P. R. FORMAN.

AUTOMATIC REVERSING MECHANISM FOR DOOR OPERATING MOTORS.

APPLICATION FILED JULY 22, 1915.

1,329,704.

Patented Feb. 3, 1920.

2 SHEETS—SHEET 1.

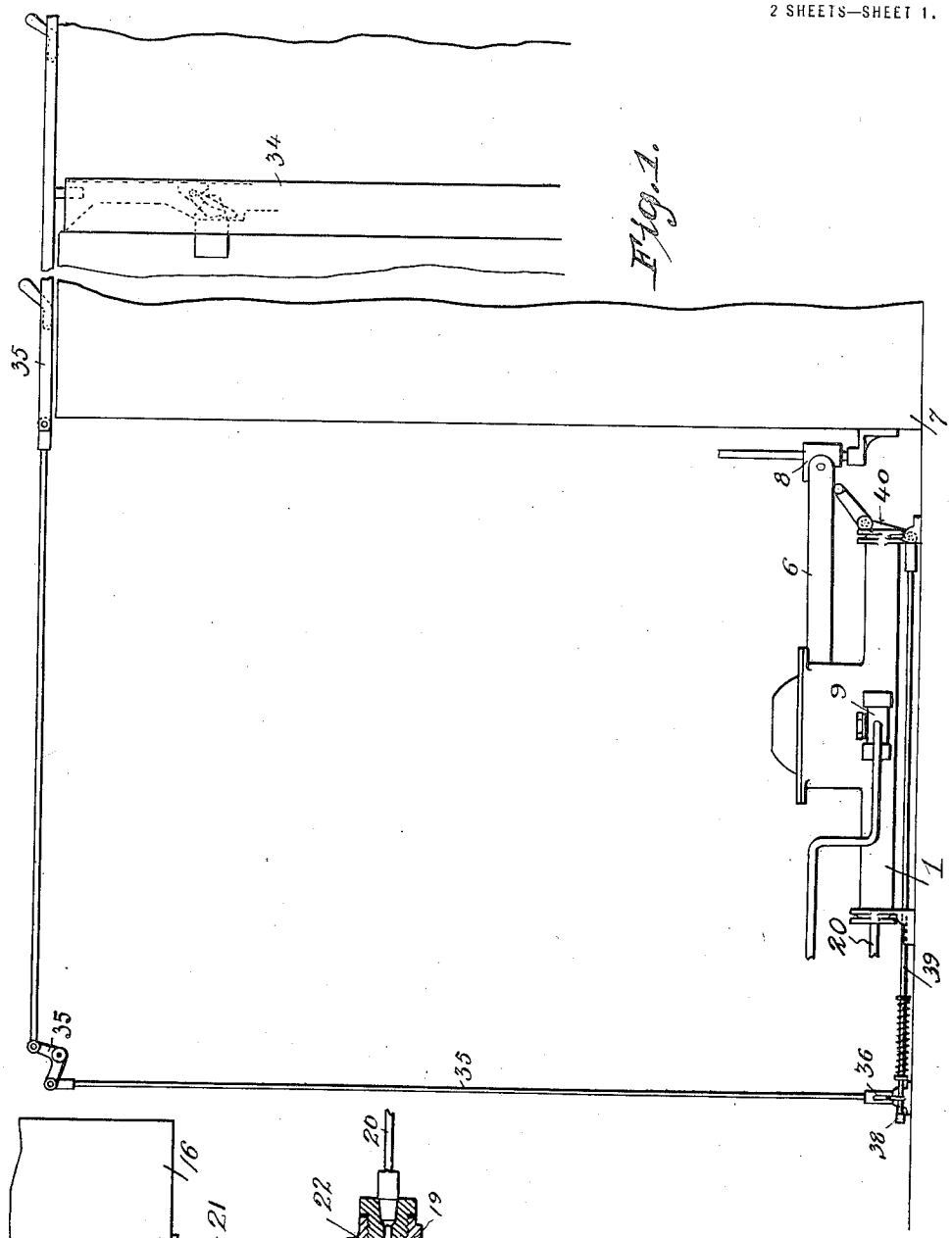



Fig. 1.

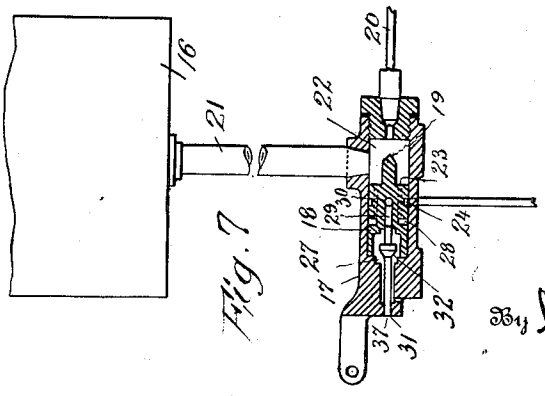



Fig. 7

Paris R. Forman Inventor.

By his Attorney Samuel G. Darby

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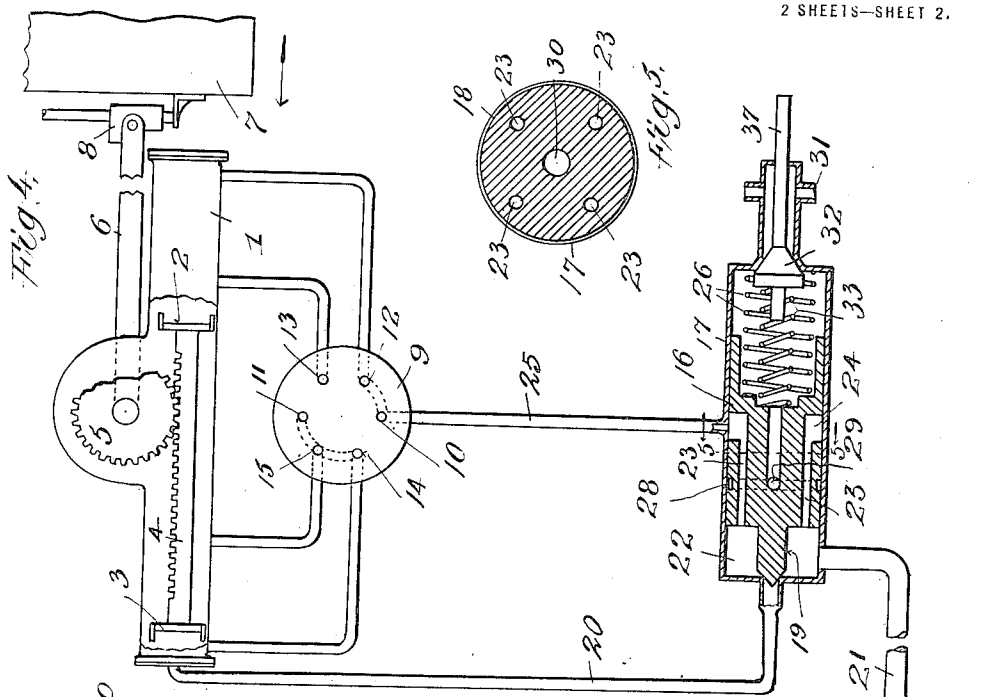


Fig. 4.



Fig. 5.

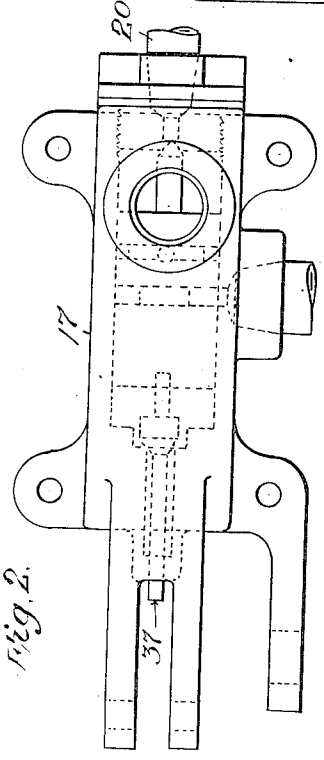


Fig. 2.

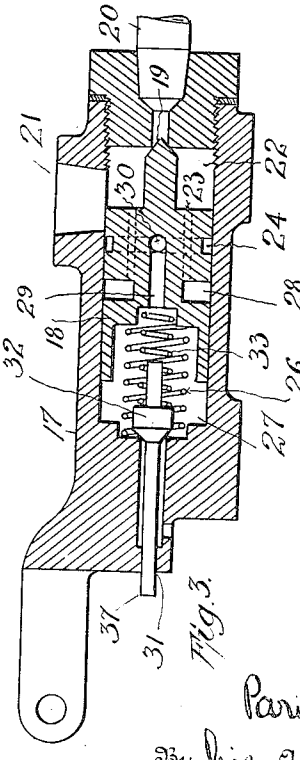


Fig. 3.

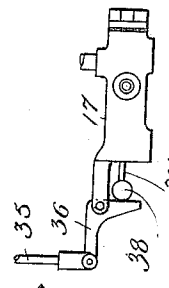


Fig. 6.

Inventor

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By his Attorney

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# UNITED STATES PATENT OFFICE.

PARIS R. FORMAN, OF CHICAGO, ILLINOIS.

## AUTOMATIC REVERSING MECHANISM FOR DOOR-OPERATING MOTORS.

1,329,704. Specification of Letters Patent. Patented Feb. 3, 1920.

Application filed July 22, 1915. Serial No. 41,331.

*To all whom it may concern:*

Be it known that I, PARIS R. FORMAN, a citizen of the United States, residing at Chicago, county of Cook, and State of Illinois, have made a certain new and useful Invention in Automatic Reversing Mechanism for Door-Operating Motors, of which the following is a specification.

This invention relates to door operating mechanism and particularly to a safety trip device for reversing the door operating motor.

The object of the invention is to provide a trip valve device which controls the supply of operating medium to the motor, and which operates when the door, in its closing movement, encounters an obstruction, to reverse the door operating motor.

A further object is to provide a trip or reversing device of the nature referred to, which is independent of the main motor control valve mechanism.

A further object is to provide a reversing mechanism of the nature referred to which permits the door operating motor to resume its door closing operation when the obstruction encountered by the door is removed.

A further object is to provide a safety arrangement of the nature referred to which is rendered inoperative when the door reaches, or closely approaches the extreme limit of its closed position.

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:

Figure 1 is a view in elevation showing a door operating mechanism and a trip valve device embodying my invention applied thereto, the latter being in longitudinal central section, with the valves unseated.

Fig. 2 is a top plan view of the trip valve device.

Fig. 3 is a view in central longitudinal section of the trip valve device showing the valves seated.

Fig. 4 is a view somewhat diagrammatic, showing the relation of the trip valve, the main motor control valve, and the motor.

Fig. 5 is a view in transverse section through the trip valve casing and plunger, as indicated by the line 5, 5, Fig. 4.

Fig. 6 is a detail view showing the vent control arrangement for the trip valve.

Fig. 7 is a detail view of the automatic trip valve device and the connections thereto.

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

In carrying out my invention I propose to employ a motor suitably connected to a door or other part to be moved, and a control mechanism for the motor, all of which parts may be of any usual, well known or suitable type or construction to secure the proper operation of the door, for instance, to open or to closed positions, and to secure the desired cushioning of the door as it approaches the limits of its movements.

In connection with the motor and its usual or main control and cushioning connections of the general nature referred to, I propose, in accordance with my present invention, to employ an auxiliary safety trip or reversing device which is actuated when the door encounters an obstruction during its closing movement, and when so actuated, causes the door operating motor to be reversed, and to resume its door closing operation when the obstruction is removed. I also propose to employ means to prevent the operation of the trip or motor reversing device after the door has reached, or nearly reached its completely closed position.

As an illustrative and operative embodiment of my invention I have shown the same applied in connection with a pneumatic motor which, in the form shown, but to which my invention is not to be limited or restricted, comprises a cylinder 1, the respective ends of which operate the pistons 2, 3, connected together by the intermediate rack 4, the latter meshing with a segment gear 5, to which is connected an arm 6, the latter suitably connected to a door 7, as indicated at 8, and in such manner that when the connected pistons 2, 3, are shifted to one limit of their movement the door is moved to completely open position, and when shifted to the other limit of their movement the door is moved to completely closed position. In the position and relation of the parts as shown the door 7 is in its completely closed position, in which case the operating arm 6

occupies an approximately horizontal position.

The supply and exhaust of operating medium, such as compressed air, to and from the motor cylinder 1, is controlled by a main valve device indicated generally by reference numeral 9. In the form diagrammatically shown in Fig. 4, to which, however, my invention is not to be limited or restricted, the main control valve device 9, includes a pressure supply port 10 and exhaust port 11, and a pair of ports to communicate with each end of the cylinder 1. Thus the ports 12, 13, are shown as communicating with the right hand end of the cylinder, while the ports 14, 15, communicate with the left hand end of the cylinder. The ports 12, 14, communicate respectively with the extreme ends of the cylinder, while the ports 13, 15, communicate with the cylinder at points removed from the respective ends thereof. These ports 13, 15, are designed to be of large area while the ports 12, 14, are of restricted area. In operation the supply port 10 is brought into communication with either the one or the other of the ports 12, 14. It is shown in communication with port 12 which communicates with the extreme right hand end of the cylinder 1. In this relation the ports 14 and 15 should be in communication with the exhaust port 11, and the port 13 closed. Similarly when supply port 10, communicates with port 14, the ports 12, 13, should be in communication with exhaust port 11, and port 15 closed.

With the ports in the position shown, that is, with the door closed, suppose it be desired to open the door. To do this the valve device 9 is operated to bring ports 10 and 14 into communication with each other. This closes port 15, and opens ports 12 and 13 to exhaust port 11. The result is that pressure medium is supplied to the left hand end of the cylinder while the right hand end of the cylinder is freely open to exhaust through ports 12, 13. Thereupon, the pistons 2, 3, begin to move toward the right, thereby moving the door toward open position. When the piston 2 passes over the connection of port 13 to the cylinder the further exhaust through this port of large area is cut off, all the exhaust thereafter being compelled to go through the restricted port 12, thereby securing the desired cushioning operation.

I will now describe the auxiliary trip or reversing valve device employed in connection with the motor and control mechanism above described, and which embodies my present invention.

Arranged in the connection from the pressure supply tank 16, to the supply port 10, of the main control device 9, is an auxiliary trip or reversing valve device which consists of a cylinder 17, in which operates a plunger 18 with a loose sliding fit. This plunger carries a valve 19 at one end which controls a connection 20, from the cylinder 17 to the left hand end of main motor cylinder 1. The tank 16 delivers into the space 22 at one end of cylinder 17 through a connection 21. The plunger 18 is provided with longitudinal ducts 23, which open at one end into the space 22, and at the other end into a peripheral channel 24. When the plunger 18 is in normal position the valve 19 is seated, thereby cutting off supply of pressure medium to the main motor cylinder 1, through connection 20, while, at the same time the channel 24, is in communication with a connection 25, see Fig. 4, which delivers to the supply port 10, of the main valve control device 9. The plunger 18 is held in its normal position by the tension of a spring 26, supplemented by pressure medium which leaks from space 22 past the loose fitting plunger 18, into the space 27 at the other end of cylinder 17, and in which space the spring 26 is located. This leakage pressure is sufficient to equalize, or partially so, the pressure on opposite ends of the plunger thereby making effective the tension of spring 26 to hold the plunger in its normal position with the valve 19 seated. If, however, the pressure medium is exhausted from chamber 27, as by opening said chamber to the atmosphere, the pressure in chamber 22, immediately becomes effective to overcome the tension of spring 26, thereby shifting the plunger toward the right from its normal position. This unseats valve 19, thereby admitting pressure medium from the supply source 16, through space 22, and connection 20 to the left hand end of main motor cylinder 1. At the same time the peripheral channel 24 is shifted out of register with connection 25 to port 10, and another peripheral channel 28 in the plunger 18 is brought into register with connection 25. Ducts 29, 30, formed through plunger 18, communicate between the peripheral channel 28 and the space 27. When, therefore, the plunger 18 is shifted toward the right from its normal position, that is, when the chamber 27, is opened to the atmosphere, the right hand end of the main motor cylinder 1 is opened to exhaust through ports 12 and 10, connection 25, channel 28, ducts 29, 30, and chamber 27, and this is accomplished without disturbing the main control valve 9. The chamber 27 is opened to the atmosphere through a port 31, and this port is controlled by a valve 32, which is normally seated to close the port 31 by means of a spring 33.

Now, by providing means to unseat valve 32, as, for instance, when the door during its closing movement, encounters an obstruction, the motor which is acting to close the door is reversed without operating or disturbing the main control valve 9, thus pro-

viding a safety arrangement which prevents injury to persons accidentally caught between the door and jamb while the door is closing.

Many specifically different arrangements may be employed for unseating the valve 32. In accordance with my invention I propose to employ means to unseat said valve when the door, in its closing movement encounters an obstruction, but which is ineffective to unseat said valve after the door is completely closed or is very nearly completely closed. A simple arrangement for accomplishing this result is shown consisting of a shoe 34, movably mounted at the front edge of the door, and adapted to be shifted relatively to the door in case the door, in closing, encounters an obstruction. Such shoes are common in the art. The movement of the shoe relative to the door is transmitted through suitable connections 35, to one arm of a bell crank lever 36, pivoted at its angle upon a bracket carried by the casing or mounting of cylinder 17, the other arm of said lever 36 being arranged to extend across the line of the stem 37 of valve 32. (See Fig. 6.) Interposed between the lever 36 and the stem 37, is an abutment 38, which, however, is withdrawable from between said lever and stem. Where the abutment is positioned between the lever and stem, and the lever is rocked by the shifting movement of the shoe as above described, the valve 32 will be unseated and the main motor reversed. When the abutment 38 is withdrawn the shifting movement of the shoe is not effective to unseat the valve 32. The abutment 38 is connected by a rod 39, (see Fig. 1) to one arm of a lever 40, the other arm of which is arranged to be engaged and rocked by the door operating arm, when the latter is in position to completely close the door or is very closely approaching that position. When the lever 40 is thus rocked the abutment 38 is shifted from between the lever 36 and stem 37, and consequently when so shifted the rocking of lever 36 or the shifting of shoe 34, will not cause the motor to reverse.

When the motor has been reversed by the shifting of the shoe 34, as above explained, it is permitted to resume its door closing operation when the shoe 34 returns to its normal position, that is, when the obstruction which caused the shoe to be shifted has been removed the spring 33, acting on valve 32 becomes effective to again seat said valve. Thereupon equalizing pressure again builds up in chamber 27, through leakage from chamber 28 past plunger 18 thereby allowing the tension of spring 26 to become effective, to restore plunger 18 to its normal position with the valve 19 seated. When the closing movement of the door is resumed after its operating motor has been reversed, as above explained, the door will not slam through any built up pressure used in reversing its operating motor because this pressure employed to reverse the motor is open to exhaust through the restricted port 14. Consequently a cushioning action takes place in the main motor.

Having now set forth the objects and nature of my invention and a construction embodying the principles thereof, I wish it to be understood that many variations and changes in the details of construction and arrangement might readily occur to persons skilled in the art and still fall within the spirit and scope of my invention.

What I claim as new and useful and of my own invention, and desire to secure by Letters Patent, is—

1. The combination with a door operating motor and its control devices, of a source of power medium, a reversing device for the motor located between the source of power medium and the motor control devices, and means operated by an obstruction to the door in its closing movement to operate said reversing device.

2. The combination of a door operating motor, a main control valve therefor, a supply connection for admitting operating medium thereto, an auxiliary reversing valve device arranged in the supply connection of the operating medium to the main control valve, and means to operate the reversing valve without disturbing the main motor valve.

3. The combination of a door operating motor, a main control valve therefor, an auxiliary reversing valve device arranged in the supply connection of the operating medium to the main control valve, and means operated by an obstruction to the door in its closing movement, to operate the reversing valve.

4. The combination with a door operating motor and its control devices, of means to reverse the motor independently of its control devices and means to prevent the operation of the reversing means when the door closely approaches its completely closed position.

5. The combination with a door operating motor and its control devices, of means to reverse the motor independently of its control devices, and means operated by the door moving devices as the door reaches its closed position to prevent operation of the reversing means.

6. The combination with a door operating motor and its control devices, of fluid pressure controlled means to reverse the motor, said means controlled by an obstruction to the door in closing and means to prevent the operation of the reversing means when the motor closely approaches its complete door closed position.

7. The combination with a door, operating

motor and its control devices, of fluid pressure controlled means to reverse the motor, said means controlled by an obstruction to the door in closing and means operated by the door moving devices as the door reaches its closed position to prevent operation of the reversing means.

8. In a door operating mechanism and in combination with a motor and its main control valve, an auxiliary valve casing communicating with a power supply source, one end of the motor, the motor control valve and the outer air, a plunger loosely fitting said cylinder and having a valve to control the connection to the motor, said plunger controlling the connection to the motor valve, a valve to control the connection of said casing to the atmosphere, and means to operate said last mentioned valve.

9. In a door operating mechanism and in combination with a motor and its main control valve, an auxiliary valve casing, a loosely fitting plunger operating in said casing, a connection from one end of said casing to a pressure supply source, and also to one side of the motor, said plunger having a valve to control said last mentioned connection, a spring acting to normally shift the plunger to seat said valve when the pressure on opposite sides of the plunger is equalized, and means to disturb the equalized pressures on opposite sides of the valve to unseat said valve.

10. In a door operating mechanism and in combination with a motor and its main control valve, an auxiliary valve casing, a loosely fitting plunger operating in said casing, a connection from one end of said casing to a pressure supply source, and also to one side of the motor, said plunger having a valve to control said last mentioned connection, a spring acting to normally shift the plunger to seat said valve when the pressure on opposite sides of the plunger is equalized, and means to open the other end of the casing to the atmosphere to cause said valve to unseat.

11. In a door operating mechanism and in combination with a motor and its main control valve, an auxiliary valve casing, a loosely fitting plunger operating in said casing, a connection from one end of said casing to a pressure supply source, and also to one side of the motor, said plunger having a valve to control said last mentioned connection, a spring acting to normally shift the plunger to seat said valve when the pressure on opposite sides of the plunger is equalized, and means operated by an obstruction to the door in closing to open the other end of the casing to the atmosphere.

12. In a door operating mechanism and in combination with a motor and its main control valve, an auxiliary valve casing, a loosely fitting plunger operating in said casing, a connection from one end of said casing to a pressure supply source, and also to one side of the motor, said plunger having a valve to control said last mentioned connection, a spring acting to normally shift the plunger to seat said valve when the pressure on opposite sides of the plunger is equalized, said plunger having ports respectively communicating with the pressure source and with the other end of said casing, and means to shift said plunger to open said valve and to open the other side of the motor to exhaust.

13. In a door operating mechanism and in combination with a motor and its main control valve, an auxiliary valve casing, a loosely fitting plunger operating in said casing, a connection from one end of said casing to a pressure supply source, and also to one side of the motor, said plunger having a valve to control said last mentioned connection, a spring acting to normally shift the plunger to seat said valve when the pressure on opposite sides of the plunger is equalized, said plunger having supply and exhaust ports to coöperate with the main motor valve, said supply ports being normally open to said main valve, and means to shift said plunger to open the auxiliary plunger valve and to open the exhaust ports to the main motor valve.

14. In a door operating mechanism and in combination with a motor and its main control valve, an auxiliary valve casing, a plunger operating therein to open one side of the motor to pressure supply and the other side to exhaust, and means operated by an obstruction to the door in closing to control said plunger.

15. In a door operating mechanism and in combination with a motor and its main control valve, an auxiliary valve casing, auxiliary devices to open one side of the motor to pressure supply and the other side to exhaust, and means to control said devices.

16. In a door operating mechanism and in combination with a motor and its main control valve, an auxiliary valve casing, auxiliary devices to open one side of the motor to pressure supply and the other side to exhaust, and means operated by an obstruction to the door in closing to control said devices.

In testimony whereof I have hereunto set my hand on this 19th day of July, A. D., 1915.

PARIS R. FORMAN.