

July 31, 1928.

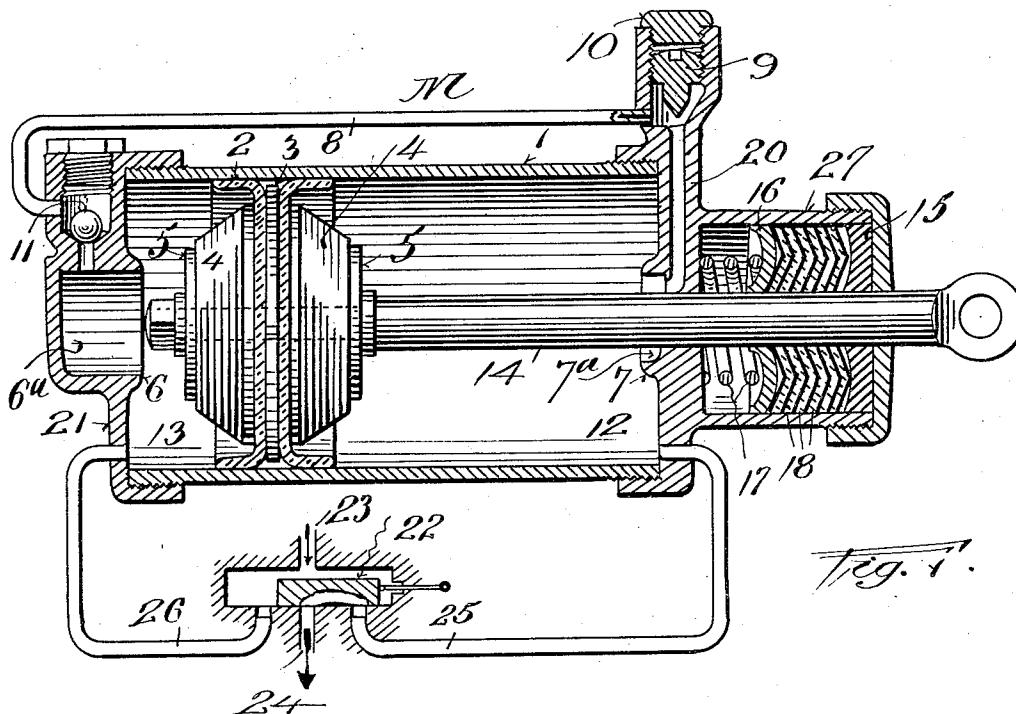
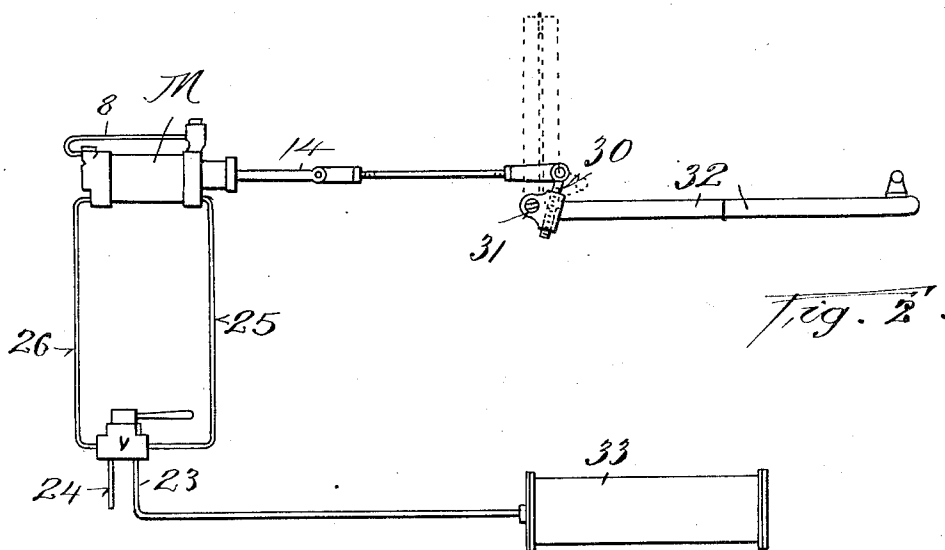
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PRESSURE ACTUATED MOTOR FOR OPERATING DOORS OR THE LIKE

Filed Sept. 29, 1923

2 Sheets-Sheet 1



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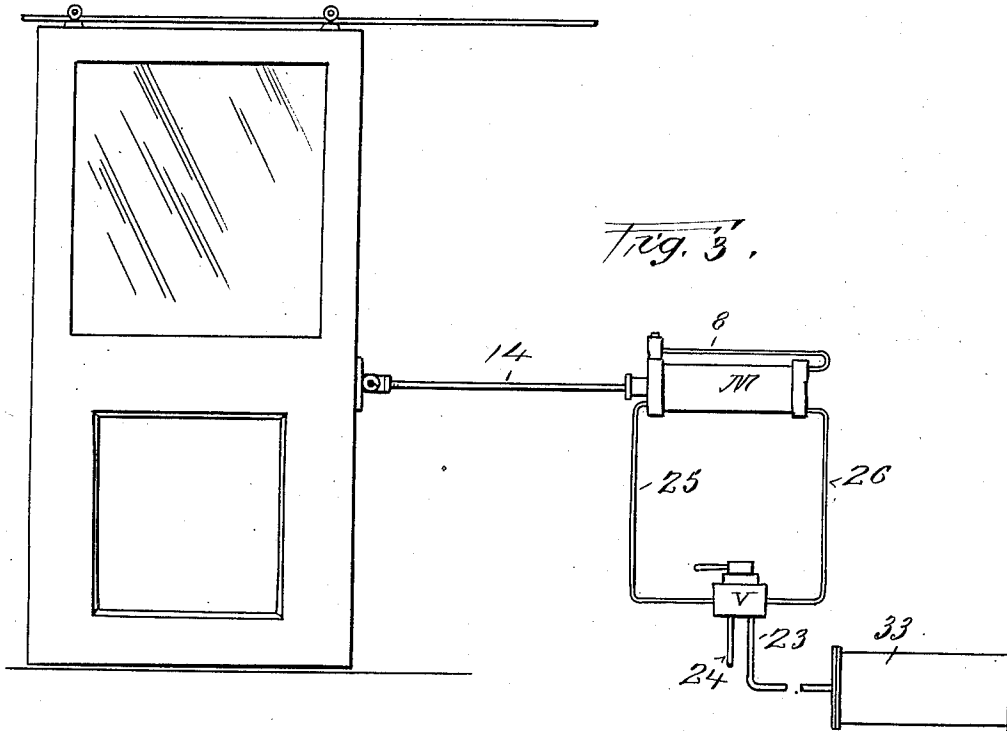
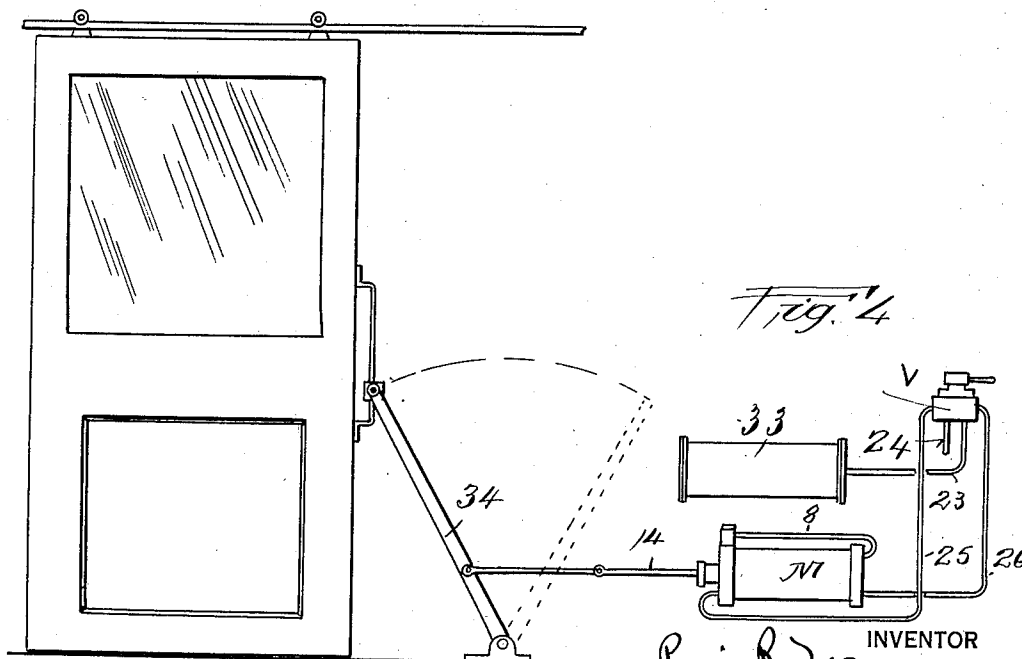
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PRESSURE ACTUATED MOTOR FOR OPERATING DOORS OR THE LIKE

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2 Sheets-Sheet 2



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UNITED STATES PATENT OFFICE.

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PRESSURE-ACTUATED MOTOR FOR OPERATING DOORS OR THE LIKE.

Application filed September 29, 1923. Serial No. 665,680.

This invention relates to pressure actuated motors for operating doors or the like.

The object of the invention is to provide a pressure actuated motor which is simple in structure, compact and light, and which is economical to construct, install and operate.

A further object of the invention is to provide a pressure actuated motor for operating doors or the like, where the travel of the door in one direction, such, for instance, as in the closing direction, is effected at a constant slow rate of speed instead of an initial quick closing movement, and then a slow cushioning movement, as the motor arrives at the end of its outstroke, or in the case of a door, at the end of the door closing movement, and where on its instroke of the engine the movement is effected at a steady uniform rate of speed which is higher than the outstroke of the engine.

A further object of the invention is to provide a motor of the type and character referred to, wherein the motor piston rod operates through a gland packing which is yieldable and is held yielding in applied erection.

A further object of the invention is to provide a motor of the nature and character referred to wherein the opposite ends of the cylinder are connected by a by-pass adapted to be freely open in the working stroke or outstroke of the motor, but closed in the reverse or instroke of the motor.

Further 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 drawings,

Fig. 1 is a view in central longitudinal section of a motor structure embodying the principles of my invention, showing the application of a conventional arrangement of control valve and the controllable by-pass which communicates between the opposite ends of the motor cylinder.

Fig. 2 is a view in diagram illustrating the application of a motor embodying the principles of my invention to the operation of a door of the folding type.

Fig. 3 is a view similar to Fig. 2 showing

the application of a motor embodying the principles of my invention, the piston of which is directly connected to a sliding door to operate the lever.

Fig. 4 is a similar view showing the application of the motor through intermediate connection to a sliding door.

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

It is a common practice to employ pressure actuated motors to operate doors wherein the motor is controlled in such manner that the initial closing movement of the door is effected at a relatively high rate of speed, and the final closing movement is effected at a reduced speed, to secure a cushioning action to prevent slamming of the door into its closed position. Such a structure of motor involves more or less complications of valve and pressure controlled devices and variable amounts of pressure which necessitate rugged and consequently comparatively heavy structures of cylinder and parts.

Moreover, in such motors employing piston rods which operate through stuffing boxes, difficulty has been encountered in providing a stuffing box which will secure the desired degree of efficiency in preventing leakage of the motor actuating pressure medium and which will not repeatedly wear, after a short period of use.

It is among the special purposes of my present invention to provide a pressure actuated motor which is exceedingly simple in structure, and can be manufactured economically, and the weight of which may be materially reduced, thereby reducing the cost of manufacture, and wherein instead of an initial working stroke, such, for instance as in the closing movement of a door to be operated thereby, the stroke of the motor is of constant speed throughout, but at a slower rate than the movement on the instroke or the opening movement of the door; and also wherein the instroke or opening movement of the door is effected at a constant uniform rate of speed, but a higher rate than the closing movement.

I also propose to employ a stuffing box structure for the motor piston rod in which the packing is resilient and is held in applied position under the yielding tension in the tightening direction. By such a structure I avoid the necessity of employing a

tightening nut such as has heretofore been employed, to squeeze the packing into applied relation to the piston rod, thereby avoiding the necessity for any care or attention such as is required to tighten up such a nut as has heretofore been employed when the packing wears in use, and also avoiding the danger which frequently occurs in practice of tightening up such a nut to a point where the piston rod is called upon to work through too high a resistance in the stuffing box. In fact, through carelessness of workmen and other help, the lock nut for the packing plant has frequently been tightened up to the point where the piston rod is locked by the compression thereon of the packing. I propose to avoid this rather serious source of trouble.

A motor embodying the principles of my invention is indicated generally by reference numeral M and is shown in detail, in Fig. 1, as including a cylinder, the opposite ends of which are closed by heads 20, 21, suitably applied to the open ends of the cylinder. Operating within the cylinder is a piston member 3 carried by a piston rod 14. The piston 3 is shown in this instance as a disk mounted upon or at one end of the piston rod 14. Also mounted upon the piston rod and disposed flatwise of the respective faces of the piston 3, are piston cups 2. These cups are held in position against the piston 3 by means of follower washers 4 which are clamped against the cups to hold them against the face of the piston in any suitable or convenient manner. Sealing disks 5, of leather or other suitable material are clamped against the outer faces of the follower washers 4. These disks 5 are arranged to seat against the ring faces 6 or 7 in the heads 21, 20 at the ends of the cylinders, which ring faces form boundary edges for the openings 6^a, 7^a, formed in the heads.

The purpose of this arrangement is that when the piston arrives at the limit of this stroke in one direction, a disk 5 will seat against the ring 6 and form a seal closing communication between the recess 6^a and the interior of the cylinder, and when the piston reaches the opposite limit of its stroke, the other ring 5 will seat against ring 7 forming a similar seal between the recess 7^a and the interior of the cylinder at its opposite end. The recesses 6^a and 7^a at the opposite ends of the cylinder are connected by a by pass 8. The end of this by pass connection which communicates with the recess 7^a in head 20 is fitted with an adjusting screw 9 whereby the area of the communication of the by pass may be adjustably controlled. If desired, or required, a screw cap 10 may serve as a plug to insure against the escape of any pressure medium which might escape past the screw plug 9.

The end of the by pass 8 which communicates with the recess 6^a in head 21 is controlled by a ball check valve 11 seating towards the cylinder.

With the structure above described, it will be seen that when pressure medium is applied to the end 12 of the cylinder, the pressure medium will not pass through the by pass 9 into the end 13 of the cylinder because of the seating of the check valve 11, but when the pressure medium is supplied to the end of the cylinder, 13, the check valve 11 is unseated and a portion of the pressure medium will escape to the end 12 of the cylinder through the by pass 8. When however the piston has travelled the limit of its stroke towards the end 12 of the cylinder, the disk 5 will seat against the ring 7 in the cylinder head 20, thereby sealing the end 12 of the cylinder from communication with the by pass 8 and the piston will be held in this limit of its stroke by the full pressure of the pressure medium applied to the end 13 of the cylinder. During the travel of the piston towards the end 12 of the cylinder, the full pressure of the pressure medium will not act upon the piston structure, since a portion of the pressure medium will escape past the piston through the by pass but there will be a preponderance of operating pressure on the piston due to the regulation and control of the by pass, thereby permitting the piston to move in its out stroke or working stroke, that is towards the right from the position shown in Fig. 1, at a steady slow constant speed of movement. When the piston arrives at the end of its stroke, the communication between the by pass and the end 12 of the cylinder is cut off by the seating of the disk 5 against the ring 7.

In the operation of the piston in the opposite direction, that is when pressure medium is admitted to the end 12 of the cylinder, the full pressure of the pressure medium is exerted on the piston to move out in its in stroke, that is towards the left as shown in Fig. 1, the by pass being cut off by the check valve 11. Consequently the piston will travel in its in stroke at a steady constant speed, but at a higher rate than the movement thereof in its out stroke. When the piston reaches the limit of its in stroke, a disk 5 will seat against the ring 6 thereby sealing the by pass from the end 12 of the cylinder. This prevents any escape of the pressure medium through the by pass to atmosphere when the piston is in its extreme in stroke position.

The supply of pressure medium to, and its exhaust from the opposite ends of the cylinder may be controlled in any suitable or convenient way. I have shown a simple arrangement wherein a slide valve 22 controls such supply and exhaust.

The pressure supply connection to the casing of the slide valve is indicated at 23 and the exhaust connection therefrom is indicated at 24. The pressure medium is supplied from the valve chamber to the end 12 of the cylinder through connection 25 and to the end 13 of the cylinder through connection 26. When the slide valve 22 is at one limit of its stroke, it opens the connection between the supply 23 and connection 26 to the end 13 of the cylinder and at the same time opens communication between connection 25 to the end 12 of the cylinder and the exhaust 24. When the slide valve is in the opposite limit of its stroke, pressure medium is applied to the end 12 of the cylinder while the end 13 is open to the exhaust. Any type of valve can be used, however, that will alternately put the two ends of the cylinder on pressure and exhaust.

The piston rod 14 passes through a stuffing box indicated at 27 within which are fitted a number of leather rings 18 which are centrally perforated to enable them to be sprung upon the piston rod. In cross section these packing rings are of angle shape or V shape, the angle portions thereof being vested the one within the other. A ring 15 is disposed within the stuffing box against which the outermost packing ring 18, or the apex of the angle portion thereof, contacts. If desired, the surface of the ring 15 against which the apex of the outer packing ring 18 contacts may be slightly concave, although this is not essential. Disposed at the inner face of the source of packing rings, is another ring 16 which is formed with a convex outer surface presenting towards the inner surface of the adjacent packing ring and engages the latter near its outer edge so that when the ring 16 is forced towards the assembled packing rings, the tendency is to force the packing rings against the piston rod, and the annular wall of the packing housing 27. The opposite or inner side of the ring 16, if desired, may be concaved, although this is not essential. A coil spring 17 is interposed between the head 20 of the cylinder and the inner face or surface of ring 16 and exerts a tension upon the packing at all times and in the direction of the tightening action of the packing rings 16.

Thus it will be seen that any escape of pressure medium into the interior of the packing box 27 from the cylinder augments the tension of the spring 17 and increases the tension upon the packing rings and the consequent tendency of the packing rings to straighten out into tightening direction. By reason of the packing being held constantly tight by a yielding pressure applied in the tightening direction, I not only avoid the necessity for employing adjusting nuts to keep the packing tightened with the attendant disadvantages above referred to,

but I provide a packing structure which is fool proof, is automatic and constantly maintained and automatically compensates for any wear, therefore requiring little, if any attention, when once installed.

I will refer to the stroke of the piston in the direction to cause the piston rod to be extended from the end of the cylinder, the working stroke or outstroke of the piston. When the motor is employed for operating, a door, for example, this stroke will effect the closing of the door. When the piston reaches the limit of its working stroke or outstroke, it is nearest the end of the cylinder where the stuffing box is located. While moving towards this limit of its travel, a regular amount of the pressure medium passes around the piston through the bypass and into the end 12 of the cylinder thereby being fed to the exhaust, and as above explained the effect of this is to prevent the piston from moving too fast in its out or working stroke or in the direction to close a door, for instance, giving a slow steady movement, in closing the door. When the piston travels in the opposite direction or at its instroke, the full effect of the pressure medium supplied to the end 12 of the cylinder is imposed on the piston thus causing a quick steady movement of the piston in that direction, thereby quickly opening the door.

In Fig. 2 I have shown the application of a motor embodying my invention to the operation of a door of the folding type, wherein the piston 4 of engine M is connected to a crank arm 30 on the pivot shaft 31 for the doorsection 32. In this case an ordinary control valve V is employed for controlling the supply of pressure medium from a convenient source, such as reservoir 33 to the opposite ends of the cylinder and the exhaust of the pressure medium from both ends of the cylinder in the manner above described.

In Fig. 3 I have shown the piston 14 of motor M connected directly to one of the vertical edges of the door. The supply of pressure medium to and from the motor being accomplished in any convenient way, a typical conventional arrangement of pressure supply and valve control being shown.

In Fig. 4 I have shown the piston rod 14 connected through a pivoted lever 34 having sliding connection with the rear vertical edge of the door. Of course the doors shown in Figs. 3 and 4 are of the sliding type.

Having now set forth the objects and nature of my invention, and a construction embodying the principles thereof, what I claim as new and useful, and of my own invention and desired to secure by Letters Patent of the United States is:

1. In a pressure actuated motor for operating doors, a cylinder, a piston operating

therein, and a piston rod for connection to the door to be operated and pressure supply and exhaust connections to piston ends of the cylinder, in combination with a by pass
5 connecting opposite ends of said cylinder, means for adjusting the area of communication between said by pass and one end of said cylinder, and a check valve controlling the communication between the by pass and
10 the other end of said cylinder said piston acting at each end of its stroke to cut off communication between the cylinder and the by-pass to prevent any exhaust of fluid pressure to the atmosphere.
15 2. In a pressure actuated motor for operating doors, a cylinder, a piston operating therein, and a piston rod for connection to the door to be operated and pressure supply and exhaust connections to piston ends
20 of the cylinder, in combination with a by pass connecting with opposite ends of said cylinder and means carried by the piston for sealing said communication at the limits

of its strokes, to prevent the further admission of or escape from the cylinder of fluid pressure.

3. In a pressure actuated motor for operating doors, a cylinder, a piston operating therein, and a piston rod for connection to the door to be operated and pressure supply
30 and exhaust connections to piston ends of the cylinder, in combination with a by pass connecting with opposite ends of said cylinder, and bearing rings surrounding the communications of the by pass with the respective
35 ends of said cylinder, and packing rings carried by the piston and seating against said rings to seal said communications, to prevent the further admission of or escape from the cylinder of fluid pressure.
40

In testimony whereof I have hereunto set my hand on this fourteenth day of September, A. D. 1923.

PARIS R. FORMAN.