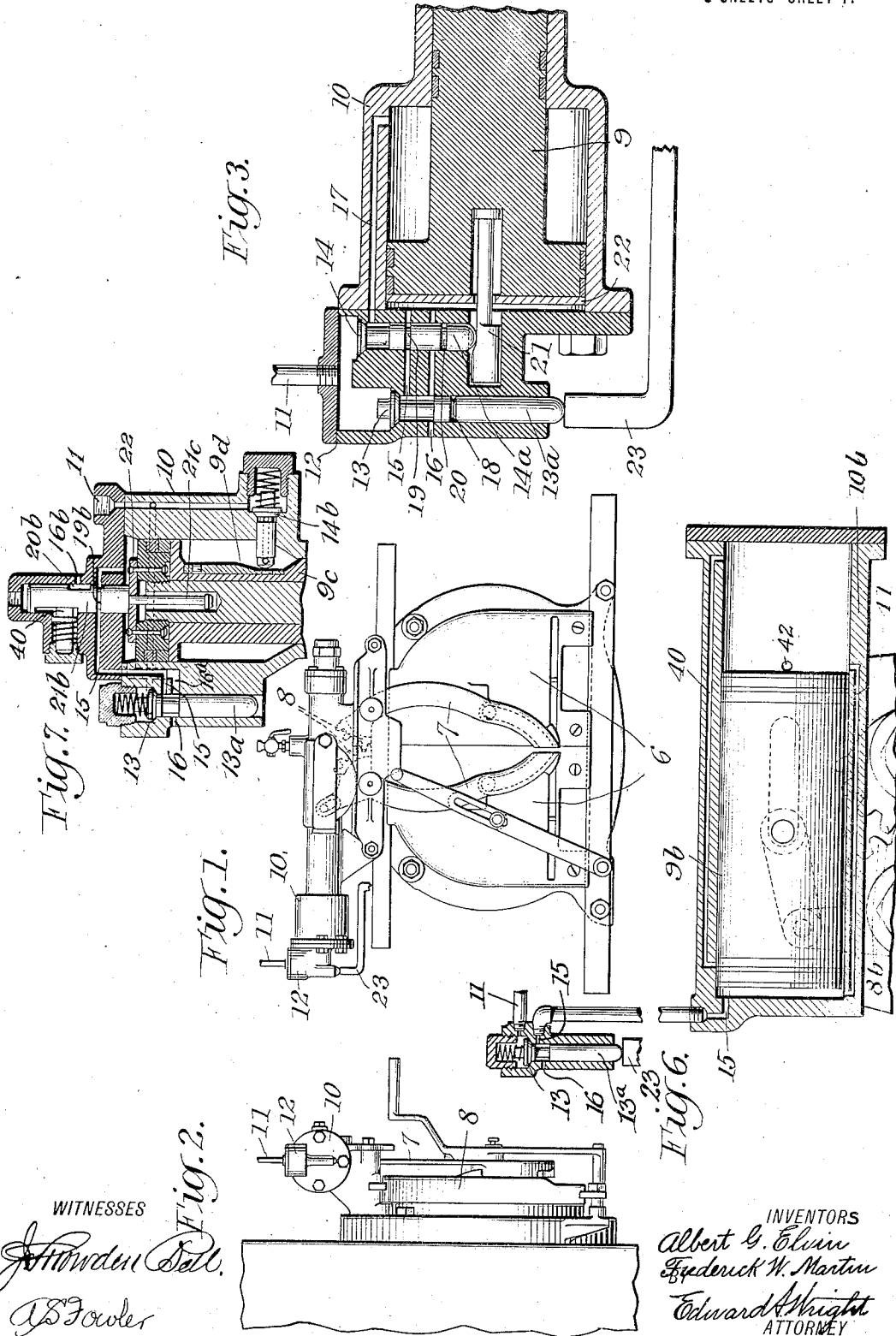


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 AUTOMATIC CLOSING DEVICE FOR FIRE DOORS.
 APPLICATION FILED OCT. 26, 1914.

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Patented Apr. 30, 1918.
 2 SHEETS—SHEET 1.



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AUTOMATIC CLOSING DEVICE FOR FIRE-DOORS.

1,264,166.

Specification of Letters Patent.

Patented Apr. 30, 1918.

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To all whom it may concern:

Be it known that we, ALBERT G. ELVIN and FREDERICK W. MARTIN, both citizens of the United States, and residents, respectively, of Somerville, in the county of Somerset and State of New Jersey, and of the borough of Manhattan, in the city, county, and State of New York, have invented a certain new and useful Improvement in Automatic Closing Devices for Fire-Doors, of which improvement the following is a specification.

This invention relates to fire door apparatus operated by fluid pressure and has for its principal object to provide means for automatically effecting a positive closing of the fire door within a predetermined interval after the same has been opened, and thereby prevent the fireman from holding the door open for a longer period.

In this fire door apparatus as used on locomotives, the fluid pressure motor for actuating the doors is usually controlled by a valve operated by a pedal device, and it has been the practice of some firemen to hold the foot upon the pedal with the door open a sufficiently long period of time to deliver several shovelfuls of fuel into the furnace. This practice is objectionable, as large drafts of cold air are admitted to the furnace at such times through the wide open door, which tends to cool the fire and chill the water heating surfaces. With our improvement this is positively prevented, as the door will be promptly closed after a predetermined time even though the fireman retains his foot on the pedal.

In the accompanying drawings: Figure 1 is a front elevation of one form of fire door apparatus embodying our improvement; Fig. 2, an end elevation of the same; Fig. 3, a vertical section of the motor; Fig. 4, a vertical section illustrating a modification; Figs. 5 and 6, similar views showing other modifications in which the doors close by gravity; and Fig. 7, a vertical section similar to Fig. 3, and showing a further modification.

According to the construction shown in Figs. 1, 2, and 3, our improvement is applied in connection with horizontally sliding doors, 6, operated by pivoted arms, 7, having intermeshing gears, 8, and one of said arms being connected to the piston, 9, movable in the horizontal cylinder, 10, of the motor. Fluid under pressure, such as compressed

air, is supplied from pipe, 11, to the valve casing, 12, containing valves, 13 and 14, supply port, 15, and exhaust port, 16. Port, 17, leads from valve, 14, to the opposite end of the cylinder. The arm, 23, adapted to be connected with a pedal device (not shown) operated by the foot of the fireman, engages the end of the stem, 13^a, of the valve, 13, for actuating the same. This stem, 13^a, also has a small groove, 18, adapted to register with the exhaust port, 16, in the open position of the valve. The stem, 14^a, of valve, 14, is provided with grooves, 19 and 20, and is operated by a rod, 21, having an inclined face at one end, and a head at the opposite end located in a recess in the piston, 9, and adapted to engage the plate, 22, on the piston head when near the outer end of its stroke.

When the arm, 23, is raised by the fireman for the purpose of opening the furnace door, the valve, 13, is opened to admit fluid through port, 15, and around groove, 19, in stem, 14^a, into the cylinder, thereby moving the piston, 9, through its outward traverse, and opening the door. In this position of the valve stem, 13^a, the small groove, 18, communicates with the exhaust port, 16, which is, however, closed by the stem, 14^a, thereby preventing escape of fluid. As the piston, 9, approaches the end of its traverse, the rod, 21, is actuated to raise the valve, 14, and stem, 14^a, to the position in which port, 17, is open to the supply, port, 15, is closed, and groove, 20, communicates with the port, 16. Fluid is thus admitted through port, 17, to the opposite end of the cylinder to return the piston to the closed position, but the capacity of the exhaust port, 16, is restricted by the small groove, 18, in stem, 13^a, whereby the fluid first admitted to the front end of the cylinder escapes very slowly, thereby retarding the closing movement of the piston. In this manner the piston will be automatically returned to its inner position, and the door closed in a predetermined time even though the fireman retains his foot on the pedal with the valve, 13, open. If he should at any time release the pedal and drop valve, 13, to its closed position, the exhaust port, 16, would be fully opened, and the piston and door would immediately be returned to the closed position. When the piston is returned to its inner position, the rod, 21 actuated to permit the stem, 14^a, to dr

close the valve, 14. This again closes the port, 17, and the exhaust port, 16, and opens the supply port, 15. There is no further movement, however, as the supply port remains closed by valve, 13, until the pedal arm, 23, is again operated. The period of time required for the automatic closing of the door depends upon the capacity of the restricted groove, 18, in valve stem, 13^a, and this may be readily fixed to suit different conditions.

As shown in Fig. 4, the improvement is applied in connection with a motor of the vertical type having a cylinder, 10^a, containing piston, 9^a, connected to the arms of a pair of doors, 6^a, pivoted to swing laterally and vertically. A valve, 24, operated by a plunger, 25, and spring, 26, is provided for controlling the admission port, 27, leading from a supply pipe, 11, into the cylinder. A port, 28, admits fluid from the cylinder into the plunger chamber when the piston is moved downward to the end of its stroke, and the piston is provided with a groove, 29, for establishing communication from the port, 28, to the exhaust port, 30, when in its upper or closed position.

When the fireman actuates the manual device for opening the door, fluid is admitted through pipe, 11, and port, 27, into the cylinder where it acts upon the upper face of the piston, 9^a, forcing the same downward and swinging the doors to the open position. When the piston reaches the lower end of its traverse, the port, 28, is uncovered, thereby admitting fluid into the chamber beneath the plunger, 25, which then moves the valve, 24, to close the port, 27. With the supply cut off, the fluid under pressure in the cylinder begins to leak away around the packing rings and through the small escape port, 30, if the same is open, so that the pressure continues to diminish gradually until it is overcome by the weight of the doors, whereupon said doors descend slowly by gravity and the piston rises in the cylinder. At the end of a predetermined period of time, the door is thus automatically closed and the piston returned to its upper position. When the piston reaches its upper position the pressure is released from the chamber beneath the plunger, 25, and the spring, 26, moves the plunger and valve, 24, downward and opens the supply port, 27. If the manual device is then still open, fluid will, of course, be again admitted to the cylinder and the operation will be repeated.

In the modification illustrated in Fig. 5, a horizontal cylinder, 10^b, is employed containing piston, 9^b, having a pin and link connection with one of the doors, 6^b, which are pivoted to swing laterally and vertically, and are provided with intermeshing segmental gears, 8^b. A valve, 13, similar

to that of Fig. 3, is provided for controlling the admission of fluid from the supply, 11, to port, 15, leading into the cylinder, the valve stem also controlling the exhaust port, 16, and being actuated by the arm, 23, of the pedal device. A port or pipe, 33, communicates with the cylinder through a restricted port, 38, and leads into an expansion chamber, 31, having a diaphragm, 32, for actuating the valve, 34, which controls admission of fluid from the supply pipe, 11, through the port, 36, to the opposite end of the cylinder. The port, 33, also communicates with the discharge port, 37, through groove, 39, of the valve stem, when the valve, 13, is in its closed position. A release port, 35, is also provided for the opposite end of the cylinder, and is open when the valve, 34, is closed.

When the valve, 13, is raised by the pedal device, ports, 16 and 37, are closed and fluid is admitted through port, 15, into the cylinder where it acts upon the piston, 9^b, moving the same to the opposite end of the cylinder and opening the doors. At the same time fluid begins feeding through the restricted port, 38, and passage, 33, into the expansion chamber, 31. If the pedal device be released at this time, the door will promptly close as the fluid is then instantly exhausted through ports, 16 and 37, and the doors will swing downward by gravity; but if the pedal is retained in its open position with the valve, 13, raised, the fluid pressure in the chamber, 31, acting on the diaphragm, 32, rises, in a short predetermined period of time, to a point sufficient to open the valve, 34, and close exhaust port, 35. Fluid is then admitted through port, 36, to the opposite end of the cylinder, and as the piston is thus balanced as to fluid pressure, the doors descend by gravity to closed position, thereby also returning the piston to its former position from which it will not again be moved until the valve, 13, is first closed and then reopened. Upon closing the valve, 13, the fluid is immediately released from the chamber, 31, through passage, 33, and exhaust port, 37. The valve, 34, then closes and the exhaust port, 35, opens so that the fluid is promptly released from both ends of the cylinder, and there will be no movement of the piston.

A simpler construction is shown in Fig. 6, wherein the valves, 14 and 34, are dispensed with, and the cylinder, 10^b, is provided with by-pass ports, 40 and 41, the former being normally closed by the piston, 9^b, but adapted to open after the piston makes a preliminary movement toward open position, and the latter port, 41, being closed by the piston in all positions except the normal closed position, as shown in Fig. 6, in which communication is established around the piston. The pedal device 23 and valve 130

13 for controlling the admission of fluid from pipe, 11, through port, 15, into the cylinder and the exhaust of the same therefrom, may be located at a distance from the cylinder, if desired. When the fluid under pressure is thus admitted into the cylinder, the piston, 9^b moves outward to operate the gears, 8^b, and open the doors. The port, 41, is sufficiently small to prevent the pressure accumulating at the rear of the piston as rapidly as the same is admitted through port, 15; this insures a prompt movement of the piston which closes the port, 41, and shortly thereafter opens the by-pass port, 40, leading to the extreme rear end of the cylinder. The port, 40, is also of small capacity and does not prevent the complete traverse of the piston to its open position, but it permits the fluid to pass slowly to the opposite side of the piston, thereby cushioning its movement, and then after a short interval allowing the pressures to equalize. The doors will then descend by gravity to the closed position, and return the piston to the other end of the cylinder in which position the port, 40, is closed while the by-pass, 41, is open around the piston to permit the prompt release of pressure from the rear end of the cylinder as soon as the pedal device is released and the fluid exhausted from the front end of the cylinder. The apparatus is then in condition for the next opening operation whenever the pedal is actuated for that purpose. If desired, an additional escape port, 42, may be provided leading from the rear of the piston to the atmosphere, but in such location as to be covered by the piston when it first starts to move outward. This insures the prompt release of the fluid in the rear of the piston, and may be employed either with or without the by-pass port, 41.

The construction shown in Fig. 7 is similar to that of Fig. 3, except that the intermediate valve, 21^b, is connected directly to the valve rod, 21^c, actuated by the striking plate, 22, on the piston, 9^c, while the valve, 14^b, for admitting fluid to the opposite side of the differential piston is operated directly by the piston through the engagement with the inclined surface, 9^d. The valve, 21^b, is provided with a groove, 19^b, for controlling the inlet port, 15, and a cavity, 20^b, for connecting the cylinder port to the restricted exhaust port, 16^b, to the atmosphere when the piston reaches the open position. To prevent the cylindrical valve, 21^b, from turning in its chamber, a spring actuated detent, 40, may be employed, engaging a groove in the valve. This also serves to hold the valve in position and prevent the same from falling into the cylinder when the piston moves downward and the shoulder of the valve is not supported by the plate, 22, of the piston.

When the valve, 13, is raised from its seat, the exhaust port, 16, 16^a, is closed and fluid from the supply, 11, flows through the inlet port, 15, around groove, 19^b, in valve, 21^b, and into the upper end of the cylinder where it acts upon the large face of differential piston, 9^c, to move the same downward and open the door or doors, as will be readily understood, there being any suitable form of connections, such as shown in Fig. 4, for instance, between the piston and said doors. As the piston moves downward, the inclined surface, 9^d, engages and opens the valve, 14^b, thereby admitting fluid from the source of supply to the opposite or smaller area of the piston. As the piston approaches the lower end of its stroke, with the doors fully open, the head of the valve rod is engaged by the plate, 22, of the piston, and the valve, 21^b, is moved downward to its lower position in which the inlet port, 15, is cut off and the cylinder is put into communication with the small escape port, 16^b, through the cavity, 20^b, in the valve. The fluid from the upper end of the cylinder then escapes slowly, and the pressure reduces sufficiently in a predetermined short period of time, so as to be overcome by the pressure upon the opposite or smaller face of the piston. The piston then moves upward and the doors close. As the piston reaches the upper end of its stroke, the plate, 22, engages the shoulder of the valve, 21^b, and returns the same to its upper position, in which the escape port is cut off and the groove, 19^b, again registers with the inlet port, 15. The valve, 14^b, will also be closed when the piston is in this position. If the admission valve, 13, is still held open, fluid will again pass into the upper end of the cylinder, and the operation will be repeated. When, however, the fireman operates the door device in the usual and proper manner by promptly releasing the pedal after the delivery of each shovelful of coal, the valve, 13, immediately drops to its seat, thereby cutting off the supply of fluid to the admission port, 15, while the stem, 13^a, opens the direct exhaust port, 16^a, whereupon the cylinder exhausts directly to the atmosphere and the door closes promptly.

In all of the modifications shown, the operation is such that after the opening of the door, the same begins to close, and will be closed automatically within a certain short interval of time, even though the fireman retains the pedal device open, thereby insuring single shovel firing, or the delivery of but one shovel of fuel into the furnace at each opening and closing of the door. With the construction shown in Figs. 5 and 6, after the door has been automatically closed, the same will remain closed until the pedal device is again operated, but in the other modifications the door will again

open and the operation will be repeated if the pedal device is held down.

Having now described our invention, what we claim as new and desire to secure by Letters Patent is:

1. In a fire door apparatus the combination of a door, a fluid pressure motor therefor, a valve for controlling the admission of fluid to said motor to open the door and for controlling the exhaust therefrom to close the door, a manual device for actuating said valve, and means operating automatically to provide for a return movement of the motor and a closing of the door at a predetermined time interval after the opening of the admission valve and while the manual device remains in its open position.
2. In a fire door apparatus, the combination of a door, a cylinder, a piston mechanically connected to the door, a manually operated valve device for controlling the admission of fluid to the cylinder to open the door and for controlling the exhaust from the cylinder to close the door, and means operating automatically to provide for a return movement of the piston and a closing of the door at a predetermined time interval after the opening of the manual valve and while the same remains open.
3. In a fire door apparatus, the combination of a door, a cylinder, a piston therein mechanically connected to the door, a manually operated valve device for controlling the admission of fluid to the cylinder at one side of the piston to open the door, and for controlling the exhaust from said cylinder to close the door, and means controlled by the movement of the piston for admitting fluid to the opposite side of said piston to provide for a return movement of the piston

and a closing of the door at a predetermined time interval after the opening of the manual valve and while the same remains open.

4. In a fire door apparatus, the combination of a door, a cylinder, a piston therein mechanically connected to the door, a manually operated valve device for controlling the admission of fluid to the cylinder at one side of the piston to open the door, and for controlling the exhaust from said cylinder to close the door, and a restricted by-pass port controlled by the movement of the piston for admitting fluid from one side of the piston to the other to provide for a return movement of the same and a closing of the door at a predetermined time interval after the opening of the manual valve.

5. In a fire door apparatus, the combination of a door, a cylinder, a piston therein mechanically connected to the door, a manually operated valve device for controlling the admission of fluid to the cylinder at one side of the piston to open the door, and for controlling the exhaust from said cylinder to close the door, a restricted by-pass port controlled by the movement of the piston for admitting fluid from one side of the piston to the other to provide for a return movement of the same and a closing of the door at a predetermined time interval after the opening of the manual valve, and an exhaust port also controlled by the piston for releasing fluid from the opposite end of the cylinder when the door is closed.

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