W. E. VER PLANCK.

GOVERNOR VALVE FOR AIR COMPRESSORS.

APPLICATION FILED OCT. 16, 1913.

1,186,247. Patented June 6, 1916.

Fig. 1.

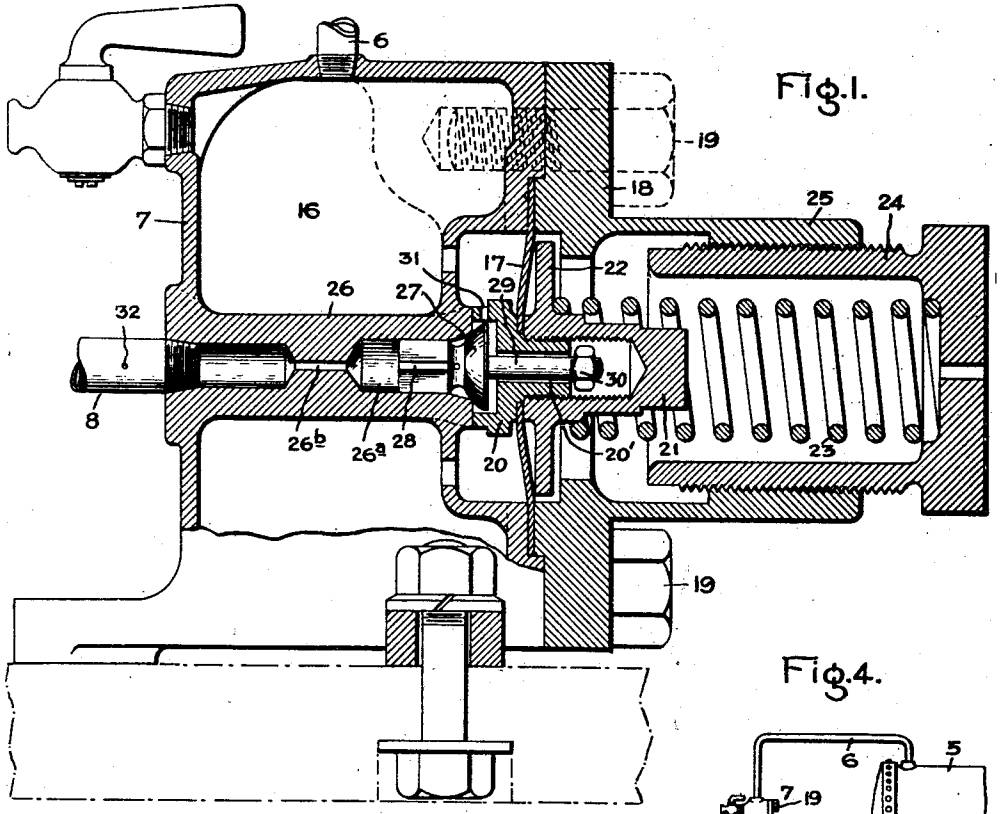


Fig. 4.

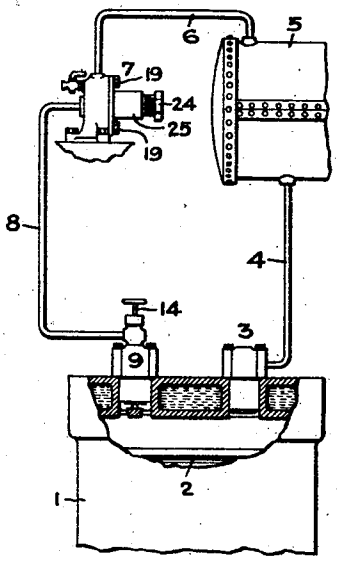


Fig. 2.

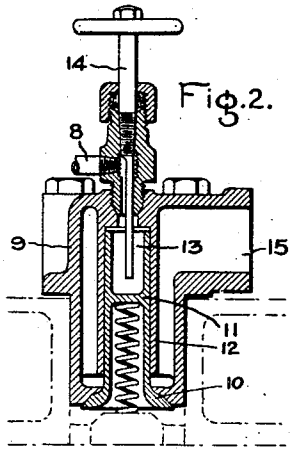
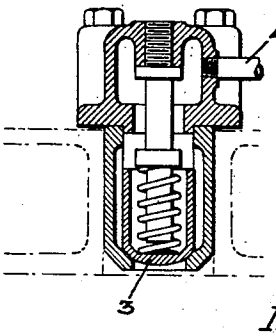


Fig. 3.



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GOVERNOR-VALVE FOR AIR-COMPRESSORS.

1,186,247. Specification of Letters Patent. Patented June 6, 1916.

Application filed October 16, 1913. Serial No. 795,560.

To all whom it may concern:

Be it known that I, WILLIAM EVERETT VER PLANCK, a citizen of the United States, residing at Erie, county of Erie, State of Pennsylvania, have invented certain new and useful Improvements in Governor-Valves for Air-Compressors, of which the following is a specification.

This invention relates to devices for preventing an excessive pressure in a tank or reservoir for the storage of compressed air. The obvious and ordinary way of doing this is to provide the reservoir with a safety valve which will open at a predetermined pressure and allow any excess of air to blow off. But this involves a waste of power, as the compressor must work constantly against the maximum pressure which the safety valve is set to hold in the reservoir. Another common expedient is to provide a pressure-responsive governor which operates at a predetermined maximum pressure to shut off the steam or other motive agent from the motor which drives the compressor. This device cannot be used, however, in compressors which are mechanically driven from the main engine shaft and are, therefore, operating continuously. In order to save power when such compressors have brought the reservoir pressure up to maximum, it has been proposed to use a pressure-responsive governor which opens an unloading valve on the compressor cylinder, thereby opening said cylinder to the atmosphere and allowing the plunger of the compressor to reciprocate freely without doing any work or requiring any power to operate it above the negligible amount necessary to overcome the friction of the moving parts.

My invention relates to a governor valve of this kind, and its object is to provide a device which is reliable and prompt in action and which will not hesitate or chatter in operation.

The invention resides in certain details of construction which will be hereinafter set forth and particularly pointed out in the claims.

In the accompanying drawing, Figure 1 is a longitudinal section of my improved governor; Fig. 2 is a longitudinal section of the unloading valve which it controls: Fig. 3 is a longitudinal section of the outlet valve of the compressor; and Fig. 4 is a diagram showing the connections of the various elements of the system.

The compressor comprises a cylinder 1 in which a plunger 2 operates, being driven by direct connection to some moving part of a prime mover. The air compressed at each stroke of the plunger lifts the spring-seated discharge valve 3 and passes through the pipe 4 to the storage reservoir 5. Connected with said reservoir by the pipe 6 is the pressure-responsive governor 7 which, when the reservoir pressure exceeds a safe limit, permits the compressed air to flow through the pipe 8 to the unloading valve. This comprises a casing 9 secured in an opening in the head of the cylinder 1. An inwardly opening spring-seated valve 10 prevents, ordinarily, the escape of air from the cylinders. The stem 11 of the valve has an easy sliding fit in a tubular guide 12, and in the upper end of said stem is a chamber 13 exposed to the pressure of the air admitted by the governor through the pipe 8. A needle valve 14 regulates the admission of air to the chamber 13, and when thus admitted the fluid pressure forces down the stem 11 and opens the valve 10. The air pushed before the plunger 2 is, therefore, no longer compressed, but escapes freely to the atmosphere through the passage 15. I have described this system somewhat in detail in order to explain the relation thereto of the governor, to which my invention is confined. It comprises a casing 7 having a chamber 16 containing air at reservoir pressure. In one side of the casing is an opening covered by a flexible diaphragm 17 whose edges are clamped air tight by an annular cap 18 secured to the casing by the screws 19. At the center of the diaphragm is an opening whose edges are clamped between a shoulder on a sleeve 20, having a screw-threaded reduced portion 20′ passing through said opening and a cap nut 21 screwed on said portion 20′ and having a flange 22. A helical spring 23 abuts at one end against said flange and at the other end is confined by a recessed nut 24 screwing into a threaded neck 25 on the annular cap 18, and serving thereby as a means for adjusting the tension of the spring.

The sleeve 20 is normally held by the spring 23 against the inner end of a tubular member 26 which projects from the side of

the casing opposite the diaphragm. The sleeve is counterbored or recessed at 26^a to house an outlet valve 27 whose seat surrounds the central bore of the member 26. The other end of said bore communicates with the pipe 8, through a restricted portion 26^b. The outlet valve 27 has guide wings 28 on one side and on the other side a stem 29 which passes loosely through the sleeve 20, and has a suitable head, such as the nut 30, on its end inside the cap nut 21.

The operation is as follows: The air entering chamber 16 passes freely through a port 31 into the recess in the sleeve 20 and thence by the clearance around the valve stem 29 to the interior of the cap nut 21. The fluid pressure, therefore, exerts an unbalanced pressure on the back of the valve 27 to hold it to its seat, the face of said valve being exposed practically to atmospheric pressure leaking into the pipe 8 past the stem 11 of the unloading valve. A small additional leakage hole 32 may be provided in the pipe 8 if desired. As the reservoir pressure builds up in the chamber 16, the tension of the spring 23 begins to be overcome by the increasing pressure on the diaphragm, so that the sleeve 20 is moved gradually to the right until it takes up the small clearance between its end and the head 30 on the valve stem. Further movement is then opposed by the spring 23. Moreover, the total pressure on the diaphragm is partly balanced by the fluid pressure acting on the unbalanced area of the back of the valve 27. The increasing reservoir pressure, however, soon becomes high enough for the effective pressure on the diaphragm to lift the valve off its seat, and the instant it does so the chamber 26^a fills with full pressure, because the passage 26^b is so small that the air cannot flow out of said recess as fast as it comes in. The pressure on the two sides of the valve 27 is, therefore, practically balanced for a moment, and the effect of this is to throw the total pressure on the diaphragm suddenly against the spring 23, an action which jerks the valve wide open with a snap or pop action without any increase in the air pressure in the chamber 16. There is, therefore, no possibility of wire drawing the air in passing through the governor valve, and the valve operates without chattering.

The reservoir pressure must be reduced quite decidedly before the spring 23 will close the valve 27, but the instant it closes, the air pressure quickly drops in the pipe 8 by reason of leakage through the hole 32 and past the valve 11, so that the valve will be held shut by the unbalanced pressure upon its back. It is essential that the pressure in the pipe 8 be either all on or all off, as any intermediate pressure will result in chattering of the outlet valve. The lost motion or clearance between the sleeve 20 and the head 30 permits the diaphragm to vibrate slightly under small variations in reservoir pressure without affecting the governor valve. In practice this clearance amounts to about five one-thousandths of an inch, while that between the flange 22 and the inside of the cap 18 is about four times as much, thus affording plenty of room for said flange to move to open the valve after it has taken up the clearance under the head. The valve 27 also has a greater lift independent of the sleeve 20 by reason of the recess in said sleeve in which said valve is housed, and in which it can move away from its seat if urged to do so by reason of the rush of air beneath it.

This pop action governor valve has been found to operate satisfactorily in practice, giving a prompt and complete relief to the compressor when the maximum reservoir pressure has been attained.

In accordance with the provisions of the patent statutes, I have described the principle of operation of my invention together with the apparatus which I now consider to represent the best embodiment thereof; but I desire to have it understood that the apparatus shown is only illustrative, and that the invention can be carried out by other means.

What I claim as new and desire to secure by Letters Patent of the United States, is:—

1. A governor valve for air compressors, comprising a casing, an outlet valve having a headed stem, a sleeve fitting loosely on said stem and movable longitudinally thereon with some lost motion, a diaphragm secured to said sleeve, and exposed to the fluid pressure in said chamber, and a spring opposing the movement of said diaphragm.

2. A governor valve for air compressors, comprising a casing, a diaphragm, a sleeve secured to said diaphragm and having a flanged cap nut on one end, an outlet valve having a stem passing loosely through said sleeve and provided with a head inside said nut, and a spring abutting against the flange on said nut.

3. A governor valve for air compressors, comprising a casing, a diaphragm exposed to fluid pressure in said casing, a sleeve secured to said diaphragm and having a flange cap nut on one end, a tubular member containing a valve seat, an outlet valve cooperating therewith and having a headed stem passing loosely through said sleeve, and a spring pressing said sleeve against the end of said tubular member.

4. A governor valve for air compressors, comprising a casing, a diaphragm exposed to fluid pressure in said casing, a sleeve secured to said diaphragm and having a counterbored end provided with a port, a tubular member having a valve seat, a valve in

the counterbore of said sleeve and having a stem passing through said sleeve, a head on said stem arranged to leave a slight clearance between it and the end on the sleeve, a cap nut inclosing said head, and a spring urging said sleeve against said tubular member.

5. A governor valve for air compressors, comprising a casing having a tubular member containing a valve seat and a recess below the same, means for retarding the escape of air from said recess, a valve engaging said seat and a diaphragm exposed to air pressure, and a lost motion connection between said valve and diaphragm.

6. A governor valve for air compressors, comprising a casing having a tubular member containing a valve seat and a recess below the same, a restricted passage for the escape of air from said recess, a valve engaging said seat and a diaphragm exposed to air pressure, and a lost motion connection between said valve and diaphragm.

7. A governor valve for air compressors, comprising a casing having a tubular member containing a valve seat and a recess below the same, a restricted passage for the escape of air from said recess, a valve and a diaphragm exposed to air pressure, a lost motion connection between said valve and diaphragm, an unloading valve, a pipe conveying air pressure thereto from said restricted passage, and means for quickly releasing the pressure in said pipe.

8. A governor valve for air compressors, comprising a casing having a tubular member containing a valve seat and a recess below the same, a restricted passage for the escape of air from said recess, a valve and a diaphragm exposed to air pressure, a lost motion connection between said valve and diaphragm, an unloading valve permitting a slight leakage of air past its stem, a pipe conveying air pressure to the unloading valve from said restricted passage, and a leakage hole in said pipe.

9. In a fluid compressor system, a compressor, a reservoir, an unloading valve for the compressor operated in response to fluid under pressure in the reservoir, and means intermediate said reservoir and said unloading valve for controlling the admission of fluid from the reservoir to the unloading valve comprising a valve and means for substantially equalizing the pressure on both sides of said valve when it is opened.

10. In a fluid compressor system, a compressor provided with an unloading valve, a reservoir connected with said compressor, means intermediate said reservoir and said unloading valve, acting in response to the pressure in the reservoir for opening said unloading valve and comprising an outlet valve for controlling the admission of fluid from the reservoir to the unloading valve, said outlet valve being normally seated by an unbalanced pressure, and means for substantially equalizing the pressure on both sides of the valve as soon as it is unseated.

In witness whereof, I have hereunto set my hand this 13th day of October, 1913.

WILLIAM EVERETT VER PLANCK.

Witnesses:
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