwise, persons may attempt to crowd their fingers between the outer edge of the shoe and the adjacent door jamb when the door is closed, in the effort to open the door by hand. This, however, is not possible since such action, as above explained, will merely open the power cylinder to exhaust leaving the door locked closed by the operating arm. Of course when the fingers are withdrawn the shoe resumes its normal position thereby putting the apparatus in condition for operation in the normal way.

Having now set forth the object and nature of our invention, and a construction embodying the principles thereof, what we claim as new and useful and of our joint invention is,—

1. The combination with a door, of means for moving the door, and means operated by the door encountering an obstruction in its path of movement for rendering the door moving means inoperative only so long as the obstruction remains.

2. The combination with a door, of power actuated devices for moving the door, and means operated by an obstruction in the path of movement of the door for arresting the power actuated devices, said means operating, when the obstruction is removed, to start up the power actuated devices.

3. The combination with a door, of a motor for moving the same, and means operated by the door encountering an obstruction in its path of movement for cutting off the supply of operating medium to the motor, said means operating to turn on said supply when the obstruction is removed.

4. The combination with a door, of a shoe toggle joint connections for movably supporting the shoe on the front edge of the door, a motor for moving the door, and means operated by movements of the shoe on its toggle joint supports for controlling the motor.

5. The combination with a door, of a motor for moving the same, a valve for controlling the motor, a rocking arm for operating the valve, a bar mounted to move with the door, and having connection with said arm to permit said bar to move with the door without moving the arm, and means operated by the door encountering an obstruction in the path of its movement for moving said bar to actuate said arm.

6. The combination with a door, of a motor for moving the same, a lever pivotally mounted on the door, a shoe movably mounted on the front edge of the door and connected to said lever, whereby, when said shoe is moved independently of the door said lever is rocked, and means operated by said lever for controlling the motor.

7. The combination with a door, of a motor for moving the same, a shoe carried at the front edge of the door to telescope thereover, yielding means normally operating to press said shoe away from the edge of the door, means operated by the movement of the shoe toward the edge of the door for arresting the motor, said means operating by the movement of the shoe away from the edge of the door for starting the motor.

8. The combination with a door, of a motor for moving the same, a bar mounted to move with the door but capable of movement independently of the door, a cam carried by the door and engaging said bar to impart axial movement thereto when moved independently of the door, means operated by the door encountering an obstruction in the path of its movement for moving said bar independently of the door, and means operated by the axial movement of the bar for controlling the door moving motor.

9. The combination with a door, of a motor for moving the same, a control valve for the motor, an auxiliary valve for controlling the supply of motor operating medium to the motor controlling valve, and means operated by the door encountering an obstruction in its path of movement for operating the auxiliary valve.

10. The combination with a door, of a motor for moving the same, a main valve for controlling the motor, means for operating said valve to start and stop the motor, an auxiliary valve for controlling the supply of power medium to the main valve, and automatic devices operated by the door encountering an obstruction in the path of its movement for operating the auxiliary valve.

11. The combination with a door, of an operating arm therefor, said arm, when the door is closed, serving to lock the door in its closed position, a motor for actuating the arm, and means for controlling the motor, said means operating to shut off the power medium from the motor when the door encounters an obstruction in its closing movement whereby the door remains locked in its closed position when the power is shut off.

In testimony whereof we have hereunto set our hands in the presence of the subscribing witnesses, on this eighteenth day of November A. D., 1909.

HAROLD ROWNTREE.
PARIS R. FORMAN.

Witnesses:
J. G. MITCHELL,
L. M. SHIELDS.