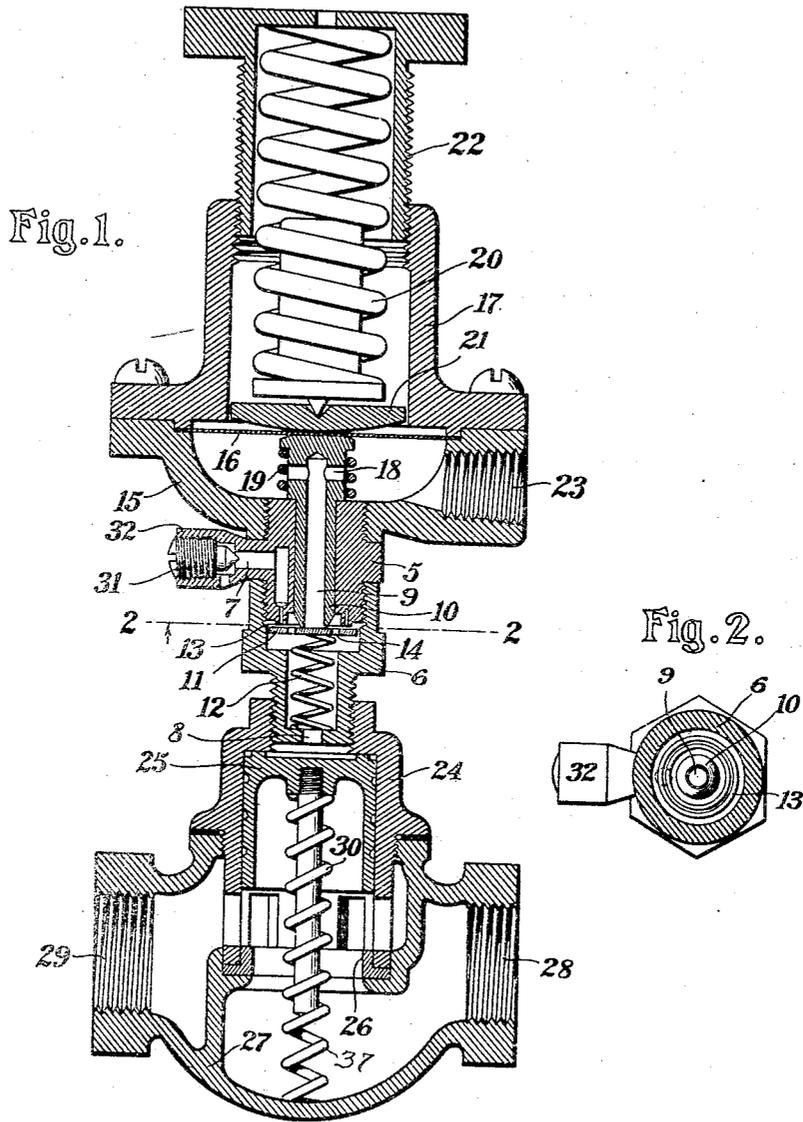


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 PNEUMATIC CONTROLLER.
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PNEUMATIC CONTROLLER.

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To all whom it may concern:

Be it known that I, JOHN L. OSBORNE, a citizen of the United States, and resident of Rochester, in the county of Monroe and State of New York, have invented certain new and useful Improvements in Pneumatic Controllers, of which the following is a specification.

This invention relates to means for controlling the operation of pneumatic motors such, for example, as those employed to actuate the relief-valves or unloader-valves of air-compressors.

In controllers for purposes such as that aforesaid it is common to employ valve-mechanism, controlled by air-pressure or otherwise, arranged to open and close a feed-passage through which compressed air or other motive-fluid is admitted to the motor, and the air so admitted is thereafter discharged from the motor through an exhaust-port or vent which is constantly open, this vent being restricted to a size sufficiently large to exhaust the air from the motor with the required rapidity, when the feed-passage is closed, but not large enough to prevent the operation of the motor when the feed-passage is open.

The use of a constantly open exhaust-port, as above described, involves a constant escape and waste of motive-fluid, and one object of the present invention is to avoid this loss. To this end I have devised a valve-mechanism which will always automatically close the exhaust-port before opening the feed-passage, and close the feed-passage before opening the exhaust-port, so that there is never direct communication between the feed-passage and the exhaust-port. In this mechanism I preferably employ only valves of the puppet type, in a form which permits them to be cheaply manufactured, and arranged in such a manner that they may be easily and accurately fitted to each other and that they tend always to seat themselves properly and avoid leakage when in use.

Another object of the invention is to so construct and arrange the valve-members of the controller that its operation is abrupt, and that there is a definite interval between the point at which the motor is thrown into operation, and the point at which it is thrown out of operation, and accordingly I so arrange the valve-mechanism that when

the feed-passage is open the pressure of the motive-fluid is operable against a surface on one of the valve-members in a direction to hold this member in open position, while the pressure is excluded from this surface when said valve-member is in the position in which the feed-passage is closed.

Other objects of the invention, and the features of construction and arrangement by which the several objects of the invention are attained, will be set forth in the following description of the preferred embodiment of the invention.

In the accompanying drawings: Figure 1 is a vertical median section of a pneumatic controller embodying the present invention, and a motor and motor-controlled valve associated therewith; and Fig. 2 is a horizontal sectional view, on the line 2—2 in Fig. 1, looking upwardly, of the valve-mechanism of the controller.

In the illustrated embodiment of the invention the valve-mechanism of the controller is inclosed within a casing comprising upper and lower members 5 and 6, threaded together as shown in Fig. 1. The casing is provided with an exhaust-port 7, through the member 5, discharging to atmosphere, and with an inlet-port constituting a part of the feed-passage to the motor, this inlet-port being in the form of a longitudinal perforation 9 in a valve-member 10.

The valve-mechanism comprises three distinct valve-members, of which the first is embodied in, or integral with the casing-member 5, the second is embodied in the member 10, and the third is embodied in a disk-like member 11, which coöperates with the other two valve-members and is pressed upwardly against them by means of a coiled spring 12. The first valve-member is fixed and is provided with an annular flat seat 13, which communicates, through an annular slot, with the exhaust-port 7. The second valve-member 10 is in the form of a stem arranged to fit closely but slide freely in the casing-member 5, and having an annular flat seat at its lower end. This seat is disposed similarly to the seat 13, that is to say, both of these seats are downwardly-disposed in the illustrated construction. The upper surface of the third valve-member is smooth and flat, so that it is adapted to make a sealing contact with each of the two valve-seats,

but between its middle portion and its periphery it is provided with openings 14 for the passage of air. The arrangement of the three valve-members is such that in the position of the parts shown in Fig. 1 the valve-member 11 is seated against the member 10, thus closing the passage 9, but is held away from the valve-seat 13, and at this time, therefore, the air is free to pass from the lower valve-casing member 6 through the valve-seat 13 to the exhaust-port 7. If the valve-member 9 be raised, however, the spring 12 will cause the member 11 to follow it until the member 11 engages the valve-seat 13, thus closing the exhaust-passage, while the passage 9 still remains closed. If the upward movement of the valve-member 9 be continued, however, this member is moved away from the valve-member 11, and a free passage is then provided between the passage 9 and the port 8, by way of the openings 14.

The valve-mechanism just described is shown as connected with diaphragm-mechanism by which it is actuated in accordance with variations in the pressure of the air which is admitted to the diaphragm-chamber and controlled by the valve-mechanism in its flow to the pneumatic motor. For this purpose the casing-member 5 is screwed into the lower part 15 of a diaphragm-casing, the diaphragm 16 being clamped between the part 15 and an upper casing-member 17. The passage 9 in the valve-member 10 communicates, by a transverse passage 18, with the chamber below the diaphragm, and the upper end of this valve-member engages the diaphragm so as to be controlled thereby. A spring 19, surrounding the upper part of the valve-member 10 maintains it in engagement with the diaphragm and causes it to follow the upward movement of the latter.

The diaphragm is normally held in depressed position by a counterbalancing spring 20 in the upper part of the diaphragm-casing, this spring cooperating with the diaphragm through a suitable follower 21, and being adjustable, in the usual manner, by means of a hollow screw 22. The spring 20 normally holds the valve-member 10 in its lowermost position, against the opposition of the springs 19 and 12, but the diaphragm-chamber may be connected, through an inlet-opening 23, with a source of supply of compressed air such, for example, as the receiver of an air-compressor.

While the controller above described may be employed in connection with pneumatic motors for various purposes, I have illustrated it as employed in connection with the motor which controls the unloader-valve of an air-compressor. For this purpose the lower end of the casing-member 6 is screwed into the upper end of a cylinder 24, in which

a piston 25 is fitted, this cylinder and piston constituting a pneumatic-motor. The piston constitutes also the movable member of the unloader-valve, since it cooperates with a valve-seat 26, which is clamped between the lower end of the cylinder and a horizontal partition within a valve-body 27. This valve-body has inlet- and outlet-openings 28 and 29, respectively, and for use as an unloader-valve the outlet-opening 29 is connected with the intake-opening of the air-pump of the compressor. The specific form of unloader-valve shown and described has certain novel characteristics which are not claimed herein, as they may form the subject-matter of a separate application.

When the controller admits compressed air to the cylinder 24 the piston 25 is forced downwardly, against the opposition of a spring 37 within the valve-body, thus seating the lower end of the piston and closing the passage through the valve-body. When the air is exhausted from the motor by the operation of the controller the piston is raised by the spring 30, thus opening the unloader-valve.

Since there is no constant escape of air through the exhaust-port 7, it is not essential that this port be limited in size. However, it may be desirable in some cases to exhaust the air gradually from the motor, to prevent too sudden a return-movement of the piston, and accordingly I have shown the exhaust-port as controlled by an adjustable valve 31, threaded into the projection 32 from the casing-member 5 through which the exhaust-port extends.

The operation of the mechanism as a whole is as follows: When the compressor is in operation the air-pressure beneath the diaphragm 16 gradually rises, as the pressure in the receiver rises, until it has reached the predetermined maximum pressure. The spring 20 is so adjusted that when this pressure is reached the diaphragm is raised, thus permitting the spring 19 to raise the valve-member 10 until the valve-member 11 engages the valve-seat 13 and closes the exhaust-port. This seating of the valve 11 relieves the valve-member 10 of the pressure of the spring 12, so that a very slight further increment of the pressure is necessary to cause the member 10 to move further. Upon this slight increment, however, the upward movement of the valve-member 10 is continued, thus disengaging it from the valve-member 11 and admitting compressed air, through the passages 18 and 9, the openings 14, the lower part of the valve-casing 6, and the port 8, to the pneumatic motor, and causing the unloader-valve to be closed. Upon the admission of compressed air in this manner to the space beneath the valve-member 10, the pressure of this air becomes effective against the lower end of this valve-

member, so as further to balance the pressure of the spring 20 upon the diaphragm. Accordingly, the pressure at which the diaphragm will again be depressed, so as to move the valve-member 10 to its normal position, will be somewhat less than that by which the diaphragm was originally raised. From this it results that there is a distinct interval between the points of opening and closing of the feed-passage to the pneumatic motor, and this arrangement has the further advantage that it renders the operation abrupt and positive, thus eliminating the possibility of partial or gradual opening or closing of the feed-passage and exhaust-port. When the pressure in the diaphragm-chamber has fallen sufficiently, however, the valve-member 10 is depressed until it is again seated against the valve-member 11, thus interrupting the admission of compressed air to the pneumatic motor, and then, upon the further downward movement of the valve-member 10, the valve-member 11 is carried with it, thus opening the exhaust-port and exhausting the air from the pneumatic motor, whereupon the unloader-valve is again opened.

It will be understood that the novel valve-mechanism hereinbefore described as an element of the pneumatic controller may be controlled by means other than the diaphragm-mechanism shown, and that it may be embodied in various other forms within the nature of the invention as it is defined in the following claims.

I claim:—

1. In a pneumatic controller, the combination of a valve-member provided with a valve-seat, a second valve-member movable relatively to the first and also having a valve-seat, a third valve-member movable relatively to the first and second and adapted to cooperate with both of said valve-seats, means tending to hold the third valve-member in engagement with said seats, and means for moving the second valve-member relatively to the first, whereby it is engaged with and disengaged from the third valve-member, and also caused to move the latter out of engagement with the first valve-member.

2. In a pneumatic controller, the combination of two concentric and relatively movable valve-members provided with similarly-disposed valve-seats, a third valve-member movable relatively to the first two and adapted to cooperate with both of said seats, means tending to force the third valve-member into engagement with the seats of the first two valve-members, and means for moving the inner one of the first two valve-members relatively to the others in a direction to cause it to engage and disengage the third valve-member, and to move the latter out of engagement with

the seat on the outer one of the first two valve-members.

3. In a pneumatic controller, the combination, with a pneumatic motor, of a valve-casing communicating with said motor and provided with a feed-passage for conducting compressed motive-fluid to the motor, and an exhaust-port for discharging motive-fluid therefrom; means actuated by variations in the pressure of the motive-fluid; and valve-members cooperating with and controlled by said means, and controlling said feed-passage and exhaust-port, said means being adapted, upon the attainment of a predetermined pressure in the motive-fluid, to first close the exhaust-port, and then open the feed-passage, and upon a drop in the pressure of the motive-fluid to a predetermined point, to first close the feed-passage and then open the exhaust-port.

4. In a pneumatic controller, the combination of a fixed valve-member having an annular valve-seat and an exhaust-port terminating thereat, and having also a bore concentric with the valve-seat; a second valve-member in the form of a plunger movable in said bore, the second valve-member having a valve-seat at the end adjacent the first-mentioned valve-seat, and a longitudinal passage terminating at said seat; a third valve-member having surfaces adapted to engage both of said valve-seats and having intermediate openings for the passage of fluid; resilient means tending to force the third valve-member into engagement with the valve-seats upon the other two valve-members; and means for actuating the second valve-member to cause it to move into and out of engagement with the third valve-member, and to cause the latter to be moved into and out of engagement with the valve-seat on the first valve-member.

5. In a pneumatic controller, the combination of a fixed valve-member having an annular valve-seat and an exhaust-port terminating thereat, and having also a bore concentric with the valve-seat; a second valve-member in the form of a plunger movable in said bore, the second valve-member having a valve-seat at the end adjacent the first-mentioned valve-seat, a pressure-sustaining surface, of substantial area surrounding its said valve-seat, and a longitudinal passage terminating at said seat; a third valve-member having surfaces adapted to engage both of said valve-seats and having intermediate openings for the passage of fluid; resilient means tending to force the third valve-member into engagement with the valve-seats upon the other two valve-members; and means for actuating the second valve-member to cause it to move into and out of engagement with the third valve-member, and to cause the latter to be moved into and out of engagement

with the valve-seat on the first valve-member.

6. In a pneumatic controller, the combination of a fixed valve-member having an annular valve-seat and an exhaust-port terminating thereat in an annular slot dividing the seat into inner and outer portions, and having also a bore concentric with the valve-seat; a second valve-member in the form of a plunger movable in said bore, the second valve-member having a valve-seat at the end adjacent the first-mentioned valve-seat, and a longitudinal passage terminating at said seat; a third valve-member in the form of a plate having surfaces

adapted to engage both of said valve-seats and having intermediate openings for the passage of fluid; resilient means tending to force the third valve-member into engagement with the valve-seats upon the other two valve-members; and means for actuating the second valve-member to cause it to move into and out of engagement with the third valve-member, and to cause the latter to be moved into and out of engagement with the valve-seat on the first valve-member.

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