Sept. 8, 1942. L. V. McCARTY 2,295,044

VALVE

Filed March 30, 1940

Fig. 1.

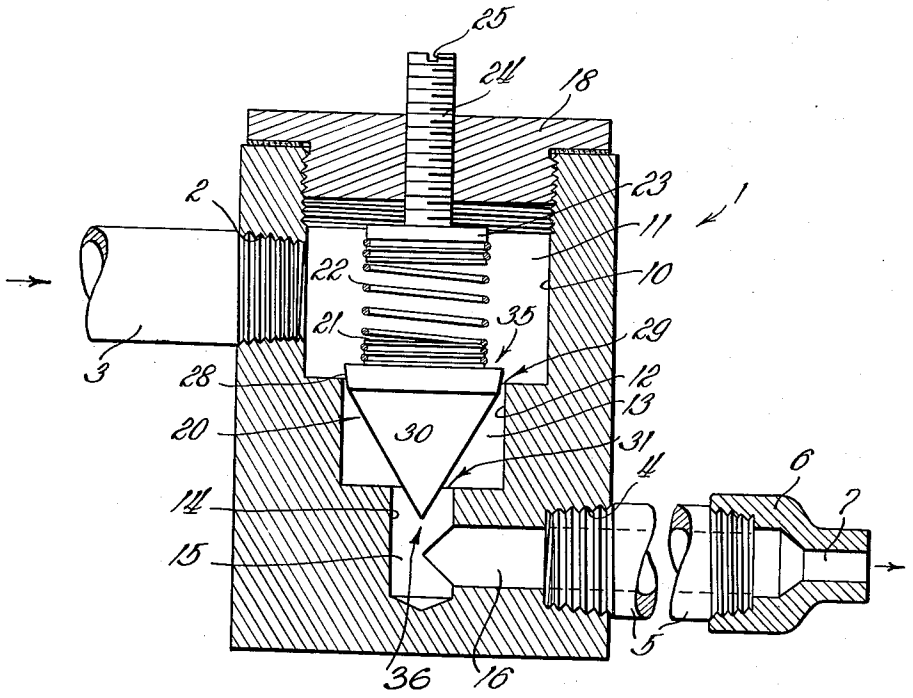
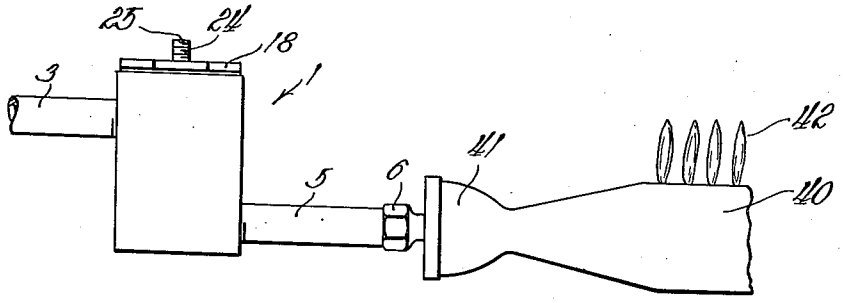


Fig. 2.



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VALVE

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8 Claims. (Cl. 50—14)

The present invention relates to an improvement in valves and is more particularly concerned with the provision of a valve for regulating the flow of fluid therethrough to maintain the delivery pressure in the outlet of the valve constant regardless of variations of head pressure of the fluid supply at the inlet of the valve.

The valve of the present invention is particularly applicable for use in connection with gas appliances which are connected to a main or manifold as a source of gas supply. The head pressure of the fuel gas in the supply main or manifold frequently rises and falls so that gas being discharged at a burner head or other discharge means, issues at either excessive or deficient pressures, depending upon the head pressure in the supply main or manifold. This is highly disadvantageous for several reasons. For example, most burners are adjusted for a certain pressure and volume of gas delivery and if the pressure in the gas supply main or manifold rises and falls, the set adjustment of a burner head, for example, will not be proper for the changing conditions. This results in an excessive and inefficient flame if the head pressure is relatively high or the flame of the burner may become extinguished if the main pressure head drops too low. It is desirable, therefore, to provide a valve between the gas supply main or manifold and the burner head or other member to maintain the delivery pressure and volume of gas to the burner head or other member constant to compensate for variation of head pressure in the main. While the valve of my invention is admirably suited for the purpose noted, it will be borne in mind that it is equally applicable for other purposes.

The primary object of my invention therefore is to provide a valve having means for maintaining the delivery pressure of fluid through a fixed discharge opening constant, regardless of fluctuations of the supply head pressures of the fluid at the inlet of the valve. More specifically, it is a further object of the invention to provide a valve having an inlet chamber, an outlet chamber, an intermediate chamber or chambers, and means cooperating with the intermediate chamber or chambers for maintaining the delivery pressure at the outlet of the valve constant.

A still further object is the provision of a valve of the character noted which is composed of a few parts and is economical to manufacture.

These and other objects and advantages will be apparent to those skilled in the art after a consideration of the following detailed description, when considered in connection with the accompanying drawing illustrating a specific embodiment of a valve constructed in accordance with the principles of my invention.

In the drawing:

Figure 1 is a detail vertical sectional view of the valve of my invention, certain parts being shown in elevation; and

Figure 2 is an elevational view of the valve of my invention employed with a gas burner.

Referring now to the drawing, I have shown a valve housing 1 having a tapped inlet 2 and a gas main or supply manifold 3 threaded therein. The valve housing is provided with a second tapped discharge outlet 4, in which a conduit 5 is threaded. The conduit 5 is provided at its opposite end with a suitable spud 6 having a reduced discharge orifice 7.

The valve housing is preferably suitably bored at 10 to provide an inlet chamber 11 communicating with the gas supply manifold 3. A counterbore 12 extends coaxially of the bore 10 from the inner end thereof to form a suitable intermediate or control chamber 13. A second counterbore 14 extends coaxially of the first counterbore 12 from the inner end thereof to form an outlet chamber 15, which communicates through the duct 16 with the discharge conduit 5 and discharge orfice 7. The valve housing 1 is tapped at the outer end of the bore 10 to receive a threaded cover member 18 to close the outer open end of the bore. A double valve member 20 having a boss or lug portion 21 is suitably suspended within the intermediate chamber 13 by means of a tension spring 22, threaded or otherwise suitably secured at one end to the boss or lug 21, which spring is similarly secured at its opposite end to a lug or boss 23 preferably formed integral with a threaded stud 24. The threaded stud 24 is carried by the cover member 18 and may be provided with a kerf 25 for adjusting the position of the double valve member 20 within the main valve housing. The double valve member 20 is formed with a downwardly tapering portion 28 for regulating the area of an upper valve orifice 29 through which the inlet chamber 11 and control chamber 13 communicate, and is further provided with a downwardly extending cone portion 30 for regulating the area of the lower valve orifice 31 through which the control chamber 13 and outlet chamber 15 communicate. The cone portion 30 and the tapering portion of the valve 28 may also be of curved configuration. The double valve member 20 is preferably made so that the intermediate effective valve area 30 is equal to the upper valve area 35, less the area

of the orifice 31. The double valve member is so formed that, when the valve is raised, the orifice 29 increases less than the oirifice 31, and, conversely, if the double valve member is lowered, the orifice 31 decreases more than the orifice 29.

The operation of the valve is as follows:

Fluid under pressure enters the inlet chamber 11 from the supply manifold 3 and the head pressure of the fluid, acting upon the area 35 of the double valve member 20, tends to close the double valve. Opposing this force, tending to close the valve, is the tension spring 22. The pressure in the intermediate chamber 13 acts on the effective cross-sectional area of the cone portion 30 of the double valve 20; and the force of the pressure in the outlet chamber 15 created by the restricted port 7 of the discharge nozzle or spud 6 acts on the area of the orifice 31 of outlet chamber 15. It is the pressure in the outlet chamber 15 and duct 16 that it is desired to maintain substantially constant at all times. It will be understood that, if desired, a restricted orifice could be made directly in the valve body 1, and it is not essential that the conduit 5 and spud 6 be employed for this purpose. The particular construction shown is desirable when the valve is to be employed in the illustrated application of the invention to a gas burner.

Assume, for purposes of illustration, that the head pressure in the supply manifold is known, spring 22 under correct tension, and the double valve is in properly adjusted position to maintain the desired discharge pressure in the outlet chamber 15 and duct 16. Now, if the double valve is raised by some external means, more fluid will flow through orifices 29 and 31, and the pressure in the outlet chamber 15 will increase, but since the arrangement is such that orifice 29 increases less than the orifice 31, the pressure in the intermediate chamber 13 will decrease. Since the effective cross-sectional area of cone member 30 of the double valve 20 is greater than the cross-sectional area 36 of the orifice of the outlet chamber 15, the resultant force decreases, tending to close the double valve member 20, causing the double valve member to assume its original position and the pressure in the outlet chamber 15 and duct 16 to assume its original value. It is believed to be obvious that if the above conditions are reversed, i. e., that the double valve member 20 is lowered by some external means, the double valve tends to open and thus restore the initial conditions.

When the valve is installed between the gas supply manifold 3 and a burner head, and the pressure in the manifold 3 increases, the double valve member 20 is urged to closed position. Since the orifice areas 29 and 31 and tension spring 22 are designed to change with the correct ratios upon either an increase or decrease in head pressure as the valve closes, the force of spring 22 opposing the head pressure increases; and as the area of the lower orifice 31 decreases more than the area of the upper orifice 29, the pressure in the intermediate chamber 13 increases. This increased pressure in the chamber 13 acting on the effective area of the cone member 30 tends to open the valve 20. By properly balancing the spring 22 and forming the double valve member 20 to proportionally regulate the areas of the orifices 29 and 31, the increased closing force due to increased head pressure in the inlet chamber 11 can be balanced by the force of the spring 22 and the pressure in the intermediate chamber 13 acting upon the cone member 30, so that the double valve 20 assumes a position which will maintain the predetermined pressure in the outlet chamber 15, and consequently the delivery pressure and volume of gas flow through the discharge duct 7 will be substantially constant.

It is to be understood that any desired ratio between orifices 29 and 31 may be obtained by suitably forming or shaping the double valve member 20, so that a substantially constant outlet pressure can be maintained within a wide range of pressures in the supply manifold. Since the tension spring 22 is part of the force resisting the head pressure in the inlet chamber 11, it will be seen that there is some maximum value of head pressure when the pressure in the discharge chamber 15 will fall off. However, a spring of suitable strength may be designed for any purpose to which the valve may be put and can be designed to cover a wide range of variations in head pressures in the particular adaptation of the valve. It will be understood that the minimum value of the discharge delivery pressure at the port 7, is the pressure of the fluid in the supply manifold less the pressure drop through the valve.

Referring to Figure 2, I have shown the valve of my invention embodied for use with a gas burner head 40. It will be apparent from the above description of the operation of the valve, that the gas issuing from the discharge nozzle into the Venturi tube 41 of the burner 40 will result in uniform burning of flame 42.

It is to be understood that devices other than the one illustrated may be constructed embodying the principles of the present invention, and that I do not intend to be limited to the precise construction shown since obvious modifications may be made therein without departing from the spirit and scope of the present invention.

I claim:

1. A valve for regulating the flow of fluid therethrough, comprising a valve housing having an inlet chamber and an outlet chamber, a third chamber intermediate said inlet and said outlet chambers, there being an upper valve orifice between said inlet chamber and said third chamber and a lower valve orifice between said third chamber and said outlet chamber, and valve means for varying the effective cross-sectional area of said orifices, said valve means being movable responsive to increased pressure in said inlet chamber for decreasing the area of said lower valve orifice at a faster rate than the area of said upper valve orifice to maintain the pressure in said outlet chamber substantially constant.

2. A valve for regulating the flow of fluid therethrough, comprising a valve housing having an inlet chamber and an outlet chamber, a third chamber intermediate said inlet and said outlet chambers, there being an upper valve orifice between said inlet chamber and said third chamber and a lower valve orifice between said third chamber and said outlet chamber, and valve means for varying the effective cross sectional area of said orifices, said valve means being movable responsive to reduced pressure in said inlet chamber for increasing the area of said lower valve orifice at a faster rate than the area of said upper valve orifice to maintain the pressure in said outlet chamber substantially constant.

3. A valve for regulating the flow of fluid therethrough, comprising a valve housing having an inlet chamber and an outlet chamber, said

outlet chamber having a fixed fluid discharge orifice, a third chamber intermediate said inlet and said outlet chambers, said third chamber having an upper valve orifice and a lower valve orifice, a double valve member for varying the flow of fluid through said orifices, and resilient means for said double valve member opposing the head pressure of said fluid in said inlet chamber, said double valve member upon an increase in head pressure in said inlet decreasing the area of said lower valve orifice at a greater rate than the area of said upper valve orifice and, upon a decrease in head pressure in said inlet, increasing the area of said lower valve orifice at a greater rate than the area of said upper valve orifice, said double valve member and said resilient means compensating for variations in head pressure of said fluid in said inlet chamber thereby maintaining the fluid pressure in said outlet chamber substantially constant.

4. A valve for regulating the flow of fluid therethrough, comprising a valve housing having an inlet chamber and an outlet chamber, said outlet chamber having a fixed fluid discharge orifice, a third chamber intermediate said inlet and said outlet chambers and having an upper and a lower valve orifice, a double valve member disposed in said intermediate chamber, spring means fixed to said double valve member and said valve body for resisting the head pressure of said fluid in said inlet chamber, said double valve member upon an increase in head pressure in said inlet chamber decreasing said lower valve orifice at a greater rate than said upper valve orifice and upon a decrease in head pressure in said inlet chamber for increasing said lower orifice at a greater rate than said upper orifice, said double valve member and said spring means compensating for variations in head pressure in said inlet chamber thereby maintaining the fluid pressure in said outlet chamber substantially constant.

5. A valve comprising a valve housing having an inlet port and a fixed outlet port, a bore in said valve housing forming an inlet chamber and communicating with said inlet port, a first counterbore in said valve housing forming an intermediate chamber, a second counterbore in said valve housing forming an outlet chamber and communicating with said outlet port, cover means for closing said bore, said bore and said first counterbore defining an upper valve orifice, and said first counterbore and said second counterbore defining a lower valve orifice, a valve member for regulating the effective area of said orifices, said valve member being movable responsive to an increase in pressure in said bore for closing said lower valve orifice at a greater rate than said upper valve orifice, and being movable responsive to a decrease in pressure in said bore for increasing the opening of said lower valve orifice at a greater rate than said upper valve orifice to maintain the pressure in said outlet chamber substantially constant.

6. A valve comprising a valve housing having an inlet port and a fixed outlet port, a bore in said valve housing forming an inlet chamber and communicating with said inlet port, a first counterbore in said valve housing coaxial with said bore forming an intermediate chamber, said inlet chamber and said intermediate chamber forming an upper valve orifice, a second counterbore in said valve housing coaxial with said bore and said first counterbore forming an outlet chamber and communicating with said outlet port, a cover member for closing said bore, a double valve member disposed in said valve housing, said valve member being adapted to close said lower valve orifice at a faster rate than said upper valve orifice and, conversely, to open said lower valve orifice at a faster rate than said upper valve orifice, a spring fixed to said double valve member and said cover member, and means for adjusting the position of said double valve member within said valve housing.

7. A valve for regulating the flow of fluid therethrough, comprising a valve housing having an inlet chamber and an outlet chamber, said outlet chamber having a fixed fluid discharge orifice, a third chamber intermediate said inlet and said outlet chambers, said third chamber having an upper and a lower valve orifice, and a double valve member adapted to close said lower valve orifice at a greater rate than said upper valve orifice and conversely open said lower valve orifice at a greater rate than said upper valve orifice, said double valve member being formed so that the portion thereof subject to the fluid pressure in said intermediate chamber is of an area substantially equal to the area of the portion of the valve member subject to the fluid pressure in said inlet chamber less the area of said lower valve orifice.

8. A valve for regulating the flow of fluid therethrough, comprising a valve housing having an inlet chamber and an outlet chamber, said outlet chamber having a fixed fluid discharge orifice, a third chamber intermediate said inlet and said outlet chamber, said third chamber having an upper and a lower valve orifice, a double valve member adapted to close said lower valve orifice at a greater rate than said upper valve orifice and conversely, open said lower valve orifice at a greater rate than said upper valve orifice, said double valve member being formed so that the portion thereof subject to the fluid pressure in said intermediate chamber is of an area substantially equal to the area of the portion of the valve member subject to the fluid pressure in said inlet chamber less the area of said lower valve orifice, and a spring fixed to said double valve member and said valve body, said upper and lower orifices, said double valve member and said spring being adapted to maintain the fluid pressure in said outlet chamber substantially constant.

LOURDES V. McCARTY.