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DIAPHRAGM OPERATED VALVES

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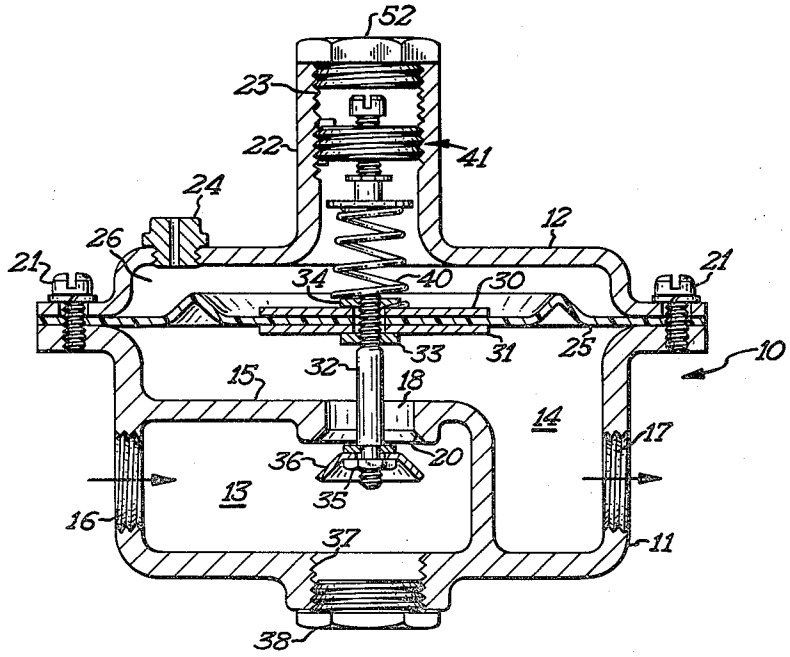


Fig 1

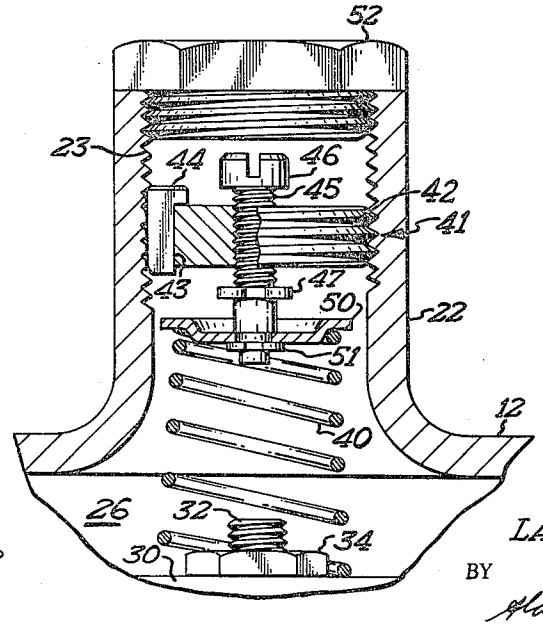


Fig 2

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DIAPHRAGM OPERATED VALVES

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This invention relates to diaphragm operated valves and, more particularly, to a novel device for adjusting the spring bias on the diaphragm operator.

In the construction of diaphragm operated valves, it is customary to have one side of the diaphragm exposed to a source of fluid under pressure, and to have a spring acting on the other side of the diaphragm to oppose the force of the pressurized fluid. This spring therefore acts to control the action of the diaphragm. In this type of arrangement, it is also customary to provide some means for adjusting the bias on the spring. In most cases this is done by simply providing an adjustment screw which is threaded into the body of the valve and which may be adjusted so as to determine the amount of bias on the spring. This type of arrangement usually provides a wide range of adjustment of the spring so that the valve may be caused to operate in response to any one of a wide range of pressures. An arrangement of this type is quite satisfactory in that a single valve may be used for a number of different applications and may be operated in response to a wide range of pressure conditions. When the valve is installed in a particular system, an adjustment may be made to provide the desired operation for that particular installation. In many cases the adjustment of the valve is not particularly critical and may be made by a relatively unskilled person without danger of the system malfunctioning or becoming hazardous because of an incorrect adjustment. This is often particularly true in low pressure systems such as in many gas furnace installations.

In other installations, however, the adjustment of the valve is more critical. This is true particularly in systems which operate under somewhat higher pressures or require a very accurate adjustment to insure proper operation of the system, for instance in systems using liquid petroleum gas. For valves which are to be used in this type of installation, it has been found very desirable to make an initial calibration or adjustment of the valve in the factory where it is made, and then to allow only a very limited adjustment when the valve is installed in the system. This insures that after this initial adjustment, the valve can be adjusted only over a range which will eliminate hazard to the user or the possibility of malfunction of the system. For reasons of economy it has been found that it is particularly desirable to have an adjustment device to perform these functions which can be readily applied to a standard type of valve without the necessity of redesign or retooling.

It is therefore an object of this invention to provide a novel arrangement for adjusting the spring bias on a diaphragm valve operator.

Another object of this invention is to provide a device for adjusting the spring bias on the diaphragm of a valve wherein an initial or factory calibration can be made, and thereafter only limited adjustment can be made.

Another object of this invention is to provide a device for adjusting the spring bias on the diaphragm of a diaphragm controlled valve which provides an initial or coarse adjustment member which may be locked in position after the initial adjustment is made, and a second adjustment member to provide only limited adjustment thereafter.

Another object of this invention is to provide an adjustment device as described above wherein the limited adjustment member is mounted directly on the initial adjustment member so that the two members form a single unit readily mountable in a pressure regulator or other diaphragm controlled valve.

Still another object of this invention is to provide an adjustment device as previously described which is compact, low in cost, and is readily adaptable for use in diaphragm operated valves currently being produced so that no redesign or retooling is required for the valve.

These and other objects of the invention will become apparent upon reading the following detailed description of the invention in conjunction with the accompanying drawing wherein:

FIGURE 1 is a cross-sectional view of a fluid pressure regulator valve which utilizes a novel spring bias adjustment device which is the subject of the present invention.

FIGURE 2 is an enlarged view of a portion of the pressure regulator of FIGURE 1 shown partially in cross-section and showing particularly the spring bias adjustment mechanism.

Referring to FIGURE 1, the reference numeral 10 generally designates a fluid pressure regulator including a body portion 11 and a cover member 12. Body portion 11 includes an inlet chamber 13 and an outlet chamber 14 with a wall portion 15 therebetween. Body member 11 is further provided with a threaded inlet port 16 opening into the inlet chamber and a threaded outlet port 17 opening from the outlet chamber. Wall 15 has an opening 18 therethrough, connecting the inlet and outlet chambers. Opening 18 has formed at the end thereof which extends to the inlet chamber, a frustoconical section 20 which provides a valve seat.

Cover member 12 is generally cup-shaped and is mounted in an inverted position on body member 11 by bolts 21 or similar fastening means. Extending upwardly from cover member 12 is a hollow neck portion 22 which is provided with internal threads 23. Cover member 12 is further provided with a vent plug 24 which has an opening therethrough to connect the interior of the cover with the atmosphere.

Mounted between body 11 and cover 12 is a flexible diaphragm 25 which has its outer periphery secured between the cover and body members by bolts 21. Diaphragm 25 is thus positioned so that its underside is in communication with outlet chamber 14, and so that its upper side cooperates with the cup-shaped cover member 12 to form a control chamber 26. A pair of rigid and centrally apertured disks 30 and 31 are placed one on either side of diaphragm 25 and are of a diameter such that the central portion of diaphragm 25 is rigidized thereby. Extending through the apertures of disks 30 and 31 and through an aperture in the center of diaphragm 25, is a valve stem 32 which is threaded at each of its ends.

A pair of nuts 33 and 34 are threaded onto valve stem 32 at its upper end and engage disks 30 and 31 so as to tightly fix the disks to the diaphragm, and to attach the valve stem thereto. Attached to the other end of the valve stem by a nut 35 is a valve member 36 which cooperates with valve seat 20 to control the flow of fluid from inlet chamber 13 to outlet chamber 14. A threaded opening 37, through body 11 and opening into chamber 13 is provided to allow insertion of the stem and valve and is closed by a threaded plug 38.

On the upper side of diaphragm 25, in control chamber 26, is mounted a spring 40 which imparts a bias to the diaphragm in opposition to the pressure in outlet chamber 14. Threaded into the hollow neck portion 22 of the cover 12 and engaging spring 40 is a spring-bias

adjustment mechanism 41 which is the subject of the present invention.

Referring now to FIGURE 2 where the spring bias adjustment mechanism is shown in more detail, an initial adjustment member 42 is threaded into the internal thread 23 of the neck portion 22. Member 42 is a generally cylindrical member with external threads formed on its outer periphery, and a key slot 43 extending axially along one side thereof. A key is inserted into the slot 43 and engages the internal threads 23 to prevent movement of memebr 42 after an initial setting thereof is made. A second adjustment member 45 is threaded through an internally threaded aperture through the center of member 42. The movement of adjustment member 45 with respect to member 42 is limited by a head 46 and a snap ring 47 on opposite ends of a threaded portion thereof, so that only a very limited movement is permitted between the two members. Secured to the lower end of adjustment member 45, is a spring engaging member 50 which is attached to the member 45 by a snap ring 51 or other appropriate means. A sealing plug 52 is threaded into the open end of neck portion 23 and is removable so that adjustment of adjustment member 45 can be made.

Prior to my present invention, the only means for adjusting the bias on spring 40 was provided by a single bias adjustment screw which was threaded into the neck portion 22. The present device requires no modification of the valve body or cover, since the spring bias adjustment mechanism is merely threaded into the neck as was done with the previous device. However, my invention provides a means whereby an initial adjustment may be made in the factory, and thereafter only a very limited adjustment is permitted. The manner in which this is accomplished will be further described below.

When the valve is assembled in the factory, the initial adjustment member 42 is threaded into the neck portion 22, carrying along with it the second adjustment member 45 and the spring engaging member 50. The valve is then tested and member 42 is adjusted so that it is at a position whereby the bias on spring 40 is approximately that which will be required in the operation of the valve. After member 42 is thus positioned, key 44 is forced into slot 43 so as to engage and deform a portion of threads 23. Hereafter, no further movement of member 42 is permitted. When the valve is installed in a system where it is to be used, a limited adjustment may be made by movement of member 45 with respect to member 42. This movement, which is limited to a very small range, is sufficient to provide final adjustment of the bias on spring 40 to cause the valve to operate properly in the system where it is to be used. However, the amount of movement of adjustment member 45 is so limited that no adjustment can be made which might result in a dangerous pressure condition in the system.

From the foregoing it can be seen that my invention provides a novel spring bias adjustment device wherein a first adjustment or calibration can be made over a rather wide range, and thereafter only a very limited range of adjustment is allowed. Further, I have provided an arrangement wherein the two adjustment members form a single unit which is readily mounted in a pressure regulator or similar valve. It will further be seen that the device is very compact and is readily adaptable for use in valves presently being produced so that no costly redesign or retooling is required.

While I have shown a specific embodiment of my invention used in a fluid pressure regulator, it is to be understood that this is for illustrative purposes only and that, obviously, it will find utility in other devices. It is further to be understood that the invention is to be limited only by the scope of the appended claims.

I claim as my invention:

1. Apparatus for adjustably loading the biasing spring of a fluid pressure regulator comprising: a housing member for the biasing spring, said housing member having a threaded aperture formed therein; a first externally threaded adjustment member threaded into said aperture and movable through a substantial axial distance with respect thereto to facilitate an initial coarse adjustment of the loading on the spring, said first adjustment member having an aperture extending therethrough; means operable to deform a portion of the threads intermediate said housing member and said first adjustment member to permanently lock said first adjustment member with respect to said housing after an initial adjustment is made; a second adjustment member extending through the aperture in said first adjustment member and being axially movable with respect thereto; abutment means on said second adjustment member, on each side of said first adjustment member, for limiting relative axial movement with respect thereto to facilitate limited adjustment of the loading on the spring after said first adjustment member is locked; and means carried by said second adjustment member and engaging one end of the spring to compress the spring according to the positions of said first and second adjustment members with respect to said housing.

2. Apparatus for adjustably loading the biasing spring of a fluid pressure regulator comprising: a housing in which the biasing spring is mounted, said housing having a threaded aperture formed therein; a first cylindrical adjustment member threaded into the aperture in said housing and having substantial axial movement with respect to said housing to facilitate an initial adjustment of the load on the spring, said first adjustment member having a threaded aperture formed axially therethrough and a longitudinally extending slot along the periphery thereof; a locking key forcibly insertible in said slot to deform the threads in said housing to permanently lock said first adjustment member with respect to said housing after an initial adjustment is made; a second adjustment member threaded into the aperture in said first adjustment member, said second adjustment member having abutment means thereon on each side of said first adjustment member to limit relative movement with respect thereto to provide limited adjustment of the loading on the spring after said first adjustment member is locked; and a spring engaging member mounted on said second adjustment member and engaging one end of the spring to compress the spring an amount determined by the positions of said first and second adjustment members with respect to said housing.

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