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A. L. SEMON

3,407,841

FLUID PRESSURE REGULATORS

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FIG.1.

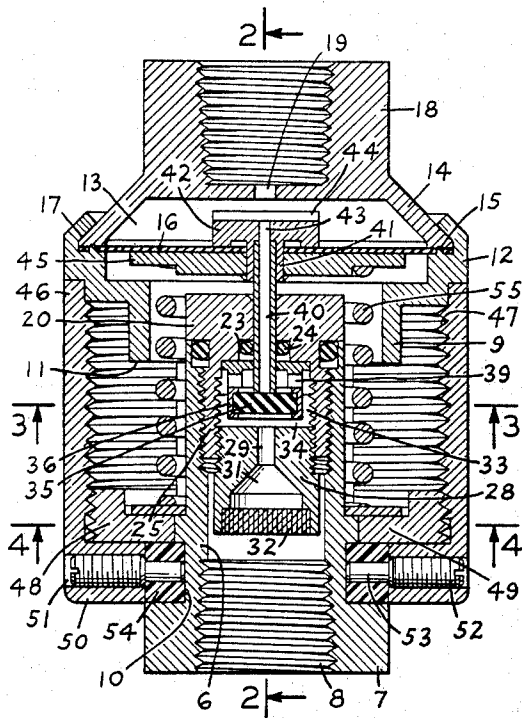


FIG.2.

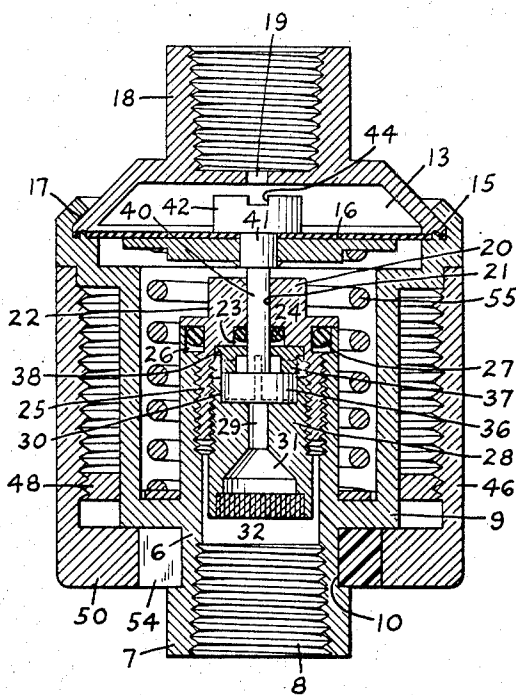


FIG.3.

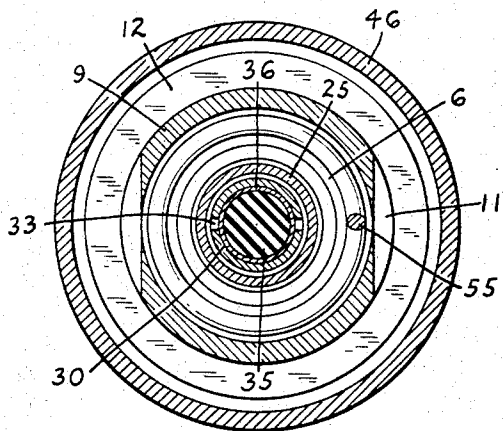


FIG.4.

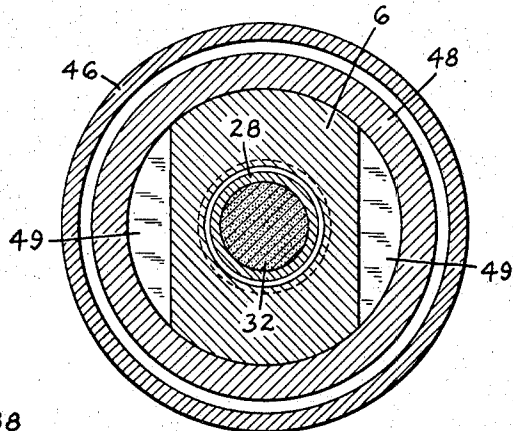
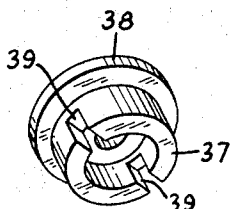


FIG.5.



INVENTOR
ALBERT L. SEMON
BY

John A. Seifert
ATTORNEY

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Albert L. Semon, 11 Eliot Place,

Short Hills, N.J. 07078

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ABSTRACT OF THE DISCLOSURE

This invention relates to a pressure regulator utilizing a compensating disc to maintain outlet pressure substantially constant upon a decrease in inlet pressure.

This invention relates to a fluid pressure regulator so constructed that when the initial fluid pressure at the inlet side is two hundred pounds per square inch and the reduced fluid pressure is set for two pounds per square inch at the outlet side, as the two hundred pounds per square inch is gradually reduced, the two pounds per square inch will only vary two ounces as the initial two hundred pounds per square inch has been reduced to five pounds per square inch.

This is accomplished by a compensating disc positioned in the path of flow of the high fluid pressure in such a manner that said high pressure will contact both sides of said compensating disc. The high fluid pressure contact on both sides of the compensating disc is equal except on the side where the inlet end of an exhaust or valve tube contacts the compensating disc and an unequal balance of fluid pressure is created due to the diameter of said tube and said unequal balance causing the compensating disc to flex. As the fluid pressure is gradually reduced, the compensating disc moves from said tube permitting flow of reduced fluid pressure to flow through the valve tube and this condition is held constant whether there is a fluid pressure flow or no fluid pressure flow through the regulator when the initial high fluid pressure has been reduced.

It is an object of the invention to produce such a regulator which is easily assembled and thereby reducing the cost of manufacture.

Other objects and advantages of the invention will be set forth in the detailed description of the invention.

In the drawing accompanying and forming a part of this application:

FIGURE 1 is a sectional view in elevation of the fluid pressure regulator;

FIGURE 2 is another sectional view taken on the line 2—2 of FIGURE 1 looking in the direction of the arrows;

FIGURE 3 is a cross-sectional view taken on the line 3—3 of FIGURE 1 looking in the direction of the arrows and showing the manner of mounting the compensating disc;

FIGURE 4 is a cross-sectional view taken on the line 4—4 of FIGURE 1 looking in the direction of the arrows and showing the mounting of an adjusting ring; and

FIGURE 5 is a perspective view of an O-ring retainer showing the manner of permitting the flow of fluid pressure around the compensating disc.

The embodiment of the invention comprises a tubular body 6 having a boss 7 internally screw-threaded, as at 8, for the connection of a conduit, not shown, and constituting the high pressure inlet of the regulator. The tubular body 6 is provided with an encircling cup-shaped portion 9 having the bottom wall spaced inwardly from the boss 7 and forming with said boss 7 an annular groove 10 for a purpose to be hereinafter described. Opposite side sections of the cup-shaped portion 9 are cut away to form open segments 11, as shown in FIGURES 1 and 3. The upper or open end section of the cup-shaped portion 9 is enlarged laterally, as at 12, to form the lower

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part of a diaphragm chamber 13. The upper part of said chamber 13 is formed by a cap-shaped housing 14 having an annular rim arranged with a groove co-operating with a tongue on the enlarged end section 12, as shown at 15 in FIGURES 1 and 2, for clamping the peripheral portion of a diaphragm 16. The cap-shaped housing 14 is secured in clamping position by crimping the marginal section of the enlarged section 12 over the rim of the cap-shaped housing 14, as shown at 17 in FIGURES 1 and 2. The closed end of the cap-shaped housing 14 is arranged with an internally screw-threaded boss 18 for the connection of an outlet conduit, not shown. The bottom wall of the boss 18 is provided with an opening 19 having a diameter approximately one-fifth the diameter of the bore of the boss 7 and constituting the outlet of the regulator.

The tubular body 6 supports a valve assembly comprising a housing including a solid body 20 arranged with a center bore 21 opening to a circular recess 23 for the mounting of an O-ring 24. The body 20 is provided with opposed straight walls 22 for the engagement of a wrench, as shown in FIGURE 2. Extending from the end of the body 20 having the recess 23, there is an internally and externally screw-threaded nipple portion 25, the external screw-threads being engaged with corresponding screw-threads in the bore of the tubular body 6 with the bottom of the body 20 abutting the inner end of the tubular body 6 and forming with a counterbore 26 in said tubular body 6 an annular chamber for an O-ring 27 which seals the connection between the tubular body 6 and the housing. A valve retainer 28 is engaged with the internal screw-threads of the housing and provided with an axial intermediate bore 29 opening at one end to a straight walled recess 30 and the opposite end of the bore 29 opening to a tapering walled recess 31 having at the entrance a straight walled enlargement for mounting a filter 32. The opposite wall portions of the recess 30 are provided with slots 33 connected to each other by a groove 34 in the bottom wall of said recess 30 extending transversely of the bore 29, as shown in FIGURES 1 and 3.

A compensating disc 35 of resilient material, such as rubber or the like, is mounted in a metal ring 36 with both faces of the center portion of the disc 35 exposed. The compensating disc 35 and its ring 36 are positioned in the recess 30 and retained in said recess by an annular wall or skirt 37 depending from a disc 38 retaining the O-ring 24 in the recess 23. The skirt 37 is provided with opposed slots 39, as shown in FIGURES 1 and 5. The slots 33 and 39 and the groove 34 provide a flow of fluid pressure on both faces of the compensating disc 35. The face of the disc exposed to the flow of fluid pressure through the slots 39 is contacted by the inlet end of an exhaust or valve tube 40 extended through the disc 38, the O-ring 24, the recess 23 and the solid body 20. The O-ring 24 seals the tube 40 in the housing body 20. The outlet end of the valve tube 40 is secured in a socket 41 of a retainer 42 having a center opening 43 communicating with the bore of the valve tube 40 and a transverse groove 44 in the exposed face of the retainer 42. The socket 41 is extended through the diaphragm 16 and anchored in a washer 45 on the fluid pressure side of said diaphragm 16. The diameter of the bore of the tube 40 is smaller than the diameter of the outlet opening 19.

The tubular body 6 is enclosed by an adjusting ring 46 provided with internal screw-threads 47 for the engagement of an adjusting nut 48 having wedges 49 extended into the segments 11 of the cup-shaped portion 9 and abutting an inwardly extending flange 50 of the adjusting ring 46, as shown in FIGURES 1 and 4. Said flange 50 is provided with opposed screw-threaded bores 51 for the mounting of set-screws 52 having smooth reduced end portions 53 engaged in opposed openings in

a split bushing 54 mounted in the groove 10 with the ends of the set-screws 52 abutting the wall of the groove 10 to retain the ring 46 in adjusted position.

The diaphragm 16 is biased by a compression spring 55 encircling the tubular body 6 with one end of said spring abutting the bottom of the cup-shaped portion 9 and the wedges 49 and the opposite end of the spring 55 abutting the washer 45.

In operation, high fluid pressure enters the bore of the tubular body 6 passing through the filter 32 into the bore 29, the groove 34, the slots 33 and 39, whereby said high fluid pressure contacts both exposed faces of the compensating disc 35 and an unequal balance is created on the face of the compensating disc 35 contacted by the inlet end of the valve tube 40 due to the diameter of said valve tube 40 and this unequal balance in the fluid pressure causing the compensating disc to flex. When the high fluid pressure is initially applied, the compensating disc 35 is urged closer to the inlet end of the valve tube 40 and as this pressure is gradually reduced within the valve assembly the compensating disc 35 flexes away from the inlet end of the valve tube 40 permitting the flow of the predetermined low fluid pressure through said valve tube 40 and the outlet opening 19. These conditions are held constant whether there is flow through the regulator or no flow through the regulator when the high fluid pressure has been reduced.

Having thus described my invention, I claim:

1. In a fluid pressure regulator, a tubular body having an inlet at one end and the opposite end arranged with a chamber having an outlet, a diaphragm mounted in said chamber to transversely partition said chamber and separate the inlet from the outlet, and a valve assembly mounted in the tubular body and having an inlet communicating with the inlet of said tubular body, a chamber in an intermediate portion of the valve assembly in communication with the inlet of said valve assembly, a tube carried by the diaphragm with the first end of said tube communicating with the outlet of the tubular body chamber and the second end of the tube extended into the chamber in the intermediate portion of the valve assembly, a compensating disc of resilient material mounted in said chamber in the intermediate portion of the valve assembly and in contact with said second end of the tube, and a fluid pressure passage around the compensating disc, whereby high fluid pressure entering the inlet of the tubular body flows into the inlet of the valve assembly through the fluid pressure passage and around the compensating disc, said high fluid pressure first urging the compensating disc into close contact with the second end of the tube, then creating a gradual reduction in the fluid pressure and finally flexing the compensating disc from the second end of the tube to permit the flow of reduced fluid pressure through the tube and the outlet of the tubular body chamber.

2. A fluid pressure regulator as claimed in claim 1, wherein the diameter of the outlet of the tubular body

chamber is approximately one-fifth the diameter of the inlet of the tubular body.

3. A fluid pressure regulator as claimed in claim 1, wherein the diameter of the outlet of the tubular body chamber is greater than the diameter of the bore of the tube.

4. A fluid pressure regulator as claimed in claim 1, wherein the tubular body is provided with an encircling cup-shaped portion spaced from the tubular body and having the bottom spaced inwardly from the inlet end of said tubular body and the open end of said cup-shaped portion forming part of the chamber of the tubular body, and opposite side sections of the cup-shaped portion having cut-away segments.

5. In a fluid pressure regulator as claimed in claim 4, a cup-shaped housing secured to the open end of the cup-shaped portion of the tubular body to form with said open end of the cup-shaped portion the chamber of the tubular body and said cup-shaped housing having a screw-threaded boss provided with an opening in the bottom of the boss constituting the outlet of the tubular body chamber.

6. In a fluid pressure regulator as claimed in claim 4, a spring in the space between the tubular body and its cup-shaped portion and compressed between the bottom of said cup-shaped portion and the diaphragm.

7. In a fluid pressure regulator as claimed in claim 4, an adjusting nut having external screw-threads and opposed wedges extended into the cut-away segments of the cup-shaped portion of the tubular body, and an adjusting ring in screw-threaded engagement with the screw-threads of the adjusting nut with one end abutting the open end of the cup-shaped portion of the tubular body and the opposite end of the adjusting ring having an inwardly extending flange adjustably retained to the inlet end of the tubular body.

8. In a fluid pressure regulator as claimed in claim 1, a filter mounted in the inlet of the valve assembly.

9. A fluid pressure regulator as claimed in claim 1, wherein the periphery of the compensating disc is encircled by a metal ring.

10. A fluid pressure regulator as claimed in claim 1, wherein the chamber in the valve assembly is provided with an annular recess encircling the tube, an O-ring seated in said recess and sealing the tube, and an annular retainer on the tube closing the recess and containing the O-ring and said annular retainer having an annular skirt abutting the compensating disc and provided with slots for the flow of fluid pressure around the compensating disc.

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WILLIAM F. O'DEA, *Primary Examiner*.

HAROLD W. WEAKLEY, *Assistant Examiner*.