T. O. PERRY.

FLUID PRESSURE REDUCER.

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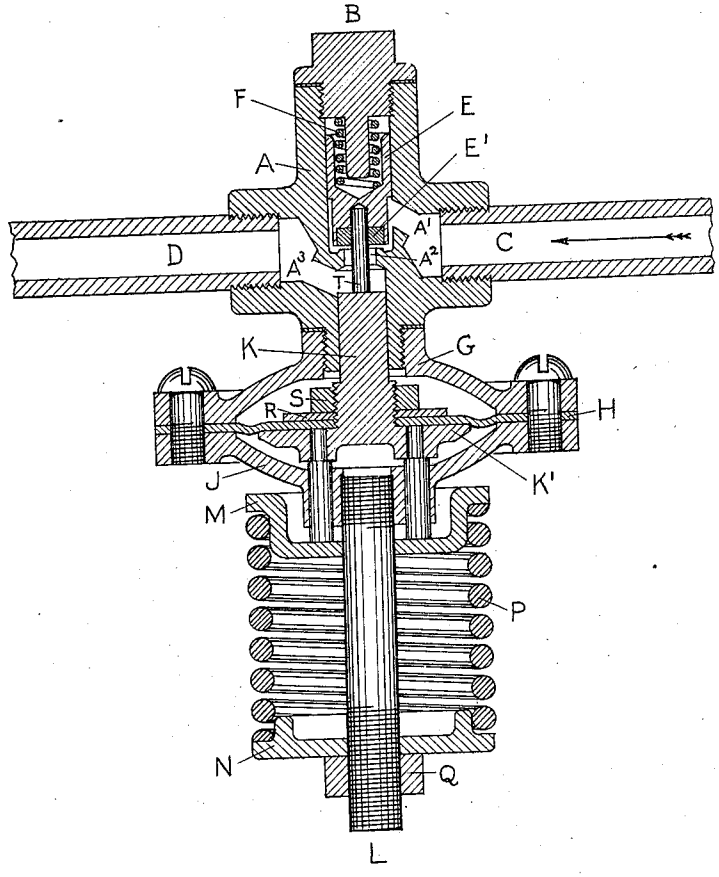
1,012,701.

Patented Dec. 26, 1911.



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FLUID-PRESSURE REDUCER.

1,012,701. Specification of Letters Patent. Patented Dec. 26, 1911.

Application filed October 23, 1909. Serial No. 524,148.

To all whom it may concern:

Be it known that I, THOMAS O. PERRY, a citizen of the United States, residing at Oak Park, in the county of Cook and State of Illinois, have invented a new and useful Fluid-Pressure Reducer, of which the following is a specification.

My invention relates to improvements in fluid pressure reducers in which a reduction of pressure is effected by a reducing valve controlled by a diaphragm or piston balanced between the reduced fluid pressure, acting against one side of the diaphragm, and the adjustable tension of a balancing spring or weight acting oppositely; and the objects of my improvement are, first, to obtain great uniformity in the reduced pressure and superior sensitiveness in response to changes in the unreduced pressure; second, to guard against accidental injury to the reducing valve, due to temporary unbalancing of the valve controlling forces; and, third, to avoid undesirable vibratory movement of the reducing valve due to oscillations in the flow of fluid. I attain these objects by the mechanism illustrated in the accompanying drawing, in which a central longitudinal section of the apparatus is shown, disclosing all essential parts, which are symmetrical and preferably cylindrical or circular with respect to the plane of the drawing.

The reducing valve, E E′, is inclosed and guided in a cylindrical valve chamber occupying the central upper part of the body casting, A, and covers a circular valve seat, A^2, with opening through a partition which forms the bottom of the valve chamber. The upper end of the valve chamber, through which the valve is inserted, is closed by a threaded cap, B. The fluid inlet pipe, C, screws into one side of the cross-like body, A, and communicates, by means of the body inlet, A′, with the lower part of the valve chamber. The fluid outlet pipe, D, screws into the opposite side of the body, A, and communicates by means of the body outlet, A^3, with the opening through the valve seat, from below the partition. The diaphragm H, is clamped around its periphery between the diaphragm clamp, J, and the diaphragm casing, G, which screws onto the lower end of the cross-like body, A, which has a cylindrical bore opening directly into the space beneath the reducing valve. Into this cylindrical bore is loosely fitted a plunger, K, which extends down through a central opening in the diaphragm and terminates below in a plunger plate, K′, on which the central portion of the diaphragm rests, and against which it is pressed in close contact by means of the washer, R, and plunger nut, S, so that a closed fluid chamber is formed between the diaphragm, H, and the diaphragm casing, G, into which fluid under reduced pressure can find its way slowly around the loosely fitted plunger, K. A push pin, T, carried by the reducing valve reaches down through the opening covered by the valve and rests upon the top of the plunger, K. Two push pins fixed in the plunger plate, K′, reach down through and are guided in holes piercing the central hub of the diaphragm clamp, J, on both sides of a tension rod, L, screwed into and extended down from the center of the hub. This tension rod, L, is practically a member integral with the diaphragm clamp. The lower end of the tension rod, L, is threaded for some distance to receive an adjusting nut, Q. A thrust plate, M, bearing against the lower protruding ends of the push pins is guided loosely on the tension rod, L, and has a peripheral shoulder which receives the thrust of a helical balancing spring, P, whose tension is adjusted by means of the tension nut, Q, pressing the tension head, N, at the lower end of the spring.

It should be noted that the diaphragm clamp, J, forms with the diaphragm, H, a closed outer chamber of quite limited area to which the outer air has only restricted access around the push pins which pierce the diaphragm clamp to connect with the balancing spring placed outside where its number of coils and dimensions may be made as large as need be without causing vibratory troubles.

Between the threaded cap, B, and the reducing valve, E, a light helical vale spring, F, is compressed sufficiently to insure closing of the valve wherever it is permitted to close by withdrawal of the plunger, K, from beneath the thrust pin, T. The reducing valve, E E′, is in the form of a hollow cylinder having a closed lower end which covers the valve seat with more or less opening between.

The upper portion of the cylindrical valve fits the valve chamber loosely for guidance, and yet sufficiently fills the chamber to prevent rapid passage of fluid, as a further safeguard against the annoying

tendency of the valve to dance and sing under the influence of vibratory flow of the fluid. The lower part of the cylindrical valve is somewhat reduced in diameter so as not to obstruct the flow of fluid around the valve seat against which the reducing valve seats in the direction of flow so that the variable unreduced fluid pressure helps to close the valve. The action will now be obvious, if, for example, we suppose the outlet pipe, D, to communicate with some form of pneumatic apparatus which requires for its operation a uniform tension of air, and the inlet pipe, C, is supposed to communicate with an air compressor or with a reservoir of compressed air maintained at any tension greater than the tension required by the conditions of use.

The tension the air may have after passing the reducing valve will act to press the diaphragm against the balancing spring whose tension is adjusted to give the desired tension of air. The reducing valve closes or opens according as the tension of the air or the tension of the spring prevails, the one over the other. So the air tension in the outlet pipe is not subject to variation beyond the limits required to compress the spring such small amount as is required for the limited moving of the valve. The necessary small variation of air tension required to operate the valve may be made less by increasing the number of coils in the balancing spring or by otherwise increasing the elastic range of the spring. But the effect of the increasing tension of the balancing spring while the reducing valve closes is counteracted in large measure by the increasing air tension in the inlet pipe, which helps in closing the valve more as the spring offers more resistance to closing. As the air pressure against the valve itself always tends to close it, the valve spring, F, might be dispensed with, though this spring facilitates the closing, especially if the apparatus is turned up side down or on its side. As the air tension against the diaphragm does not pull the reducing valve against its seat, but only withdraws the plunger, K, from the thrust pin, T, neither the valve nor the valve seat can be damaged by reducing the tension of the balancing spring without first relieving the air pressure against the diaphragm, when making a change in the adjustment for tension. This is of especial importance when the reducing valve is faced with soft material such as rubber or leather.

I claim:

1. In a fluid pressure reducer, the combination with a reducing valve, a controlling diaphragm, an inner diaphragm chamber adapted to receive reduced fluid pressure and a plunger operatively connecting said reducing valve with said diaphragm, of a diaphragm clamp forming with said diaphragm a closed outer diaphragm chamber and having a tension member protruding outward, an adjustable tension head on the outer extremity of said tension member, a thrust plate centrally disposed between said tension head and said diaphragm clamp, a balancing spring interposed between said tension head and said thrust plate, and push pins piercing said diaphragm clamp whereby the thrust of the balancing spring is transmitted to said diaphragm through restricted openings into said outer diaphragm chamber, substantially as herein set forth.

2. In a fluid pressure reducer, the combination with a reducing valve, a controlling diaphragm, an inner diaphragm chamber adapted to receive reduced fluid pressure slowly through a restricted opening, and a plunger adapted to restrict said opening and operatively connect said reducing valve with said diaphragm, of a diaphragm clamp forming with said diaphragm a closed outer diaphragm chamber and having a tension member protruding outward, an adjustable tension head on the outer extremity of said tension member, a thrust plate centrally disposed between said tension head and said diaphragm clamp, a balancing spring interposed between said tension head and said thrust plate, and push pins piercing said diaphragm clamp whereby the thrust of the balancing spring is transmitted to said diaphragm through restricted openings into said outer diaphragm chamber, substantially as herein set forth.

3. In a fluid pressure reducer, the combination with a reducing valve, a controlling diaphragm, an inner diaphragm chamber adapted to receive reduced fluid pressure slowly through a restricted opening, and a plunger adapted to restrict said opening and operatively connect said reducing valve with said diaphragm, of a diaphragm clamp forming with said diaphragm a closed outer diaphragm chamber and having a central tension member protruding outward, an adjustable tension head on the outer extremity of said tension member, a ring shaped thrust plate surrounding said tension member between said tension head and said diaphragm clamp, a balancing spring interposed between said tension head and said thrust plate, and push pins piercing said diaphragm clamp whereby the thrust of the balancing spring is transmitted to said diaphragm through restricted openings, which slowly pass air into and out of said outer diaphragm chamber, substantially as herein set forth.

4. In a fluid pressure reducer, the combination with a reducing valve and a controlling diaphragm, of an inner diaphragm chamber adapted to receive reduced fluid pressure slowly through a restricted pas-

sage, a plunger adapted to restrict said passage and operatively connect said reducing valve with said diaphragm, an outer diaphragm chamber adapted to receive and exude free air slowly through restricted openings, a balancing spring placed exterior to said outer diaphragm chamber adapted to push on said diaphragm oppositely to said reduced fluid pressure, and push pins adapted to restrict said openings into said outer diaphragm chamber and transmit the pressure of said spring to said diaphragm, substantially as herein set forth.

5. In a fluid pressure reducer, the combination with a reducing valve, and a controlling diaphragm, of an inner diaphragm chamber adapted to receive reduced pressure slowly through a restricted passage, a plunger adapted to restrict said passage and operatively connect said reducing valve with said diaphragm, an outer diaphragm chamber adapted to take and expel free air slowly through restricted opening, a balancing spring exterior to said outer diaphragm chamber adapted to push said diaphragm oppositely to the action of said fluid pressure, and push pin connection, between said balancing spring and said diaphragm adapted to restrict said opening into said outer diaphragm chamber, substantially as herein set forth.

THOMAS O. PERRY.

Witnesses:
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JAMES A. TOWNSEND.