

J. L. OSBORNE.
PNEUMATIC CONTROLLER.
APPLICATION FILED MAY 21, 1917.

1,293,178.

Patented Feb. 4, 1919.

Fig. 1.

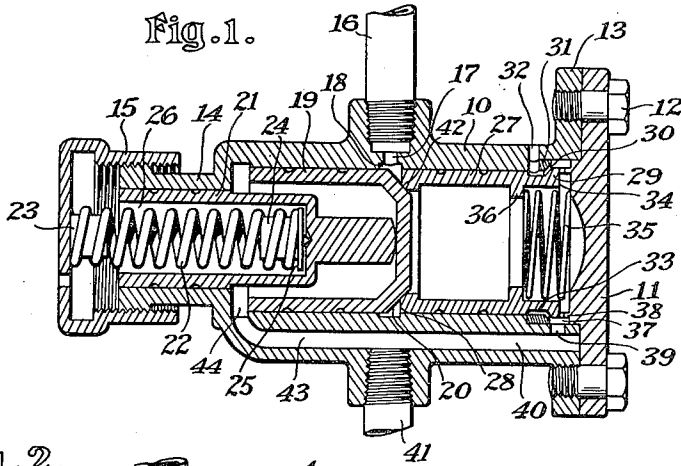


Fig. 2.

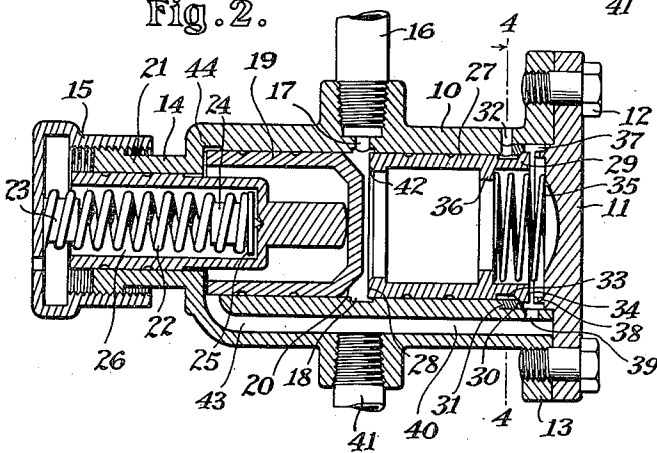


Fig. 4.

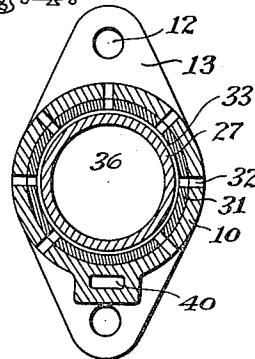


Fig. 3.

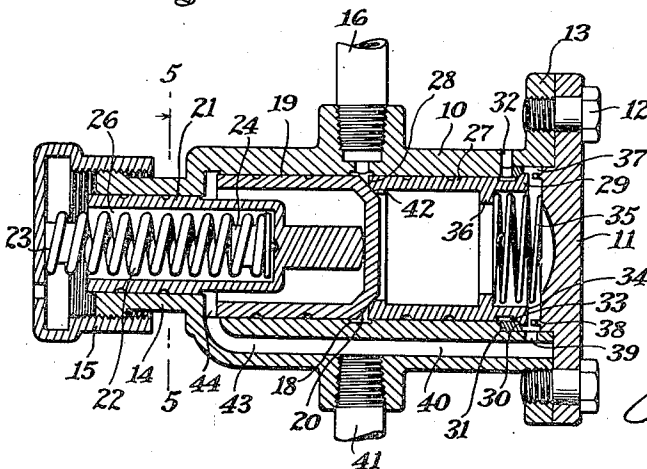
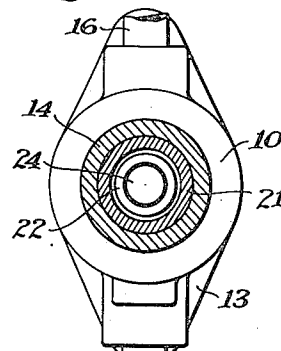


Fig. 5.



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UNITED STATES PATENT OFFICE.

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PNEUMATIC CONTROLLER.

1,293,178.

Specification of Letters Patent.

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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.

The present invention relates to means for controlling the operation of pneumatic devices such, for example, as relief-devices or unloader valves of air compressors. Such devices operate to open a port or valve at some predetermined receiver pressure, allowing the air under pressure to pass from the receiver to the unloader in order to stop compression, after which, as there is no air being delivered to the receiver by the compressor, the pressure will decrease either fast or slow according to the demand, and when the pressure has decreased to a point where it is desired to reload the compressor and resume compression, the pressure closes the valve or port from the receiver and opens another port or valve to the atmosphere, exhausting the air in the unloader and reloading the machine.

In unloader or relief devices of air compressors it is desirable, prior to the time the predetermined receiver pressure is reached, that the motor of the unloader or relief device be subjected only to atmospheric pressure, and when the predetermined receiver pressure is attained, that the full receiver pressure be exerted on the motor of the unloader or relief device to insure its complete and positive operation. It is also desirable, when the receiver pressure has decreased to some certain amount below the predetermined receiver pressure, that the motor of the unloader or relief device be abruptly relieved of the receiver pressure and again be subjected only to the atmospheric pressure that the motor may positively and completely return to the position such motor was in prior to the time the predetermined pressure was attained.

An object of this invention is to provide a controller or pilot valve, the name by which it is most commonly known, to bring about these desirable results in the operation of

the unloader valves or relief devices of air compressors and like devices, and also to provide a construction which may be easily and quickly taken apart for repair or cleaning without disturbing the pipe connections leading into or from the controller.

To these and other ends, the invention consists of certain parts and combinations of parts all of which will be hereinafter described, the novel features being pointed out in the appended claims.

In the drawings:—

Figures 1, 2 and 3 show axial, sectional views through the valve, Fig. 1 showing the valve closed or in the position which it occupies when the pressure in the receiver is below the predetermined amount, Fig. 2 illustrating the position which the valve occupies when the valve is open to connect the receiver to the motor of the relief valve or unloader, and Fig. 3 illustrating the position of the valve during the first part of the closing movement of the inlet valve, and before the opening of the exhaust;

Fig. 4 is a section on the line 4—4, Fig. 2; and

Fig. 5 is a section on the line 5—5, Fig. 3.

In the illustrated embodiment of the invention, there is provided a valve casing 10, having a main cylindrical bore opening at one end of the casing, said open end being closed by an end or cover plate 11 secured in position by bolts 12 which engage with a flange 13 on the casing 10. The opposite end of the casing 10 is provided with a reduced portion 14 having a cylindrical bore of less diameter than that of the main portion 10 of the casing, the reduced portion being externally threaded and engaged by internal threads on a cap 15. An inlet pipe 16 connects with a source of supply such as a receiver, and leads, by way of a port 17, to an annular chamber 18, which is formed in the interior wall of the casing 10.

Within the casing 10, and to one side of the annular chamber 18, operates a piston or valve 19, which shall be known hereinafter as an inlet valve. This valve is preferably of cup formation and fits slidably the interior wall of said casing 10 with its closed end tapered or beveled at 20, and lying,

when the valve is in a closed position, opposite the annular chamber 18, so that the higher or inlet pressure may be communicated to this cone-shaped or pressure-receiving face 20 in order to shift the valve 19 away from its seat and toward the reduced end 14 of the casing 10.

Also operating within the cylinder 10 is a valve 27, to be known hereinafter as the exhaust valve and preferably in the form of an open-ended piston or member, slidably fitted in the cylinder 10, with the end adjacent the annular chamber 18 forming a pressure face 28. Also formed on this end of the exhaust valve is a seat 42 with which the tapered pressure face 20 of the inlet valve coöperates to close the interior of the exhaust valve to the chamber 18. The other end of the exhaust valve is provided with an exterior annular enlargement 29 beveled to coöperate with a beveled valve seat 30, formed on a ring 31 tightly fitted within the enlarged end of the casing 10 adjacent the wall 11 to close the interior of the piston 27 to the atmosphere. The casing 10 and the ring 31 are provided at intervals with exhaust openings 32, while the exhaust valve 27 has an annular groove 33 in proximity to the enlargement 30. When the annular enlargement on the exhaust valve 27 is moved away from the valve seat 30, the interior of the exhaust valve 27 communicates with the atmosphere by way of the ports 32 and the annular grooves 33, but, when the annular enlargement 29 engages the seat 30, a communication to the ports 32 is closed. The extreme or outer end 34 of the exhaust valve 27 acts as a pressure face which has a greater area than the pressure receiving face 28 for a purpose to be hereinafter set forth. A spring 35 abuts, at one end, the wall 11, while its other end engages a shoulder 36 within the exhaust valve 27. This spring tends to move the enlargement 29 on the exhaust valve toward the ports 32, under certain conditions which will be hereinafter set forth. At the end of the casing 10 there is provided an annular chamber 37, and the head 11 has spacing means 38 thereon which holds the exhaust valve 27 in a position where it cannot close this chamber 37 to the interior of the exhaust valve 27. The chamber 37, by way of a port 39, connects with the passageway 40 leading to the outlet 41 which connects with the relief device, unloader valve, or other device.

A counterpressure means acts on the inlet valve 19 to move the latter to closed position, said means preferably comprising a spring 22, which, in this instance, is of helical formation, having one end surrounding a centering projection 23 arranged on the inside of the cap 15, and forming an adjustable abutment for one end of the spring.

The other end of the spring surrounds a loosely mounted centering device 24, and abuts the shoulder 25 on said device, the device being arranged within a hollow portion 26 on the plunger 21.

The hollow portion 26 on the plunger 21 is a piston which is slidably fitted in engagement with the reduced portion 14 of the casing 10 to relieve the inlet valve 19 of the force of the counterpressure means under certain conditions hereinafter set forth. This piston will be known hereinafter as the auxiliary motor.

A by-pass 43 is provided in the casing 1 between the interior of the exhaust valve 27 and the cup face of the inlet valve 19, this by-pass 43, in this instance, forming a continuation of the passageway 40. An annular chamber 44 may be provided at the junction of the casing 10 with the reduced portion 14, and into this chamber 44 the by-pass 43 leads. This arrangement permits the pressure on the opposite faces of the inlet valve 19 to be equalized at certain times for a purpose which will hereafter appear. Also by this arrangement fluid pressure may be communicated to the exposed faces of the piston or auxiliary motor, and in this way the action of the counterpressure spring 22 on the inlet valve 19 and the exhaust valve 27 may be relieved, under certain conditions, as will be hereinafter set forth.

Operation.

When the predetermined pressure, acting on the exposed area 20 of the inlet valve 19, is attained, the force of the counterpressure means 22 is overcome and the inlet valve 19 is moved slightly away from its seat 42 on the exhaust valve 27 allowing the pressure to increase in the chamber formed by the hollow exhaust valve 27. This pressure acting on that face or area of the inlet valve 19, not exposed to the pressure before the slight opening of the inlet valve 19, causes an abrupt opening or "pop" effect on the inlet valve 19. Instantly the pressure in the chamber, formed by the hollow exhaust valve 27, becomes equal to the predetermined pressure so that the pressure is equal on both ends of the exhaust valve 27 thus permitting the spring 35 to move the beveled annular enlargement 29 into engagement with the corresponding seat on the ring 31 to close the exhaust opening or port to the atmosphere. Simultaneous with the movement of the exhaust valve 27 toward the seat on the ring 31, the enlarged annular portion 29 of the exhaust valve 27 is moved from its seat on the projection 38 on the cap 11, thus exposing the area of the enlarged part to the predetermined pressure, and as this area is greater than the area 28, the pressure tends to move and to hold the ex-

haust valve 27 to the seat or ring 31. The different parts are then in the positions shown in Fig. 2. In these positions, the fluid under pressure will flow through the exhaust valve 27, the annular slot between the enlarged end 29 and the projection on the cap 11, the opening 39, the passageway 40, and the connection 41, to the motor of the relief device or unloader, to the chamber 44 formed by the hollow or cup-shaped inlet valve 19, and, acting upon the auxiliary motor 26, the exposed area of which is somewhat greater than the area 20 of the inlet valve 19 before opening, relieves the inlet valve 19 of the force exerted by the counterpressure means 22. The reason for relieving the inlet valve 19 and the exhaust valve 27 from the force exerted by the counterpressure means 22 will be apparent when we consider that the pressure is now equal on both ends of the inlet valve 19, and this would permit the counterpressure means 22 to close the inlet valve 19, if the auxiliary motor were not provided to prevent this from occurring. The advantage of this construction is that a very decided pop-valve effect is provided upon the opening of the inlet valve 19, and yet the different members have been brought back to a nearly balanced condition for the reverse action or the closing of the inlet valve 19 and the opening of the exhaust valve 27.

It is to be understood that the inlet valve 19 opens at some predetermined pressure, and closes and opens the exhaust valve 27 with a fixed decrease below the predetermined pressure at which the inlet valve 19 is opened. With some certain decrease commensurate with the area of the auxiliary motor 26 and the counterpressure means 22, the inlet valve 19 is moved into the position shown in Fig. 3 where it is in engagement with the seat 42 on the exhaust valve 27 and closes the opening into the chamber formed by the hollow exhaust valve 27, and at the same time moves the annular enlargement 29 of the exhaust valve 27 slightly away from the seat 30 on the ring 31, thus effecting a slight opening to the atmosphere which causes a decrease in the pressure beyond the inlet valve 19, allowing the higher pressure in the annular groove 18 and the receiver to act on the area 28 of the exhaust valve 27 thereby abruptly moving the exhaust valve 27 and the annular enlargement 29 away from the seat 30 on the ring 31, thereby establishing an opening to the atmosphere by means of the exhaust openings 32. This permits the pressure in the motor of the relief device or unloader to pass to the atmosphere through the connection 41, passageway 40, opening 38, and the annular groove 37, and also to exhaust the pressure from the chamber formed by the

hollow inlet valve 19, thus relieving the auxiliary motor of its actuating force and permitting the full force of the counterpressure means to be exerted on the inlet valve 19. This holds the latter in engagement with the seat 42 on the exhaust valve 27 during the opening movement of the exhaust valve, and the escape of air from the chamber formed by the exhaust valve 27 by means of minute slots on the face of the projection 38 of the cap 11.

What I claim as my invention and desire to secure by Letters Patent is:—

1. A pneumatic controller comprising a casing having an inlet, an outlet, and an exhaust, an exhaust valve having a passage therethrough to establish communication between the inlet and the outlet, and an inlet valve arranged to close said passage.

2. A pneumatic controller comprising a casing having an inlet, an outlet, and an exhaust, an open-ended exhaust valve forming a communication between the inlet and the outlet, and an inlet valve arranged to close said communication and to move the exhaust valve to open the exhaust.

3. A pneumatic controller comprising a casing having an inlet, an outlet, and an exhaust, an exhaust valve for the exhaust, a spring acting to close said exhaust valve, an inlet valve having a pressure face exposed to the inlet pressure so that the valve may be opened by pressure thereon, and counterpressure means for moving said inlet valve to closed position and for opening the exhaust.

4. A pneumatic controller comprising a casing having an inlet, an outlet, and an exhaust, an exhaust valve for closing the exhaust having a passage therethrough forming a communication between the inlet and the outlet, and an inlet valve arranged to close said communication, the exhaust valve having two faces, one exposed to the inlet pressure and the other exposed to the outlet pressure, and a spring acting on said exhaust valve to close the exhaust, said spring being opposed to the pressure acting on the face exposed to the inlet pressure.

5. A pneumatic controller comprising a casing having an inlet, an outlet, and an exhaust, an exhaust valve for the exhaust having a passageway forming a communication between the inlet and the outlet and also having two faces, one exposed to the inlet pressure and the other one exposed to the outlet pressure, the latter having a larger area than the former, a spring acting in opposition to the pressure on the face exposed to the inlet pressure, an inlet valve arranged to close said passageway, and means acting on the inlet valve to move the latter toward the exhaust valve to close the passageway.

6. A pneumatic controller comprising a casing having an inlet, an outlet, and an exhaust, an exhaust valve for the exhaust having a passageway forming a communication
5 between the inlet and the outlet and also having two faces, one exposed to the inlet pressure and the other one exposed to the outlet pressure, a spring acting in opposition to the pressure on the face exposed to the inlet pressure to close the valve, an inlet
10 valve arranged to close said passageway, and counterpressure means acting on the inlet valve to move the latter toward the exhaust valve to close the passageway, the
15 inlet valve having a face exposed to the inlet pressure when said inlet valve is closing the passageway through the exhaust valve so as to effect the initial opening of the inlet valve.

7. A pneumatic controller comprising an inlet valve having a pressure face subject to inlet pressure for effecting the opening of the valve, counterpressure means for closing the valve, and means controlled by the inlet
25 valve and relieving the inlet valve of the force of the counterpressure means after the inlet valve is open.

8. A pneumatic controller comprising an inlet valve having a pressure face to effect the opening of the valve, and also having an opposed pressure face to produce a balanced action in the valve after the movement of the valve to open position, counterpressure means for closing the valve, and means
35 for relieving the valve of the force exerted by the counter pressure means after the valve is open.

9. A pneumatic controller comprising an inlet valve, having a pressure face for effecting the opening of the valve, and an opposed pressure face to produce a balanced action in the valve after the latter is opened, counterpressure means for closing the valve, and means for causing the inlet pressure to act
45 on the counterpressure means after the opening of the valve to relieve the valve of the force of said counterpressure means.

10. A pneumatic controller comprising an inlet valve having a pressure face to effect the opening of the valve, and an opposed pressure face to produce a balanced action in the valve after the latter is opened, a spring for closing the valve, and a piston connected to the spring having a face exposed to the
55 inlet pressure after the opening of the valve to relieve the valve of the force exerted by the spring after the valve is open.

11. A pneumatic controller comprising a casing having an inlet, an outlet, and an exhaust, an exhaust valve for closing the exhaust, an inlet valve arranged to engage the exhaust valve and having a pressure face to produce the opening of the inlet valve, counterpressure means for closing the inlet

valve and opening the exhaust valve through the engagement of the inlet valve with the exhaust valve, and an auxiliary motor for relieving the inlet and the exhaust valve of the force exerted by said counterpressure means, after the inlet valve is opened. 65 70

12. A pneumatic controller comprising a casing having an inlet, an outlet, and an exhaust, an exhaust valve for closing said exhaust, an inlet valve arranged to engage the exhaust valve and having a pressure face to effect the opening of the inlet valve, a bypass connecting the opposite face of the inlet valve with the outlet side of the inlet valve so that the same pressure may be communicated to opposite sides of the inlet valve to balance the latter after the inlet valve is open, and counterpressure means tending to move the inlet valve toward the exhaust valve to close the inlet valve and open the exhaust. 75 80

13. A pneumatic controller comprising a casing having an inlet, an outlet, and an exhaust, an exhaust valve for the exhaust having a passage therethrough for establishing communication between the inlet and the outlet, means for closing the exhaust valve, and an inlet valve arranged to close the passage-way through said exhaust valve and to engage the exhaust valve to move the latter from its seat. 85 90

14. A pneumatic controller comprising a casing having an inlet, an outlet, and an exhaust, an exhaust valve for the exhaust, means for moving the exhaust valve to closed position, and an inlet valve arranged to cut off communication between the inlet and the outlet and engaging the exhaust valve to move the latter to open position. 95 100

15. A pneumatic controller comprising a casing having an inlet, an outlet, and an exhaust, an exhaust valve for the exhaust, means for closing said exhaust valve, an inlet valve arranged to cut off communication between the inlet and the outlet and having a pressure face by which the inlet valve may be opened by pressure thereon, counterpressure means tending to move the inlet valve to close the same and to open the exhaust, against the action of the closing means, and an auxiliary motor for relieving the first two valves of the force exerted by the counterpressure means. 105 110 115

16. A pneumatic controller comprising an inlet valve having a pressure face to effect the opening of the valve, a spring-pressed piston acting on said valve to close the same, the piston having a face in communication with the pressure, which opens the inlet valve, after the opening of the inlet valve in order to relieve the valve of the force exerted by the spring-pressed piston. 120 125

17. A pneumatic controller comprising a casing having an inlet, an outlet, and an exhaust, an open-ended exhaust valve arranged

to close the exhaust and having two opposed faces one by which it is held open and the other by which it is closed, an inlet valve for closing the passageway through said exhaust valve having a pressure face by which the said inlet valve is opened, and a spring-pressed piston for closing the inlet valve and moving the exhaust valve to open position, said piston having a pressure face exposed to pressure upon the opening of the inlet valve, so that the inlet valve and the exhaust valve are relieved of the force exerted by the spring-pressed piston upon the opening of said inlet valve. 10

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