July 17, 1934. C. H. CARDWELL ET AL 1,966,608

ENGINE FOR OPERATING VEHICLE OR OTHER DOORS BY COMPRESSED AIR

Filed Aug. 8, 1933

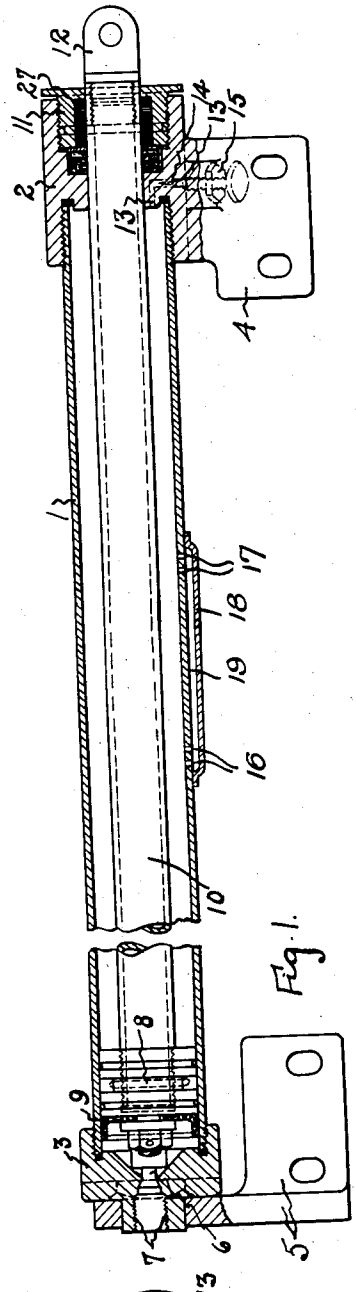

Fig. 1.

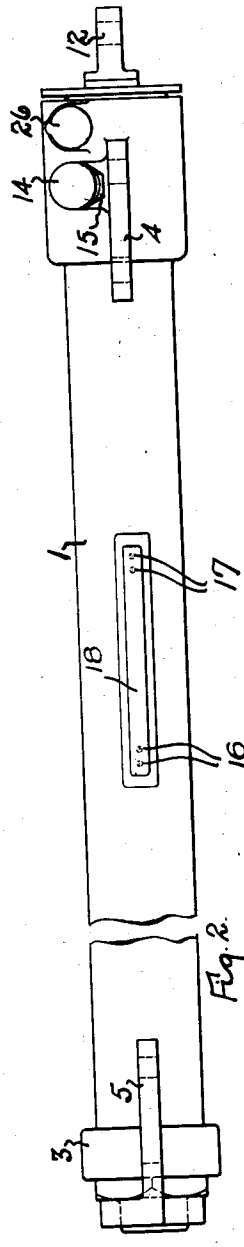

Fig. 2.

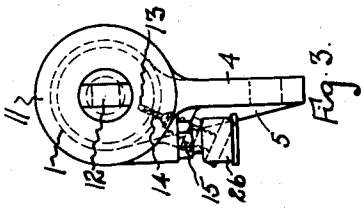

Fig. 3.

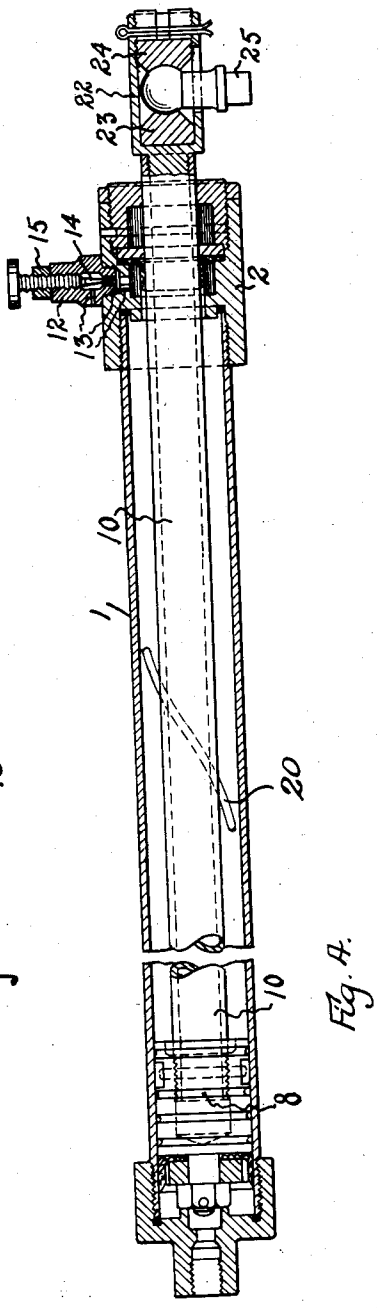

Fig. 4.

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Patented July 17, 1934 1,966,608

# UNITED STATES PATENT OFFICE

1,966,608

## ENGINE FOR OPERATING VEHICLE OR OTHER DOORS BY COMPRESSED AIR

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Application August 8, 1933, Serial No. 684,136
In Great Britain August 11, 1932

6 Claims. (Cl. 121—44)

This invention relates to single-acting compressed air or like fluid pressure engines and suitable for operating doors of railway and other vehicles which are moved in one direction by hand and the other direction by power. Whilst the engine according to the present invention is particularly adapted for use for closing by power the doors of railway and other vehicles which are opened by hand, it is to be understood that the engine may be used for other purposes.

Doors closed by power sometimes are obstructed in their closing movement, for example by the body of a person, and the obstruction removed whilst power is still being supplied to the door engine, and it is an object of the present invention to provide a single acting engine which shall be such that, should the movement of its piston be stopped, due to an obstruction preventing further movement of a door, and the obstruction be removed whilst power is supplied to the engine sudden and rapid movement of the piston under the full power of the compressed air, and the consequent slamming of the door, will be prevented. A further object is to provide a single acting engine in which the piston shall be cushioned at the end of its power stroke. Further an engine according to this invention is such that the full power is effective for starting the movement of the piston from its initial position and for moving the piston through the earlier or a predetermined portion of its stroke.

The invention consists essentially in a single-acting fluid pressure engine having means whereby a counter pressure will build up in the cylinder during an intermediate portion of the power stroke of the piston, and retard the movement of the piston, such counter pressure also cushioning the piston during the final portion of said stroke.

The engine according to the invention is such that should an obstruction to the part actuated by the engine cause the movement of the piston to be arrested at a position intermediate the limits of its stroke and the obstruction be removed whilst power is being supplied to the engine, the further or continued movement of the piston will be a steady and relatively slow movement so that, assuming the part operated by the engine to be a door, slamming of the door will be prevented.

The invention further consists in a single-acting fluid pressure engine, comprising, in combination, a cylinder closed at both ends, a piston therein, a piston rod extending from one side of said piston through the appropriate end cover of the cylinder, means for admitting pressure fluid to the cylinder at the end thereof remote from the said piston rod, a duct adapted after the piston has moved through a predetermined portion of its power stroke to place the spaces on opposite sides of the piston in communication and to maintain such communication until the piston approaches the end of its power stroke, and an exhaust passage from the cylinder space at that end of the cylinder through which the piston rod works, said exhaust passage having a cross sectional area less than that of the said duct, whereby after an initial travel under full power the speed of the piston will be reduced and said piston will be cushioned in the final portion of its movement.

The duct affording communication between opposite sides of the piston during the intermediate portion of its stroke may be provided externally of the cylinder or in the cylinder wall as may be desired, and the port for the exhaust of pressure fluid from that end of the cylinder through which the piston rod extends would be a relatively small or bleed port and be controlled by an adjustable needle valve.

In the accompanying drawing,—

Fig. 1 is a longitudinal section through an engine according to one embodiment of the invention.

Fig. 2 is an outside view or plan of the engine shown in Fig. 1.

Fig. 3 is an end view of the engine shown in Figs. 1 and 2 as seen from the left hand end of these figures, and

Fig. 4 is a longitudinal section through an engine according to another embodiment of the invention.

Referring firstly to Figs. 1, 2 and 3, the engine shown therein comprises a relatively long cylinder 1, having end caps or covers 2 and 3. Conveniently the cylinder is formed of an appropriate length of tube on to the ends of which the end caps or covers 2, 3 are screwed. The end covers 2 and 3 have lugs 4 and 5, by means of which the engine may be secured in place. The end cover 3 has a port 6 leading into the bore of the cylinder 1, the fluid pressure supply pipe (not shown) being connected to the end cover at the tapped hole or bore 7, so as to supply fluid to the engine through the port 6. 8 is the engine piston which is of any appropriate form and as shown is provided with a cup leather packing 9 at its side or end facing the fluid pressure supply port 6. From the opposite side of the piston 8 the piston rod 10 extends, this piston rod being of relatively large diameter and working through

an appropriate packing gland or stuffing box 11 in the end cap or cover 2 of the cylinder. At its extreme end the piston rod 10 is provided with an eye 12, or it might be with any other appropriate fitting for connection to the door or other part to be operated. An exhaust or bleed port 13 is provided in the end cover 2, this port being controlled by an adjustable screw down needle valve 14 adapted to be locked in its adjusted position by a locking nut 15. At appropriate distances from the opposite ends of the cylinder 1, ports 16 and 17 extend through the cylinder wall, and suitably secured to the outer periphery of the cylinder as by brazing or welding is a dished member 18, the space 19 between which and the cylinder wall is in constant communication through ports 16 and 17 with the bore of the cylinder 1.

An example of the appropriate distance of the ports 16 and 17 from the ends of the cylinder would be represented by so positioning these ports that after the engine has completed substantially one half of its stroke, the piston would be positioned so that the opposite ends of the cylinders would be interconnected through the by-pass. The length of this by-pass would be such that for given pressure conditions and speed of operation of the engine, a desired pressure would be built up in the right hand end of the engine (any one of Figures 1, 2 and 3) so that the final movement of the piston after the interconnection between the by-pass is broken would be cushioned so that the engine would operate at a slower speed to the end of its stroke. To put it another way, in the case of door operation by the engine, the by-pass would be positioned so that by the time the door reached a position where it might catch a person therein, a sufficient pressure would have built up in the cylinder end so that the door would complete its final stroke at a slower speed, making it possible for a person to extricate himself, or, if necessary, to push the door partly open for this purpose.

The operation of the engine illustrated in Figures 1, 2 and 3 is as follows:—

With the parts in the position shown the cylinder space at the right hand side of the piston 8 is open to exhaust through the port 13, controlled by the needle valve 14. On motive fluid being admitted to the left hand end of the cylinder through the port 6 the piston will be moved towards the right and on passing the ports 16 pressure fluid will flow through the ports 16, the space 19 and the ports 17 to the cylinder space at the right hand side of the moving piston 8. The ports 17 are of greater cross-sectional area than exhaust port 13, and consequently compressed air will be admitted to the cylinder space at the right hand side of the piston 8 more rapidly that it can escape from such space through the exhaust port 13. Thus a counter pressure will be set up in said cylinder space and will act on the right hand side of the piston 8. Owing to the relatively large diameter of the piston rod 10 the pressure area at the right hand side of the piston 8 is relatively small. The counter pressure referred to, whilst not being sufficient to prevent the piston 8 continuing its movement under the action of the motive fluid acting on its left hand side or larger area, as it builds up, retard or slow down the movement of the piston.

Assuming the engine to be employed for closing a door and the door to meet an obstruction in its closing movement, such for example, as a person being accidentally caught between the door and the door frame or between the two doors of a pair of sliding doors, the movement of the piston 8 would be arrested, and owing to the building up of the counter pressure on the right hand side of the piston it would be possible to open the door by hand against the action of the pressure, acting on the left hand or larger area of the piston, so as to release the person or remove the obstruction. On the removal of the obstruction to the closing of the door the piston 8 will continue its interrupted movement so as to close the door, but owing to the counter pressure acting on the right hand or smaller pressure area of the piston, the movement of the piston will not be sudden and rapid but will be steady and relatively slow. When the piston in its travel passes beyond the ports 17 further feed of pressure fluid from the cylinder space at the left hand side of the piston to the cylinder space at the right hand side of the piston will be prevented and the pressure fluid trapped between the piston and the end cover 2 of the cylinder will serve to cushion the piston at the end of its power stroke owing to the restriction of the exhaust port 13. When the supply of fluid pressure to the cylinder space at the left hand side of the piston 8 is shut off the return stroke of the piston will be made by the manual opening of the door or doors assuming the engine to be employed for closing a door or doors. It will be understood that when the supply of motive fluid to the cylinder is shut off the cylinder space at the left hand side of the piston 8 will be placed to exhaust.

Referring now to Fig. 4, the engine shown in this figure differs from that shown in Fig. 1, in that the duct which, during the intermediate portion of the stroke of the piston provides communication between the cylinder spaces at opposite sides of the piston, instead of being provided externally of the cylinder 1 is constituted by a groove or recess 20 formed or cut in the inner side of the cylinder wall, the groove extending in a helical direction in the cylinder wall. It will be understood that on the piston 8 passing the left hand end of the groove 20 motive fluid from the left hand side of the piston will enter the groove and flow therein past the piston and into the cylinder space at the right hand side of the piston, the operation being exactly the same as with the construction shown in Fig. 1. The end cap 2 of the cylinder 1 in Fig. 4 is equipped with a needle valve 14 controlling exhaust through the passage 13, the valve being locked in its adjusted position by a nut 15, as in Figures 1, 2 and 3. In Figure 4, the valve is mounted in a separate block or member 31 which is screwed into an aperture in the end cap 2. The piston rod 10 in Fig. 4 is shown terminating in a yoke member 22, between pressure blocks 23, 24 in which a ball-ended stud 20 is mounted, but it is to be understood that the particular formation of the free end of the piston rod and the manner of its connection to the part to be operated form no part of the present invention.

The gland or stuffing box in the end cap 2 through which the piston rod slides may comprise a portion to which lubricant is supplied by any appropriate means, such for example, as the grease cup or equivalent 26, Figs. 2 and 3, which supplies lubricant to a felt or other suitable pad or washer 27 in the said end cap 2.

The engine shown in Fig. 4 may be equipped

with piston rod lubricating means similar to that shown in Figs. 2 and 3 or with any other convenient lubricating means.

Some of the constructional details described herein may be varied without departing from the invention. For example, instead of the duct affording communication between the cylinder spaces at opposite sides of the piston, when the latter is in the intermediate portion of its stroke, being provided by the dished member 18, Figs. 1, 2 and 3, or the helical groove 20, Fig. 4, the duct or channel might be provided by a portion of pipe appropriately connected at its end to ports in the cylinder wall.

Having now particularly described and ascertained the nature of our said invention, and in what manner the same is to be performed, we declare that what we claim is:—

1. A single acting fluid pressure engine, comprising, in combination, a cylinder closed at both ends, a piston therein, a piston rod extending from one side of said piston, through the appropriate end cover of the cylinder, means for admitting pressure fluid to the cylinder at the end thereof remote from the said piston rod, a duct adapted after the piston has moved through a predetermined portion of its power stroke to place the space on opposite sides of the piston in communication and to maintain such communication until the piston approaches the end of its power stroke, and an exhaust passage from the cylinder space at that end of the cylinder through which the piston rod works, said exhaust passage having a cross sectional area less than that of the said duct, whereby after an initial travel under full power the speed of the piston will be reduced and said piston will be cushioned in the final portion of its movement.

2. A single acting fluid pressure engine comprising in combination, a cylinder closed at both ends, a piston therein, a piston rod extending from one side of said piston, through the appropriate end cover of the cylinder, means for admitting pressure fluid to the cylinder at the end thereof remote from the said piston rod, a duct adapted after the piston has moved through a predetermined portion of its power stroke to place the space on opposite sides of the piston in communication and to maintain such communication until the piston approaches the end of its power stroke, said duct being positioned externally of the cylinder, and an exhaust passage from the cylinder space at that end of the cylinder through which the piston rod works, said exhaust passage having a cross sectional area less than that of the said duct, whereby after an initial travel under full power the speed of the piston will be reduced and said piston will be cushioned in the final portion of its movement.

3. A single acting fluid pressure engine, comprising in combination a cylinder closed at both ends a piston therein, a piston rod extending from one side of said piston, through the appropriate end cover of the cylinder, means for admitting pressure fluid to the cylinder at the end thereof remote from the said piston rod, a duct adapted after the piston has moved through a predetermined portion of its power stroke to place the space on opposite sides of the piston in communication and to maintain such communication until the piston approaches the end of its power stroke, said duct being formed with a plate secured to the outer periphery of the cylinder, and ports being provided in the cylinder wall at appropriate distances from the opposite ends of the cylinder to place the space between said plate and the cylinder wall in communication with the bore of the cylinder, and an exhaust passage from the cylinder space at that end of the cylinder through which the piston rod works, said exhaust passage having a cross sectional area less than that of the said duct, whereby after an initial travel under full power the speed of the piston will be reduced and said piston will be cushioned in the final portion of its movement.

4. A single acting fluid pressure engine comprising in combination, a cylinder closed at both ends, a piston therein, a piston rod extending from one side of said piston, through the appropriate end cover of the cylinder, means for admitting pressure fluid to the cylinder at the end thereof remote from the said piston rod, a duct adapted after the piston has moved through a predetermined portion of its power stroke to place the space on opposite sides of the piston in communication and to maintain such communication until the piston approaches the end of its power stroke, said duct being a groove formed in the inner cylinder wall and extending through an appropriate portion of the length of the cylinder, and an exhaust passage from the cylinder space at that end of the cylinder through which the piston rod works, said passage having a cross sectional area less than that of the said duct, whereby after an initial travel under full power the speed of the piston will be reduced and said piston will be cushioned in the final portion of its movement.

5. A single acting fluid pressure engine comprising in combination, a cylinder closed at both ends, a piston therein, a piston rod extending from one side of said piston, through the appropriate end cover of the cylinder, means for admitting pressure fluid to the cylinder at the end thereof remote from the said piston rod, a duct adapted after the piston has moved through a predetermined portion of its power stroke to place the space on opposite sides of the piston in communication and to maintain such communication until the piston approaches the end of its power stroke, and an exhaust passage from the cylinder space at that end of the cylinder through which the piston rod works, said exhaust passage having a cross sectional area less than that of the said duct, whereby after an initial travel under full power the speed of the piston will be reduced and said piston will be cushioned in the final portion of its movement, said exhaust passage having an adjustable needle valve therein.

6. A single acting fluid pressure engine comprising in combination, a cylinder closed at both ends, a piston therein, a piston rod extending from one side of said piston, through the appropriate end cover of the cylinder, means for admitting fluid pressure to the cylinder at the end thereof, a duct adapted after the piston has moved through a predetermined portion of its power stroke for placing the space on opposite sides of the piston in communication and to maintain such communication until the piston approaches the end of its power stroke, and means forming an exhaust passage from the other end of the cylinder, said exhaust passage having a cross sectional area less than that of the said duct, whereby after an initial travel under full power the speed of the piston will be reduced and said piston will be cushioned in the final portion of its movement.

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