J. F. McELROY.

DOOR OPERATING DEVICE.

APPLICATION FILED NOV. 23, 1907.

917,642.

Patented Apr. 6, 1909.

2 SHEETS—SHEET 1.

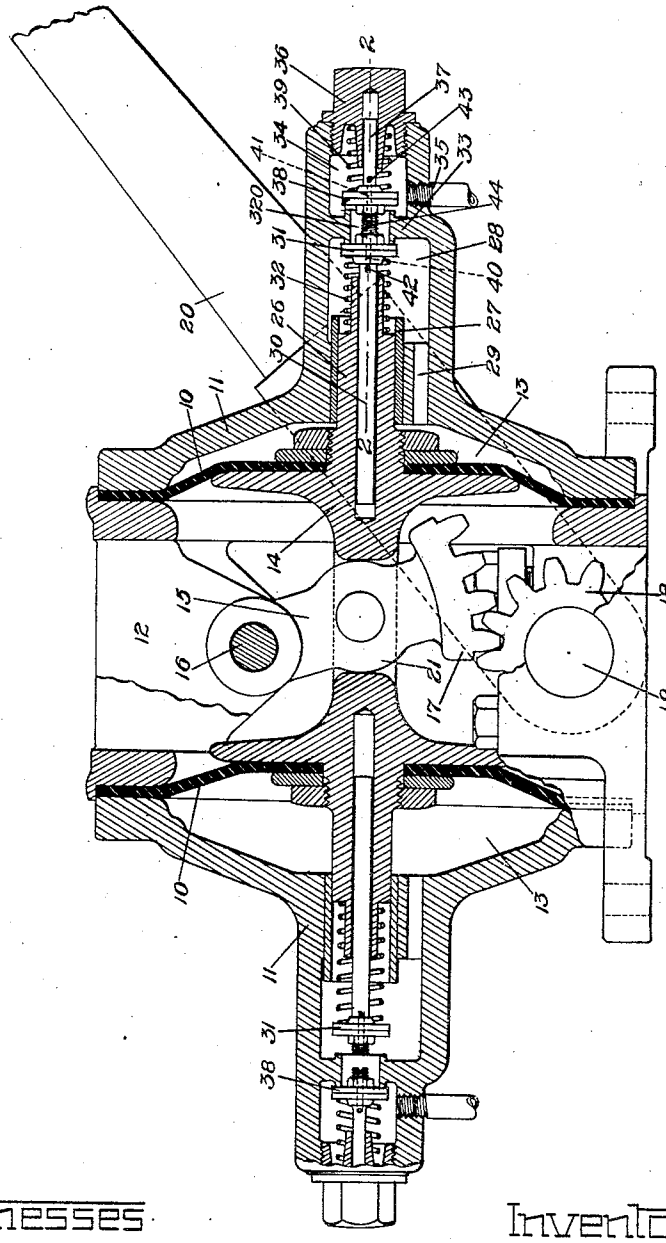


Fig. 1.

Witnesses

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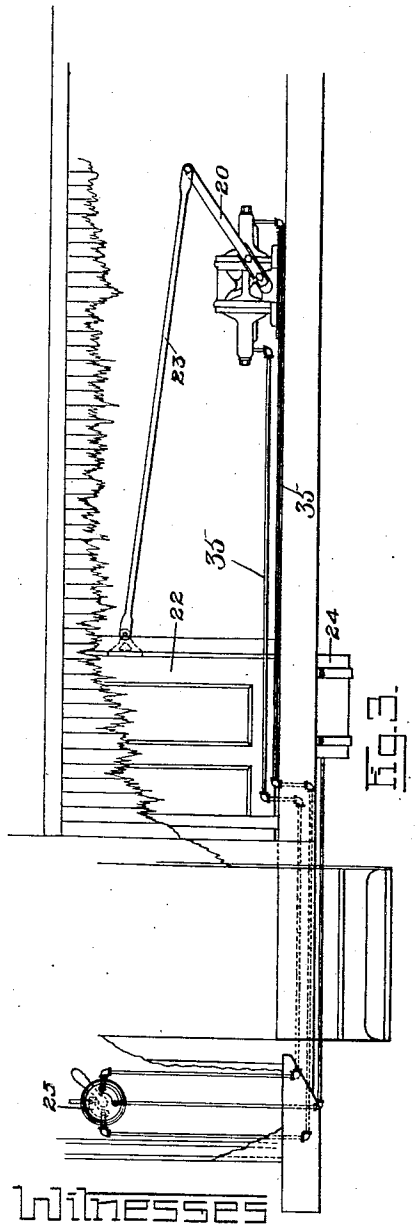


Fig. 3.

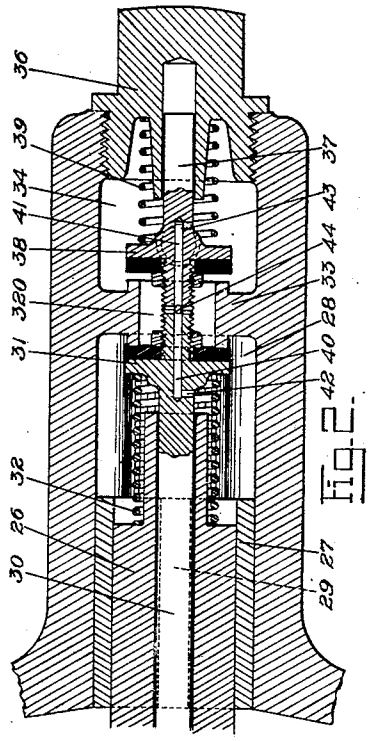


Fig. 2.

Witnesses

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UNITED STATES PATENT OFFICE.

JAMES F. McELROY, OF ALBANY, NEW YORK, ASSIGNOR TO CONSOLIDATED CAR HEATING COMPANY, OF ALBANY, NEW YORK, A CORPORATION OF WEST VIRGINIA.

DOOR-OPERATING DEVICE.

No. 917,642. Specification of Letters Patent. Patented April 6, 1909.

Application filed November 23, 1907. Serial No. 403,432.

To all whom it may concern:

Be it known that I, JAMES F. McELROY, a citizen of the United States, residing at Albany, in the county of Albany and State of New York, have invented certain new and useful Improvements in Door-Operating Devices, of which the following is a specification.

This invention relates to fluid-pressure motors for operating car doors, steps or equivalent elements, whose supply and discharge can be controlled by valve-mechanism located at a distant point such as the car platform. It relates more especially to motors of this class in which the traverse of the piston or equivalent septum operates an auxiliary valve mechanism causing the fluid to be throttled during the latter part of the stroke, whereby the operated element may be brought to rest gradually, without shock. An example of such motors is found in patent to Neal, No. 41,446.

The objects of my invention are to enable motors of this class to work by fluid pressure in both directions, to automatically throttle the fluid-supply or both supply and discharge, and to improve the construction and operation of the devices for automatically throttling either the motor supply or discharge or both supply and discharge. Some of these objects may be independently accomplished by using more or less of the mechanism hereinafter described.

Of the annexed drawings, Figure 1 is a vertical longitudinal section showing the motor and the valve mechanism for automatically varying its rate of action at different points. Fig. 2 is an enlarged section on the line 2—2 of Fig. 1. Fig. 3 is an elevation showing the application of the motor and its controlling-mechanism to a car door. The car step may also be operated by a motor of this general type, as I have indicated in a separate application, Serial No. 406,263, but have not here shown.

The motor members are two opposed diaphragms 10, 10 mounted in casings 11, 11 having a common middle member 12 and an air-pressure chamber 13 on the outer side of each diaphragm. The diaphragms are connected by a common hub-piece 14 whereby motion is communicated to the door-operating lever from a point between the diaphragms. For this purpose a short lever 15 is pivoted at 16 to the middle casing-member 12 and formed with a gear-segment 17 at its lower end engaging the teeth of a second gear segment 18 which is mounted on the shaft 19 of the multiplying-lever 20. Where the short lever 15 passes through the hub-piece 14 it engages the latter by means of circular-arc abutments 21 so that the swinging motion of the short lever is transmitted by the gear segments to the multiplying-lever 20. The latter is of sufficient length to give the door its complete opening and closing movement by a comparatively short throw of the lever 15. In Fig. 3 the multiplying lever 20 is shown as connected with the sliding car-door 22 by means of a rod 23.

Air pressure being taken from a tank 24 of the air-brake system is alternately admitted to each side of the motor apparatus and simultaneously exhausted from the other side, and this action is controlled by a suitable motorman's valve 25 shown conventionally. The diaphragm motor may be placed under one of the car seats and the lever 20 and rod 23 located between the seats and the sheathing, these members being thus protected and out of the way but readily accessible and having room to properly perform their functions. The diaphragms 10 are made of sufficient diameter to furnish the required power at the outer end of lever 20 with the air-brake pressure ordinarily available. By using practically the full air-brake pressure on a large diaphragm or other septum of short stroke and employing a multiplying-lever to obtain the necessary amplitude of movement in the door, the apparatus is made very economical of air. A motor of this kind is here described as a preferred construction without however intending to wholly limit the invention, which principally resides in the novel valve-mechanism now to be described, to such a type of motor.

The valve mechanism for producing a variable motion in the door is shown as applied to each diaphragm although it might be used on only one. Considering the one at the right (Figs. 1 and 2) of which the valve mechanism at the left is a duplicate turned end-for-end, it will be seen that the diaphragm-stem 26 extends through a bushed guide-bearing 27 in the head of casing 11 into an air-chamber 28 communicating with the diaphragm-chamber 13 by an open duct 29 and this stem is centrally apertured to guide the stem 30 of a check-valve 31, the latter

being backed by spring 32 which abuts on the diaphragm-stem 26. Valve 31 acts against a valve-seat formed at the left-hand end of an air-passage 320 in a partition 33 which separates chamber 28 from air-chamber 34, the latter being entered by the air supply and exhaust pipe 35. A screw plug 36 closes chamber 34 at its outer end and guides the stem 37 of a second check-valve 38 coöperating with a valve-seat at the right-hand end of passage 320. A spring 39 tends to seat this valve. The valves are prevented from both seating at once by causing the inner ends of their stems to abut, as shown, and it will be noted that the two valve-stems have small ducts 40, 41 drilled in them with openings 42, 43 back of the respective valves in the chambers 28 and 34, and also an opening 44 into the air-passage 320 between the abutting stems of the two valves.

The operation is as follows. The lever 20 being at one extreme of its movement with the door 22 open and the diaphragms positioned as shown in Fig. 1, in which case the right-hand chambers 13, 28, and 34 are exhausted of pressure, compressed air is then admitted by the motorman's valve through the right-hand pipe 35 to chamber 34, and since check-valve 38 is off its seat, the air enters chamber 28 with comparative freedom through passage 320 and past the check-valve 31, the pressure of the entering air unseating said valve and acting against the right-hand diaphragm 10. A comparatively slight unseating of check-valve 31, insufficient to permit the other check-valve 38 to seat itself, allows pressure to quickly accumulate in chamber 13 and move the diaphragm 10, which, acting against short lever 15 and through the gear-segments 17, 18 upon the multiplying-lever 20 swings the latter and moves the door toward a closed position. During the first part of this movement, or until the check-valve 38 becomes seated, the air flows freely into the chamber 13 and the door is moved quickly, but the recession of diaphragm stem 26 relieving the tension on spring 32 at a predetermined point in the closing movement of the door permits the spring 39 and the air-pressure back of check-valve 38 to seat said valve, which then obstructs the further flow of air into the diaphragm chamber. The only passage for the air is then by way of the restricted ducts 41, 40, and it can only reach the diaphragm chamber 13 through the small openings 42 and 44. The closing impulse upon the door is therefore diminished by a decrease in the rate of air supply back of the motor diaphragm and this in itself is an influence tending to prevent the door from slamming shut.

It will be understood that while air is being supplied to the right-hand diaphragm chamber 13 it is simultaneously exhausted from the left-hand diaphragm chamber by virtue of opening an exhaust-passage to the atmosphere through the motorman's valve 25 at the same time that the compressed air is being supplied to the right-hand diaphragm chamber. It being desirable to provide a positive air cushion for retarding the final closing movement, I provide for this by the seating of the check-valve 31 of the left-hand motor and the slow escape of air from the left-hand diaphragm chamber through ducts similar to the ducts 40, 41 at the right.

When the car-door is opened by a reversal of the motorman's valve 25, causing compressed air to be admitted to the left-hand motor and simultaneously exhausted from the right-hand motor, the door-opening movements of the motor are a repetition of its door-closing movements but in the opposite direction, the first part of the movement being relatively quick due to the free entrance of compressed air under the opened left-hand valve 38 and past the companion valve 31, while the final movement is executed more slowly when the left-hand valve 38 has become seated and cuts down the air supply. At about the same time that the left-hand valve 38 seats, the right-hand valve 31, which up to this time had remained unseated, becomes seated by the accumulation of spring-pressure behind it, due to the rightward movement of the diaphragm structure, and restricts the outflow of air from that motor so that the last part of the opening movement is positively cushioned.

It being noted that I have provided a double motor and duplicate valve mechanisms for restricting the air-supply and the air-discharge during the latter part of both the opening and closing movements of the door, it will be obvious that I may perform any lesser number of these functions by omitting one or more of the automatic valves, or omitting one set of these valves, or employing any one of the combinations of these several valves presented by the construction herein set forth. The construction of the valves themselves and their related parts may also be considerably modified without departing from the invention. It will further be understood that although the valves are shown as directly actuated by the diaphragm-stems, and their casings integrally combined with the motor casings in a compact structure, yet this is not the only arrangement coming within the scope of the invention.

By mounting the motor charging and discharging valve at the car end or other control point and providing an independent automatic fluid-throttling valve mechanism operated by the traverse of the motor septum or some connected part, I avoid the use of long and complicated mechanical connections for operating said charging and discharging valve and am enabled to free the latter valve from any control exercised by the

motor. The specific character of the automatic valve-mechanism above-described makes it an improvement over any prior devices known to me in the matter of simple and reliable action in either or both directions.

I claim:

1. A motor for operating a door or similar element comprising a fluid-pressure chamber having a motor septum and adapted to be charged and discharged by a distant valve-mechanism, in combination with auxiliary valve-mechanism operated by the fluid pressure and controlled by the traverse of the motor septum for automatically throttling the supply and discharge of the motive fluid respectively during the completion of the septum stroke in opposite directions.

2. A motor for operating a door or similar element comprising a septum member, two chambers for containing fluid pressures to act in opposite directions on said member, a distant valve-mechanism for charging and discharging said chambers, and auxiliary valves in the path of the motive fluid for said chambers, said valves controlled by the traverse of the septum member and causing the admission of motive fluid to one of said chambers and the discharge from the other chamber to be throttled during the completion of the stroke of said member.

3. A motor for operating a door or similar element comprising a fluid-pressure chamber having a motor septum, a fixed conduit forming a main passage for the motive fluid, connecting with said chamber and having a valve-seat, an automatic check-valve coöperating with said seat, means whereby said valve is seated by the traverse of the septum during the completion of its stroke, and means forming a secondary restricted passage for throttling the motive fluid as soon as the check-valve is seated.

4. A motor for operating a door or similar element comprising a fluid-pressure chamber having a motor septum, a check-valve which, when closed, causes a throttling of the discharge from said chamber during the latter part of the septum stroke, and a spring interposed between said valve and the septum, whereby the traverse of the septum yieldingly closes the valve.

5. A motor for operating a door or similar element comprising a fluid-pressure chamber having a motor septum, valve-mechanism for charging and discharging said chamber, and a secondary valve between said valve mechanism and the chamber, closed by the traverse of the motor septum during the latter part of its power stroke and adapted to cause the throttling of the fluid-pressure supply to said chamber.

6. A motor for operating a door or similar element comprising a fluid-pressure chamber having a motor septum, a check-valve controlling the fluid supply to said chamber, a connection between said valve and the septum whereby the valve is held open during the first part of the working stroke of the septum and permitted to close during the latter part of said stroke, and means forming a restricted passage for throttling the fluid supply when said valve is closed.

7. A motor for operating a door or similar element comprising a fluid-pressure chamber having a motor septum, means for charging and discharging said chamber with motive fluid, and oppositely-seating check-valves controlling respectively the fluid-supply and fluid-discharge of said chamber and mechanically controlled by the traverse of the septum.

8. A motor for operating a door or similar element comprising a reciprocating motor-member having a chamber on one side, a pipe for supplying motive fluid to said chamber and discharging it therefrom, and means for restricting both the supply and discharge flows during the latter parts of the movements of said member, said means including a pair of alternately and oppositely seating check-valves operated by the motor member, together with restricted ducts for permitting fluid flow when the valves are seated.

9. A motor for operating a door or similar element comprising a reciprocating motor septum having a fluid-pressure chamber on one side, a passage controlling the supply of fluid to and its discharge from said chamber and having valve-seats at opposite ends, a pair of oppositely and alternately seating check-valves coöperating with the respective seats and actuated by the motor septum, springs for seating said valves, and restricted ducts by-passing the valves for permitting fluid flow around them when seated.

10. A motor for operating a door or similar element comprising a reciprocating motor septum having a fluid-pressure chamber on one side, a passage opening into said chamber and having valve-seats at opposite ends, a pair of oppositely-seating check-valves controlling the inlet and outlet flows through said passage respectively and held apart a distance greater than the distance between the valve-seats, a spring for seating the inlet-controlling valve, and an oppositely-acting spring interposed between the septum and the outlet-controlling valve for seating the latter during the completion of the discharge stroke of the septum.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses, the 9th day of November, 1907.

JAMES F. McELROY.

Witnesses:
BEULAH CARLE,
ERNEST D. JANSEN.