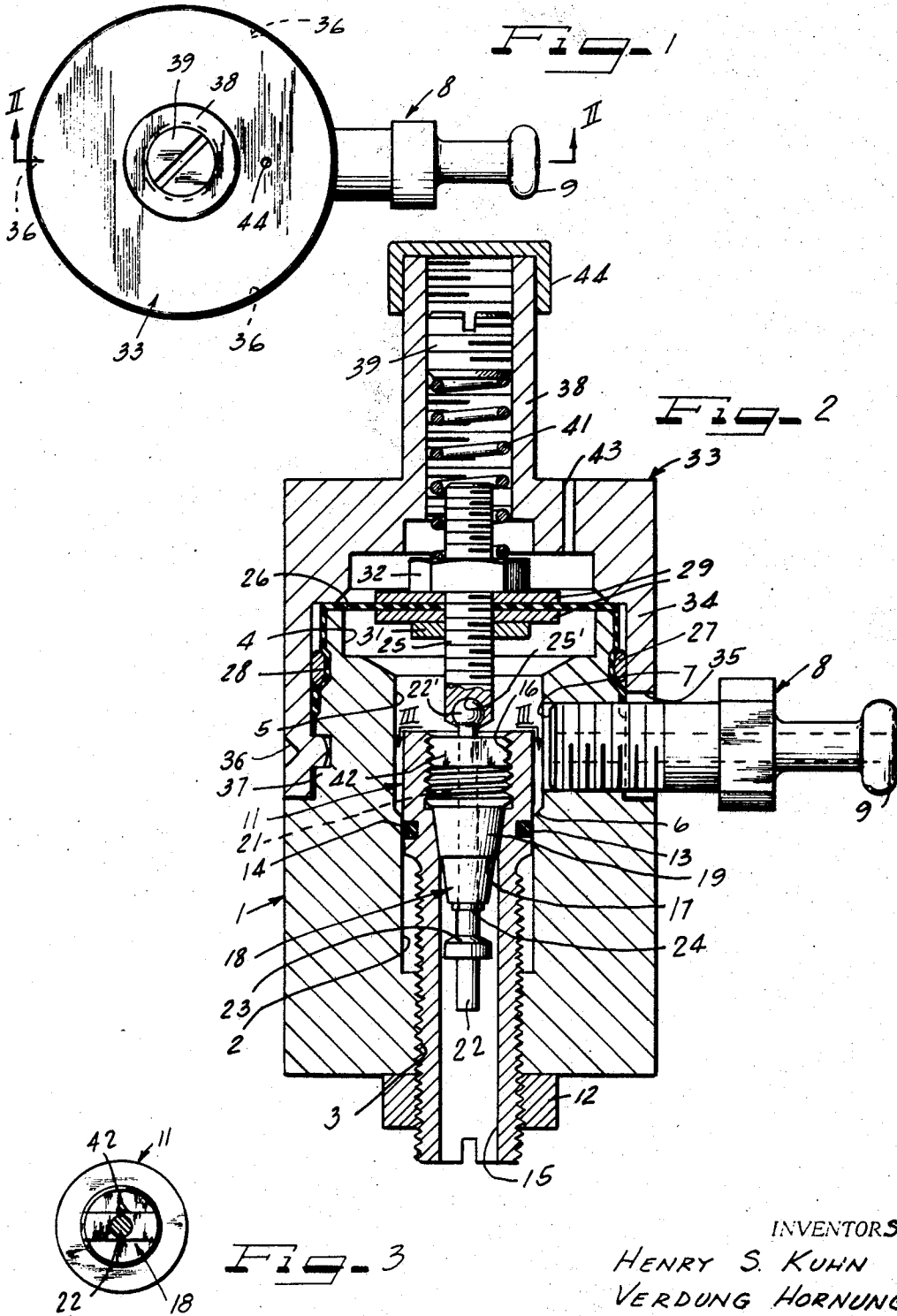


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PRESSURE REDUCING VALVE

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PRESSURE REDUCING VALVE

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2 Claims

ABSTRACT OF THE DISCLOSURE

A miniature pressure reducing control valve for low pressures comprising a hollow body structure constructed to provide a fluid chamber, open at one end, which is closed by a diaphragm, the body structure having a fluid passage therein for operatively connecting the chamber to a fluid supply, a valve structure operative to control the fluid into said chamber disposed in said passage and operatively connected to the diaphragm for actuation thereby in opposition to spring means biasing said valve structure in an open position, said body structure having a passage communicating with said chamber and forming a port for discharge of fluid therefrom.

Background of the invention

The invention is directed to a miniature pressure reducing control valve for reducing the pressure of a fluid as for example oxygen from a relatively high supply pressure to a relatively low utilization pressure, as for example, on the order of one pound or less at which the valve will automatically shut off. The device is of particular application in connection with the filling of small elastic articles to insure inflation to the desired low pressure, as for example a predetermined number of ounces per square inch.

The invention has among its objects the production of such a valve structure which will provide the desired control and at the same time is exceedingly small, for example, capable of being constructed in generally cylindrical form having an overall diameter on the order of one-inch or less and only several inches in length, enabling its use, for example, directly on the discharge nozzle of a fluid supply line.

Another object of the invention is the production of such a valve structure which, although of miniaturized construction, is extremely simple in construction and employs comparatively large, rugged working elements.

A further object of the invention is the production of such a structure, the output pressure of which is readily adjustable substantially up to the supply pressure, and which may be readily and economically produced.

Many other objects and advantages of the construction herein shown and described will be obvious to those skilled in the art from the disclosure herein given.

Summary of the invention

A pressure reducing and control valve structure constructed in accordance with the present invention employs a hollow body structure, illustrated as being formed in two parts, one of which is provided with a bore therein forming a chamber which is closed by a diaphragm, the body having two passages therein, both of which communicate with the chamber, in which one of the passages comprises a fluid inlet port and the other a fluid discharge port. Disposed in the passage forming the fluid inlet is a valve structure which may be constructed similar to the usual "valve inside" employed in automobile tire valve stems in which the valve member thereof is operatively connected to a stem axially aligned with the valve member and secured to the diaphragm, with the stem and valve member being urged in an open position

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by a spring disposed at the outer side of the diaphragm.

In the filling operation the chamber is in direct communication by means of the discharge passage with the object being filled whereby the fluid pressure in such chamber, corresponds with the fluid pressure in the article being filled. When the pressure in the chamber exceeds the biasing force of the spring means disposed at the opposite side of the diaphragm, movement of the latter will be transmitted to the valve stem whereby the valve member will move into an operatively closed position, thereby shutting off further flow of the fluid controlled by the valve.

The construction preferably is such that most of the components may be readily produced by screw machine operations, at the same time permitting simple and accurate adjustment of the pressure at which the valve closes.

Brief description of drawings

In the drawings wherein like reference characters indicate like or corresponding parts;

FIG. 1 is a top plan view of a valve structure embodying the invention;

FIG. 2 is a sectional view taken approximately on the line II—II of FIG. 1; and

FIG. 3 is a fragmentary sectional view taken approximately on the line III—III of FIG. 2.

Detailed description of the invention

The embodiment of the invention illustrated in the drawings comprises a body structure or member, indicated generally by the numeral 1, illustrated as being of generally cylindrical construction having an axially disposed bore therein, indicated generally by the numeral 2, provided at its lower end with an internally threaded portion 3 and at its upper end with an enlarged counter bore 4 forming a fluid receiving chamber, the lower portion 5 of which is of lesser diameter than the portion 4 but greater in diameter than the portion 2, with the juncture therebetween forming one offset or shoulder 6. The body member 1 is also provided with a radially extending passage 7 therein forming the discharge port for the chamber and having a fitting 8 threaded therein which is provided at its outer end with an object engaging nipple 9, adapted to be inserted in the filler opening of the object to be inflated. Disposed in the body member 1 is a valve supporting member 11, the upper end of which is disposed in the portion 5 with the lower end of the member 11 being provided with external threads thereon engaged with the threaded portion 3 of the body member and locked in position by a nut 12. The valve supporting member 11 is provided with an annular groove 13 therein, which is positioned below the offset 6 and carries an O-ring 14 engageable with the adjacent wall of the bore 2, to effectively seal the juncture between the valve supporting member 11 and the body member 1, and at the same time permitting axial adjustment of the member 11 with respect to the body member, for compensation of manufacturing tolerances, valve travel, etc.

The valve supporting member 11 is provided with an axially extending bore 15, the upper end of which is enlarged and provided with internal threads 16, adjacent the lower end of which is a downwardly tapering seat 17. Threaded into the portion 16 is a downwardly depending valve body 18 provided with a tapering portion 19 shaped complementally to the seat 17 and preferably formed from a resilient material, as for example a layer of natural or synthetic rubber, or the like, thereby forming an effective fluid-tight seal between the valve supporting member 11 and the valve body 18. Disposed in the axially extending bore 21 of the valve body 18 is a valve stem 22, having a generally conically shaped valve or sealing member 23, of a resilient material such as a natural or syn-

thetic rubber, which is cooperable with the valve seat 24 at the lower end of the valve body 18. Thus by upward movement of the valve stem 22 and engagement of the surface of the member 23 with the seat 24, the passage to the chamber 4 formed by the bore 15 may be closed. The operating movement of the valve stem 22 is controlled by an actuating stem 25, provided at its lower end with a cylindrical recess 25' in which is disposed a spherically shaped projection 22', formed on the upper end of the valve stem 22, whereby movement of the actuating stem 25 may be transmitted to the valve stem 22.

The upper end of the actuating stem 25 is operatively connected to a flexible diaphragm 26, the peripheral edges of which are secured to the upper end of the body member 1 by suitable means, illustrated as comprising an O-ring 27 which clamps the peripheral edge of the diaphragm in an annular groove 28 in the periphery of the body member 1. The diaphragm 26 is illustrated as being firmly clamped between two washers 29, the lower of which is seated on a suitable abutment member 31, which may consist of a threaded washer carried by external threads on the stem 25, with the entire assembly being locked in position by a suitable nut 32 likewise threaded on the stem 25. This construction is particularly suitable where it is desired to provide an adjustment of the stem with respect to the diaphragm. However, where such an adjustment is not necessary the abutment member 31 may, for example, take the form of a snap ring which is locked in an annular groove on the stem 25.

The upper portion of the stem 25 and diaphragm 26 is enclosed by a cover member, indicated generally by a numeral 33, having a cylindrical side wall 34, the inner diameter of which is so selected that it will effect a compression of the O-ring 27, thereby firmly locking the O-ring in clamping relation. The side wall of the cover member may be provided with a slot 35 adapted to receive the fitting 8, and the cover member may be secured to the body 1 by any suitable means, as for example by staking 36 at spaced points about the periphery of the cover member to swedge the material thereof into an annular groove 37 in the body member 1.

The cover member is provided at its upper end with an axially extending tubular portion 38, the interior of which is threaded and is adapted to receive a set screw 39, engageable with the upper end of a compression spring 41, the lower end of which bears on the nut 32, thus urging the actuating stem 25 and valve stem 22 in a downward direction as viewed in FIG. 2, which represents the open position of the valve. Thus the adjustment of the set screw 39, the compression of the spring 41 may be varied and the closing pressure of the valve thereby adjusted.

As illustrated in FIGS. 1 and 3, the valve body must be provided at its upper end with an upwardly directed, diametrically extending relatively narrow projection 42 through which the valve stem 22 extends. In assembly, the valve body may be readily turned down into operative position by means of a suitable tubular tool having an inner diameter slightly greater than that of the stem 25, and having a slot in the lower end thereof of a size to receive the projection 42. Likewise the cover member may be provided with a vent passage 43, therein to insure equalization of the air pressure within the cover member with the external air pressure, as well as function as a safety valve in the event the diaphragm 26 ruptures.

Assuming the device is employed in connection with the filling of an inflatable article, following engagement of the nipple 9 with the filler opening of such article, fluid is supplied to the lower end of the bore 15 from which it may flow through the valve body 18 into the lower portion 5 of the receiving chamber and discharge through the fitting 8. This will continue until the pressure within the article being inflated and thus in the chamber 4 reaches a sufficient magnitude that the diaphragm 26 and with it the actuating stem 25 is moved in an upward

direction, as viewed in FIG. 2, in opposition to the action of the compression spring 41, a sufficient distance to effect a seating of the valve or sealing member 23 on the cooperable valve seat 24 of the valve body 18, thereby preventing further flow of fluid into the chamber 4 and the article being inflated. The pressure within such article and in the chamber 4 operative to actuate the closure of the valve structure may be readily determined by adjustment of the set screw 39, to vary the biasing force on the diaphragm. To protect the set screws as well as prevent tampering with the adjustment thereof, a suitable cap 44 may be provided, for example of a suitable rubber or other material whereby the cap may be readily frictionally engaged with the free end of the rubber portion 28.

It will be apparent from the above disclosure that we have provided a very simple yet highly efficient pressure reducing and shut-off valve structure which is exceedingly compact in size and at the same time very efficient for controlling the low pressure filling of inflatable articles and the like.

We claim:

1. A miniature pressure reducing valve for low pressure operation, comprising a hollow body structure constructed to provide a fluid chamber open at one end, said body structure having a passage therein communicating with and forming a fluid discharge port for said chamber and provided with a discharge fitting, a diaphragm closing said open end, said body structure having a fluid inlet passage therein for operatively connecting said chamber with a fluid supply, which fluid inlet passage is formed by a tubular, valve-supporting member secured to said body structure and extending outwardly therefrom to provide an inlet fitting for connection to a fluid supply, gasket means disposed between said body structure and valve supporting member, the latter having an internally threaded portion at its inner end, a valve structure operative to control the flow of fluid into said chamber, comprising a valve body threaded into said threaded portion and having an external conical sealing face bearing on a complementary seat formed in said supporting member, means operatively connecting said diaphragm and said valve structure for controlling the actuation thereof comprising an actuating stem movable with said diaphragm and having an end operatively connected with the other end of said valve stem for transmitting movement of the diaphragm thereto, the connection of said valve stem with the actuating stem comprising a generally spherically shaped projection on the adjacent end of the valve stem, disposed in a complementary recess in the adjacent end of said actuating stem, the inner end of said valve body, with respect to said valve supporting member, terminating in a valve seat, a valve stem disposed in said valve body and having an end extending therefrom at said valve seat, a valve element carried by such exposed end of the valve stem cooperable with said valve seat for selectively closing said inlet passage a generally cylindrically shaped cover member having a depending side wall concentrically disposed with respect to the end portion of said body structure carrying said diaphragm, the latter extending over said open end and back along the adjacent exterior side-wall surface thereof, which is provided with a circumferentially extending groove therein, an O-ring engageable with said diaphragm to maintain the peripheral portions thereof in said groove, said depending side wall of said cover member enclosing the O-ring and adjacent portion of the diaphragm, said cover member having an internally threaded, axially extending bore therein, spring means for biasing said valve structure in an open position comprising a compression spring extending into said bore, and a set screw disposed in said bore and engageable with the adjacent end of said spring, the opposite end of the latter being disposed to apply biasing pressure on said actuating stem.

2. A pressure reducing valve according to claim 1, wherein said body structure is provided with a second

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circumferentially disposed groove, said cover member having an inwardly directed projection thereon extending into said second groove for locking said cover member to said body structure, said cover member having a vent passage therein communicating with the interior of the cover member for equalizing air pressure therein.

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