

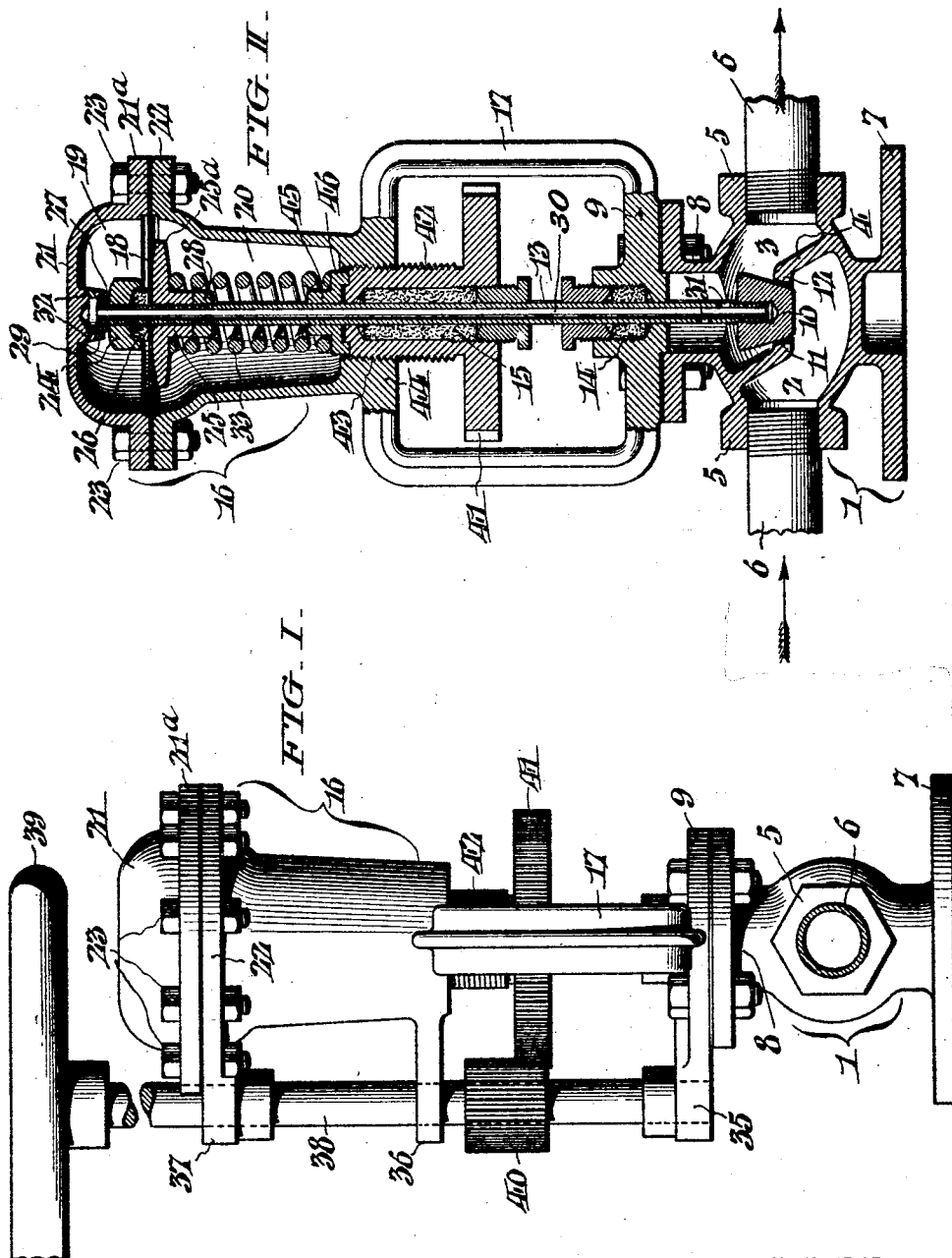
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PRESSURE REGULATING DEVICE

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UNITED STATES PATENT OFFICE.

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PRESSURE-REGULATING DEVICE.

Application filed February 18, 1925. Serial No. 10,043.

This invention relates to devices for regulating the pressure of fluid flow through piping, and more particularly to a type with provisions for adjustment.

Devices of the type referred to as heretofore constructed, especially those for high pressure installations, I have found to be more or less unreliable in that they were incapable of properly holding their adjustment after setting. As a consequence, therefore, they could not be used in instances requiring maintenance of steady fluid flow at comparatively high pressures, for example, in oil burning systems where such a condition is absolutely essential to uniform delivery of the fuel oil to the burners and to safe, efficient and economical operation of the systems.

In its broadest aspect, my invention is directed toward overcoming the objections noted, and to this end it has for an object the provision of a structurally simple and sturdy regulator which is not only absolutely dependable from the standpoint of the permanency of its adjustments, but which is also capable of extensive regulation for maintenance of steady pressures of fluid delivery over a very wide range of values.

Advantages accruing to my invention, other than those already recited, will be apparent from the detailed description hereinafter of a typical embodiment thereof as illustrated by the drawings, whereof

Fig. I is an elevation of the improved pressure control device.

Fig. II is a longitudinal sectional view of the same.

As herein shown, the device comprises a valve 1 whose casing will be observed as of conventional configuration in that the same is globular with the entrant and delivery sides 2, 3 of its flow passage set apart by a partition 4 extending diagonally across the interior. The opposite ends 5, 5 of the valve casing are polygonally flanged, in the customary way, and internally tapped to receive the threaded ends of contiguous sections 6, 6 of piping through which the flow to be measured is conducted. For convenience in securing and supporting the valve 1 in upright position as shown, the valve casing is provided with an integral circular base 7. Projecting upward from the valve casing is a hollow flanged neck 8 whose interior is open to the flow passage 3 of the

valve 1, and which is closed at the top by a plate 9 bolted or otherwise secured in place.

The movable element of the valve 1 is in the form of a tapered plug 10 that cooperates with a conically-ground seat about a port 11 located centrally of the horizontal portion 12 of the partition 4 previously mentioned. The plug 10 is secured to the lower end of a tubular stem 13 that extends to the exterior upwardly of the valve casing through a lower stuffing box 14 in the closure plate 9, thence through a second stuffing box 15 into a hollow chambered head 16 supported at an elevation above said valve casing by a yoke 17 conveniently formed integral with said head and the closure plate 9 as shown. The head 16 serves as a housing for means whereby the action of the valve is automatically controlled, said means including a flexible diaphragm 18 of sheet metal, preferably phosphor bronze, which spans the interior of the head and separates the same into upper and lower sub-divisions 19, 20, respectively. The diaphragm 18 is held in place by perimetric marginal engagement thereof between the flange 21^a of a removable dome cover 21, and an opposing flange 22 extending about the top of the main or body portion of the head 16, bolts 23 being employed to clamp the parts securely and fluid-tightly together. The diaphragm 18 is furthermore centrally pierced for protrusion therethrough of the upper end of the tubular stem 13 which is threaded at this region to take opposing nut collars 24, 25 respectively disposed above and below said diaphragm to secure it to the stem 13, the nut collar 25 having an extended flange 25^a whose rounded surface will permit the necessary flexure of the diaphragm 18 and yet restrain excessive movement such as would be likely to cause undue strain or fracture. A packing gasket 26 interposed beneath and partly accommodated in the hollow of the collar 24, serves to insure a fluid tight juncture with the diaphragm 18; and additional auxiliary jamb nuts 27, 28 are employed with the collars 24, 25 to insure against the possibility of loosening of the assemblage. Guidance, in addition to that provided by the stuffing boxes 14, 15, is afforded the stem 13 by a central inwardly-projecting axially-bored boss 29 of the dome cover 21 adapted to slidably receive the nut 27. Communication be-

tween the upper subdivision 19 of the head 16 and the flow passage 3 through the valve 1 is by way of the axial duct 30 in the stem 13, connecting ports 31 being provided in the latter at a region immediately adjacent the plug 10, and ports 32 in the boss 29 aforementioned for the purpose stated. Through the avenue of communication thus established, the surface of the diaphragm 18 exposed in the upper subdivision 19 of the head 16, is at all times subject to the action of the pressure of the flow through the valve 1. Within the lower subdivision 20 of the head 16 the stem 13 is surrounded by a helical compression spring 33 which bears at the top end against the flanged portion 25^a of the collar 25, thereby tending to urge the diaphragm 18 upward and to keep the plug 10 elevated with the port 11 open for passage of fluid through the valve 1.

In order that the compressive force of the spring 33 may be adjusted for maintenance of different working conditions of the valve 1, I provide means as follows: Journaled in lug bearings 35 and 36—37 (Fig. I) projecting laterally respectively from the cover plate 9 and the head 16, is a vertical shaft 38 with an actuator in the form of a hand wheel 39 at its upper end, and a spur pinion 40 on that portion thereof between the bearings 35, 36. The face of the pinion 40 is made comparatively broad to accommodate relative planal shifting of an intermeshing gear wheel 41 whose hub 42 affords the axial cavity for the stuffing box 15 through which the tubular stem 13 enters the head 16. The hub 42 of the gear wheel 41 is in screw threaded engagement with an axial opening 43 in the base or bottom 44 of the head 16; and on the upper end of said hub 42 rests a collar 45 which is free on the stem 13 and shouldered as at 46 to provide an annular seat or abutment for the contiguous end of the spring 33. Rotation of the shaft 38 in one direction or the other by means of the hand wheel 39, will thus result in planal shifting of the gear wheel 41 and effect corresponding variation in the compression of the spring 33. In practice, the chamber 20 of the head 16 is kept partly filled with oil or grease to ensure free movement of the valve stem 13 in the collar 45 and the hub 42 of the gear wheel 41.

In the operation of the device, it will be apparent that the fluid pressure exerted on the side of the diaphragm 18 exposed thereto in the subdivision 19 of the head 16 by virtue of the communication with the flow passage in the casing of the valve 1 via the hollow stem 13, will tend to close the valve, i. e., to hold the plug 10 against its seat 11 on account of the difference in the opposed surface areas of said diaphragm and plug exposed to the fluid. However, through regulation of the pressure of the spring 33

under control of the hand wheel 39 and interposed gearing 40, 41, any desired ratio of differential action may obviously be predetermined between the diaphragm 18 and the plug 10, the spring 33 acting reversely, or in effect to oppose the force exerted downwardly upon said diaphragm and therefore to assist raising of the plug 10 from its seat. Consequently, the flow through the piping 6 may be very accurately controlled: in fact in actual practice with the ports approximately proportioned as shown in the drawings, it is quite possible to secure differences between the applied and delivered pressures in the ratio of twelve to one, or even greater. Furthermore, with the regulating gears 40, 41, constructed as herein shown, it is obvious that the device will remain absolutely fixed in adjustment after once being set, and against yielding to fluctuations in the applied pressure as likely to attend pump action.

As already pointed out, the main object of my invention is to provide a regulating device suitable in instances requiring fluid delivery at a uniform, comparatively high pressure. The regulating device of my invention is therefore especially applicable in connection with oil burning systems where delivery of the oil to the burners at a uniform pressure and rate is of paramount importance to proper and efficient operation of such systems.

Having thus described my invention, I claim:

1. A pressure regulating device comprising a valve with a movable closure member having a tubular stem, a diaphragm secured to said stem and exposed to the flow to be regulated for opposed differential action relative to the closure member, means effective to restrain excessive flexure of the diaphragm, a compression spring directly operative on the diaphragm, and gear actuated means enabling adjustment of the spring pressure and corresponding variation in the differential action as between said diaphragm and the valve closure member, one of said gears affording axial guidance for the valve stem.

2. A pressure regulating device comprising a valve with a movable closure member having a tubular stem, a hollow head separated interiorly by a flexible diaphragm into two subdivisions, one such subdivision communicating with the flow passage in the valve by way of the tubular stem to permit opposed differential action of the diaphragm relative to the valve closure member, a pressure spring in the other subdivision of the chamber operative reversely upon the diaphragm, means effective to restrain excessive flexure of the aforesaid diaphragm, and intermeshing gears enabling adjustment of the spring pressure to vary the differential ac-

tion as between the diaphragm and the valve closure member, one of said gears embodying a stuffing box affording guidance for the aforesaid tubular stem.

- 5 3. A pressure regulating device comprising a valve with a movable closure member, a hollow head subdivided interiorly by a flexible diaphragm into two subdivisions, said diaphragm being centrally pierced for
10 attachment to the tubular stem of the valve closure member and to permit protrusion of the latter to establish communication of one of the aforesaid subdivisions with the flow passage of the valve through the hol-
15 low of the stem for opposed differential action of the diaphragm relative to the valve closure member, means effective to restrain excessive flexure of the diaphragm, a helical compression spring surrounding the valve
20 stem in the other of the subdivisions aforesaid operative reversely upon said diaphragm, and intermeshing gears enabling adjustment of the spring pressure to vary the differential action as between the diaphragm
25 and the valve closure member, one of said gears having its hub affording packed guidance for the aforesaid tubular stem.

4. A pressure regulating device compris-

ing a valve with a movable closure member, having a tubular stem, a hollow head separated interiorly by a flexible diaphragm into two subdivisions, one such subdivision communicating with the flow passage in the valve by way of the tubular stem to permit
30 opposed differential action of the diaphragm relative to the valve closure member, a compression spring in the other subdivision of the chamber operative reversely upon the diaphragm, means effective to restrain ex-
35 cessive flexure of the diaphragm, screw means enabling adjustment of the spring pressure to vary the differential action as between the diaphragm and the valve closure member, and intermeshing gears including an
40 actuating hand wheel for adjusting the screw means, one of said gears being broader than the other to accommodate relative planal shifting while maintaining locking interengagement therewith at all times, and
45 the other gear embodying a stuffing box affording guidance for the tubular stem aforesaid.
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In testimony whereof, I have hereunto signed my name at Philadelphia, Pennsylvania, this 13th day of February, 1925.

JAMES D. LALOR.