June 26, 1928. 1,674,662

H. ROWNTREE

DOOR CLOSING MECHANISM

Filed June 10, 1922 2 Sheets-Sheet 1

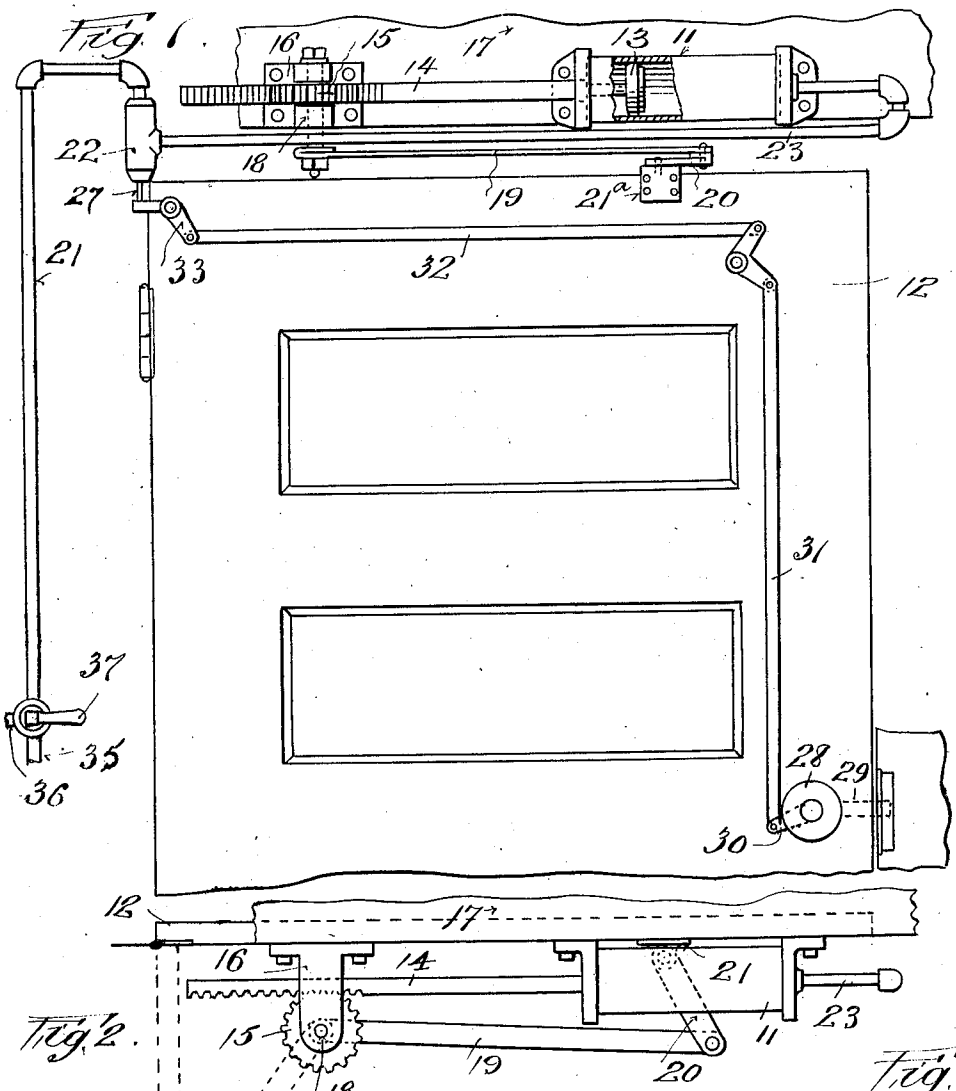


Fig. 2.

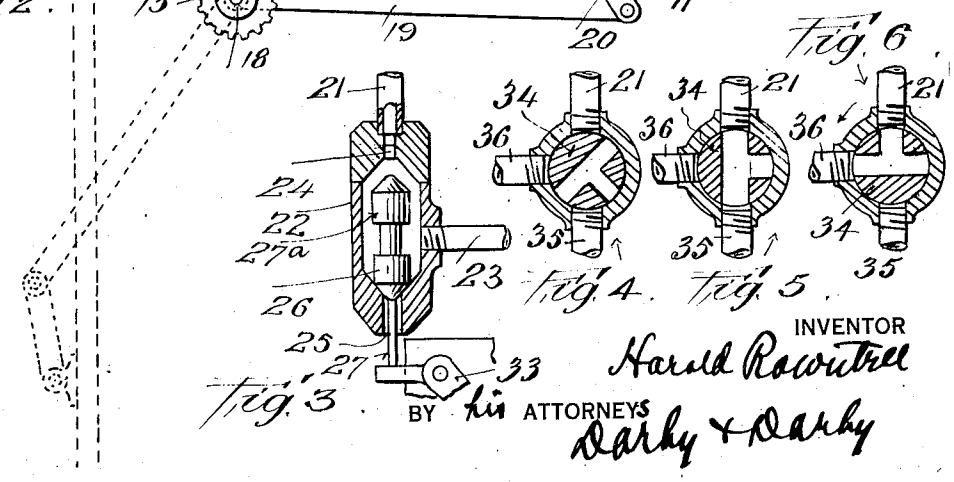


Fig. 3. Fig. 4. Fig. 5.

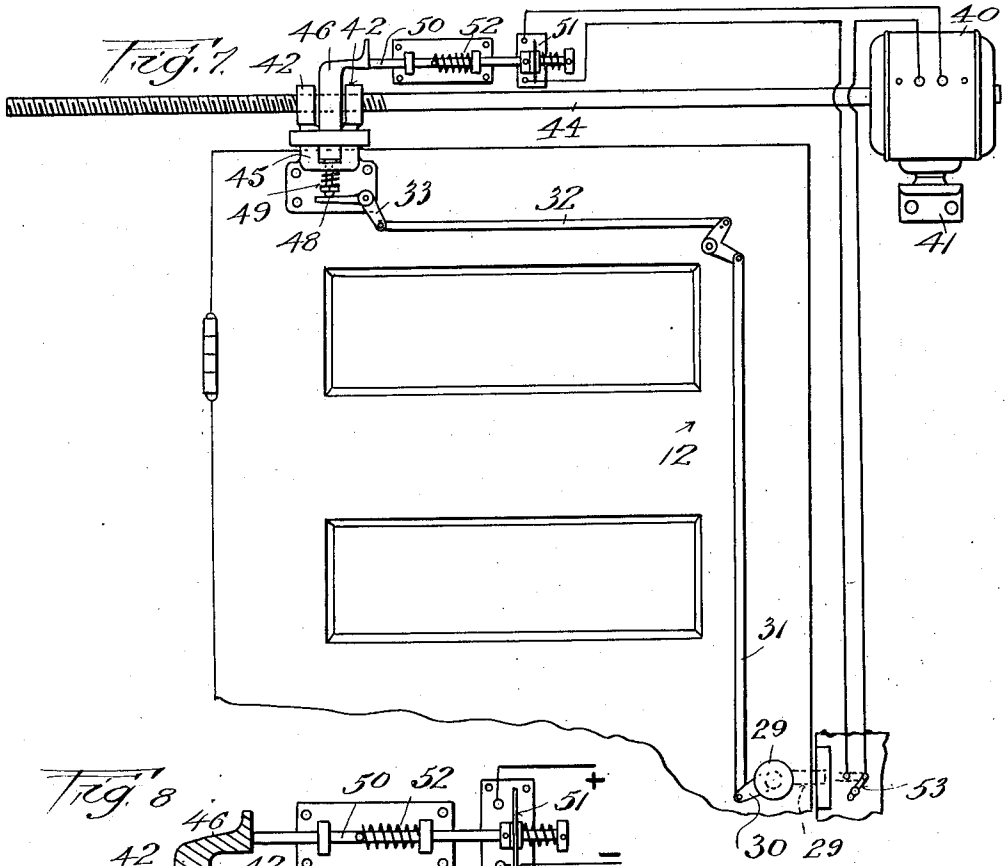
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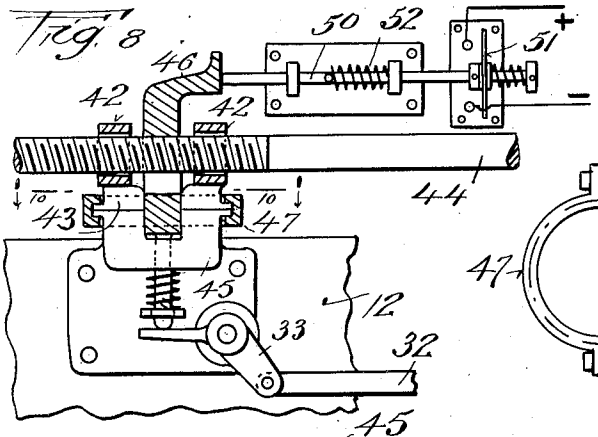
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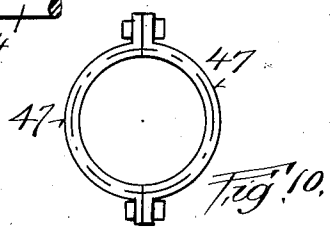
H. ROWNTREE

DOOR CLOSING MECHANISM

Filed June 10, 1922 2 Sheets-Sheet 2







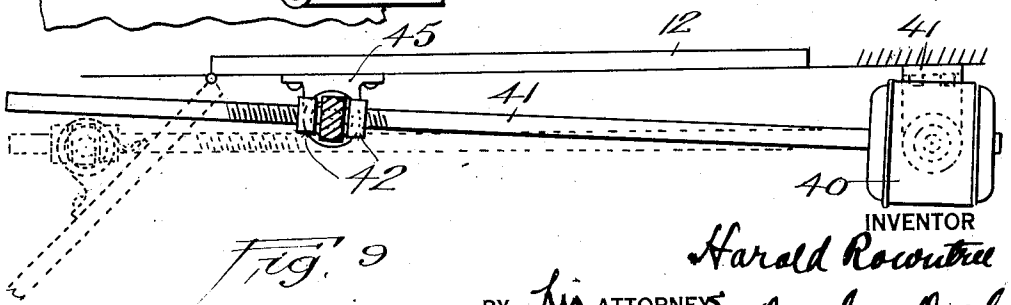


Fig. 9

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UNITED STATES PATENT OFFICE.

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DOOR-CLOSING MECHANISM.

Application filed June 10, 1922. Serial No. 567,327.

This invention relates to door closing mechanism, and more particularly to means for relieving the door of the application of door closing power while the door is being moved towards open position.

The object of the invention is to provide a mechanism which is simple in structure and efficient in operation for applying power to effect the closing movement of the door, and from the influence of which power the door is relieved when it is opened.

A further object of the invention is to provide a door closing mechanism of the nature referred to wherein the door is freed from the application thereto of power to effect the closing movement thereof coincidently with the unlatching or release of the door latch.

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:

Fig. 1 is a view in front elevation, parts broken out, and in section, showing a door closing mechanism and control devices therefor, embodying the principles of my invention, and wherein a pneumatic power device for closing the door is employed.

Fig. 2 is a top plan view of the construction shown in Fig. 1.

Fig. 3 is a broken detail view in section showing a control valve for the pneumatic power device.

Figs. 4, 5 and 6 are broken detail views in section showing a control valve in the line of pressure supply to the pneumatic power device.

Fig. 7 is a view similar to Fig. 1 showing my invention employed in connection with an electrically operated power device.

Fig. 8 is a broken detail view, partly in elevation, and partly in vertical section, showing a portion of the electrically operated power mechanism and control switch.

Fig. 9 is a view in top plan of the construction shown in Fig. 7, with the switch mechanism omitted, and the switch operating member in section.

Fig. 10 is a detached detail view of a portion of the swivel mounting for the power controlling nut.

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

Referring particularly to the pneumatic power mechanism shown in Figs. 1 to 6, a small cylinder 11 is suitably mounted in a convenient position with reference to the door 12, preferably upon the framing immediately above the door. A piston 13 operates within the cylinder 11, which is connected to a rack bar 14, arranged to mesh with a gear 15 suitably mounted upon a bracket 16 secured to the framing 17 of the door. Connected to the shaft 18 on which pinion 15 is mounted is one end of an arm 19, the free end of which is connected by link 20 to a bracket 21^a connected to the upper edge of the door 12. In practice the pinion 15 is disposed in parallel relation to the hinge axis of the door and preferably as closely adjacent to the hinge axis of the door as is convenient. Pressure medium from any convenient source is supplied through a pipe connection 21, valve casing 22, and pipe 23, to one end of the cylinder 11, such pressure medium normally tending to move the piston 13 in a direction to actuate the gearing 14, 15, and arms 19, 20, in a direction to close the door, or to hold the door in closed position. The casing 22 communicates through a restricted opening 24 with the pressure supply pipe 21. The casing 22 is formed with an opening 25 to the atmosphere, said opening preferably being of greater area than the restricted opening 24 from pressure supply pipe 21 into said casing. The pipe connection 23 delivers from the casing 22 to the cylinder 11. By suitably controlling the exhaust opening 25 it will be seen that the pressure medium is exhausted from the cylinder 11 through the enlarged opening 25 more rapidly than pressure is supplied through the restricted opening 24. Therefore, when the opening 25 is freely opened to the atmosphere the pressure supply to cylinder 11 is relieved, and hence the door is relieved of the power force applied thereto in a direction to close same or to hold it in closed position. In the arrangement shown a valve 26 may be employed to control the exhaust opening 25 of valve casing 22. The stem 27 of this valve ex-

tends through the casing and into position to be engaged and controlled in any suitable or convenient manner. If desired, the valve 26 may include also a seating portion 27ª, which, when valve 26 is unseated, operates to close the restricted opening 24 into the casing from the supply pipe connection 21, so that by manipulating the valve stem 27 not only is the valve 26 unseated to open the cylinder to exhaust, but also the supply of pressure medium is cut off.

As above indicated, the valve stem 27 may be controlled in any suitable or convenient manner. I have shown an arrangement wherein the valve stem 27 is controlled coincidently with the operation of withdrawing the door latch. I have indicated a door knob 28, which may be of usual construction, arranged to control the latch bolt 29 in the usual or ordinary manner. On the shaft of the bolt knob 28 is an arm 30 which is connected through rods 31, 32, to a bell crank lever 33, carried by the door, and one arm of which is arranged in position to engage the valve stem 27 when the door knob is rocked to release the latch bolt, thereby unseating valve 26 and opening the cylinder 11 to exhaust, and also, if desired, cutting off the supply of pressure medium through the seating of the valve member 27ª. Since the release of the latch bolt 29 is the initial operation for opening the door, it will be seen that the action of releasing the latch bolt liberates the door from the door closing force applied to the door by the pressure medium supplied to the cylinder 11, so that the door may be opened freely and easily without the resistance or opposition of such door closing power. As the door swings towards its open position as indicated in dotted lines in Fig. 2, the piston 13 is moved towards the right hand end of the cylinder 11, but this movement is not opposed by pressure medium since the right hand end of the cylinder 11 is freely opened to exhaust or to atmosphere through the unseating of valve 26. The instant the door handle or knob 28 is released the valve 26 again seats, thereby cutting off the communication between the cylinder and the atmosphere, and hence permitting the pressure medium to be supplied to the cylinder, thereby instantly imposing upon the door a door closing force or power. If desired a valve device may be employed in the supply connection 21, whereby the supply and exhaust of operating medium to and from the cylinder may be controlled, or the cylinder cut off from pressure medium and exhaust independently of valve 26. 27ª, and hence independently of the operation of the door handle or knob 28. In Figs. 4, 5, and 6 I have shown a simple structure of three-way valve 34 arranged in the pipe connection 21, and operating to control the communication of said connection 21 with the power medium supply pipe 35, or an exhaust connection 36. A valve operating handle 37, see Fig. 1, may serve to control valve 34. In the position shown in Fig. 6 the supply connection 21, and hence the power cylinder 11, are open to exhaust. In the position shown in Fig. 5 the connection 21 and supply pipe 25 are brought into communication with each other, and in the position shown in Fig. 4, both the supply and exhaust connections are cut off. In this position the door will be held in any position occupied by it at the time the valve 34 is actuated into this cut-off position.

In Figs. 7, 8, 9 and 10, I have shown my invention as embodied in an electrically operated door closing device. In this arrangement an electric motor indicated at 40 is pivotally mounted upon a supporting bracket 41 suitably attached to a convenient part of the frame in which the door is set, and when actuated revolves a screw rod 44. This rod operates through guides 42 carried by a member 43 swivelly mounted upon a bracket 45 secured to the door 12. A half nut 46 is movably mounted in the swivel member 43 for movement into and out of engagement with the threads of the threaded rod 44. The member 43 is swivelly mounted in the bracket 45 in any suitable or convenient manner. I have shown clamp rings 47 engaging cooperating flanges on the member 43 of the bracket 45 for this purpose. When this half nut 46 is in position for the threads of the threaded portion of rod 44 to engage the same, and the electric motor 40 is put into operation, a pressure power is applied to the door 12, tending to close the same, or to hold the same in closed position. When it is desired to open the door, I propose, in accordance with my invention, to shift the half nut 46 out of engaging relation with respect to the threaded portion of rod 44, thereby relieving the door of any force or power exerted by the motor 40, tending to close the door, and hence enabling the door to be opened easily and readily without the application of an opposing force thereto. The half nut 46 may be disengaged from the rod 44 in any suitable or convenient manner. In the arrangement shown, I propose to effect the release of the half nut 46 coincidently with the operation of the door handle or knob 28 through arm 30 and connections 31, 32, similar to those above described with reference to Fig. 1, and bell crank 33. One arm of the bell crank 33 engages a pin 48 connected to the half nut 46. A spring 49 may serve to normally tend to hold the half nut 46 in engagement with the threaded rod 44 and to resist the action of the bell crank 33.

If desired, and in order to preserve pow-

er, a switch device may be arranged in the circuit of the motor to open when the door reaches its closed position. I have shown a form of switch device suitable for this purpose wherein a projecting portion of the half nut 46 is arranged to engage a rod 50 carrying a contact member 51 arranged to control the circuit of the motor 40. A spring 52 serves to normally hold the switch member 51 in position to complete the circuit of the motor. When the rod 50 is engaged by the nut 46 the motor circuit is opened and the supply of current thereto is cut off.

If desired, a manually operated switch device 53 may be arranged in the circuit of the motor, so that the circuit of the motor may be opened at any desired time manually and independently of the operation of the half nut, or the manipulation of the door handle. By opening the circuit of the motor 40 through the manual switch 53, the door will be held in whatever position it may occupy at the moment of opening said circuit. The switch device 53 may be mounted in any convenient position upon the door casing.

From the foregoing description it will be seen that I provide a door closing device which is exceedingly simple, wherein power is employed for closing the door, the ordinary door latch retaining the door in its closed position. Upon the release of the latch, however, in order to effect the opening of the door, the door is liberated or freed from the power applied to close it, so that the door will swing freely towards its open position. The instant the door latch is released power is again applied in a direction to close the door. The door, however, may be held in any position to which it may be moved.

In the case of the form of my invention illustrated in Figs. 1 to 6 wherein a pneumatic closing device is employed, I have found that a very desirable cushioning effect is obtained during the closing movement of the door under the influence of the pressure medium supplied to the closing motor, the door automatically being slowed down as it completes approximately two-thirds of its closing movement to full open position, the completion of the closing movement being effected under the slowing down of the movement. This result is obtained and will be understood when it is considered that the piston 13 operating within the cylinder 11 is exposed on one side to the operating pressure medium supplied to the cylinder through the restricted opening 24, and therefore at a regulated rate of supply, this operating pressure of course being in excess of atmospheric pressure to which the opposite side of the piston is exposed. During the closing movement of the door the momentum acquired by the door develops in itself a force or power which acts upon the piston tending to move it in the same direction of the movement thereof under the influence of the pressure medium supply. This momentum force may cause the piston to travel faster than its speed of travel under the influence of the restricted or regulated pressure supply. The result is to create a reaction, vacuum, or back pressure, due to atmospheric pressure, to which the piston is exposed, counterbalancing and overcoming the pressure of the operating medium. The result is a slowing down of the closing movement of the door until the pressure in the cylinder again builds up through accumulation therein of the regulated pressure supply, such building up of pressure in the cylinder continuing until the reaction or atmospheric pressure resistance is overcome, and in the conflict of these opposing pressures the door completes its final movement with a very efficient cushioning action. I have found, for instance, that if initially the operating pressure supplied to the closing cylinder is five to ten pounds, then the closing movement of the door is initiated from its fully open position. The pressure in the cylinder falls when the door reaches approximately two-thirds of its closing movement, to zero or even below zero due to the combined effects of momentum of the door and atmospheric pressure as above explained. I regard this cushioning action as a valuable feature of my invention.

Many variations and changes in the details of construction and arrangement will readily occur to persons skilled in the art and still fall within the spirit and scope of my invention as defined in the claims, what I claim as new and useful and of my own invention and desire to secure by Letter Patent is,—

1. In a door closing device, power operated means to close the door, means to retain the door normally closed, and means controlled by the release of the door retaining means to release the door from the influence of the power operated closing means.

2. In a door closing device, power operated means to close the door, a latch to retain the door closed, and means operated coincidently with the release of the latch to release the door from the influence of the power operated closing means.

3. In a door closing device, power operated means to close the door, means to manually open the door, and means controlled by the said manual means to release the door from the power closing means.

4. In a door closing device, power operated means to close the door, a handle connected to the door to open it, and means operated by the actuation of the handle for releasing the door from the power operated closing means.

5. In a door closing device, a pressure operated motor to close the door, a latch to retain the door closed, and means operated coincidently with the release of the latch to open the motor to exhaust.

6. In a door closing device, a pressure operated motor to close the door, a valve to open the motor to exhaust, means to retain the door closed, and means actuated by the release of said retaining means to open said valve, thereby relieving the door from the power action of the closing motor.

7. In a door closing device, a pressure operated motor to close the door, a valve to control the supply and exhaust of operating pressure medium to and from said motor, means to retain the door closed, and means actuated by the release of said retaining means to move said valve into position to cut off the pressure supply to the motor and to open the motor to exhaust.

8. In a door closing device, a pressure operated motor to close the door, a manually operated valve to control the exhaust from said motor, a latch to retain the door closed, and means actuated by the release of the latch to unseat said valve and open the motor to exhaust.

In testimony whereof I have hereunto set my hand on this fifth day of June, A. D. 1922.

HAROLD ROWNTREE.