May 1, 1934. G. B. SHAWN 1,956,977

COMBINED REGULATING AND SNAP ACTION GAS VALVE

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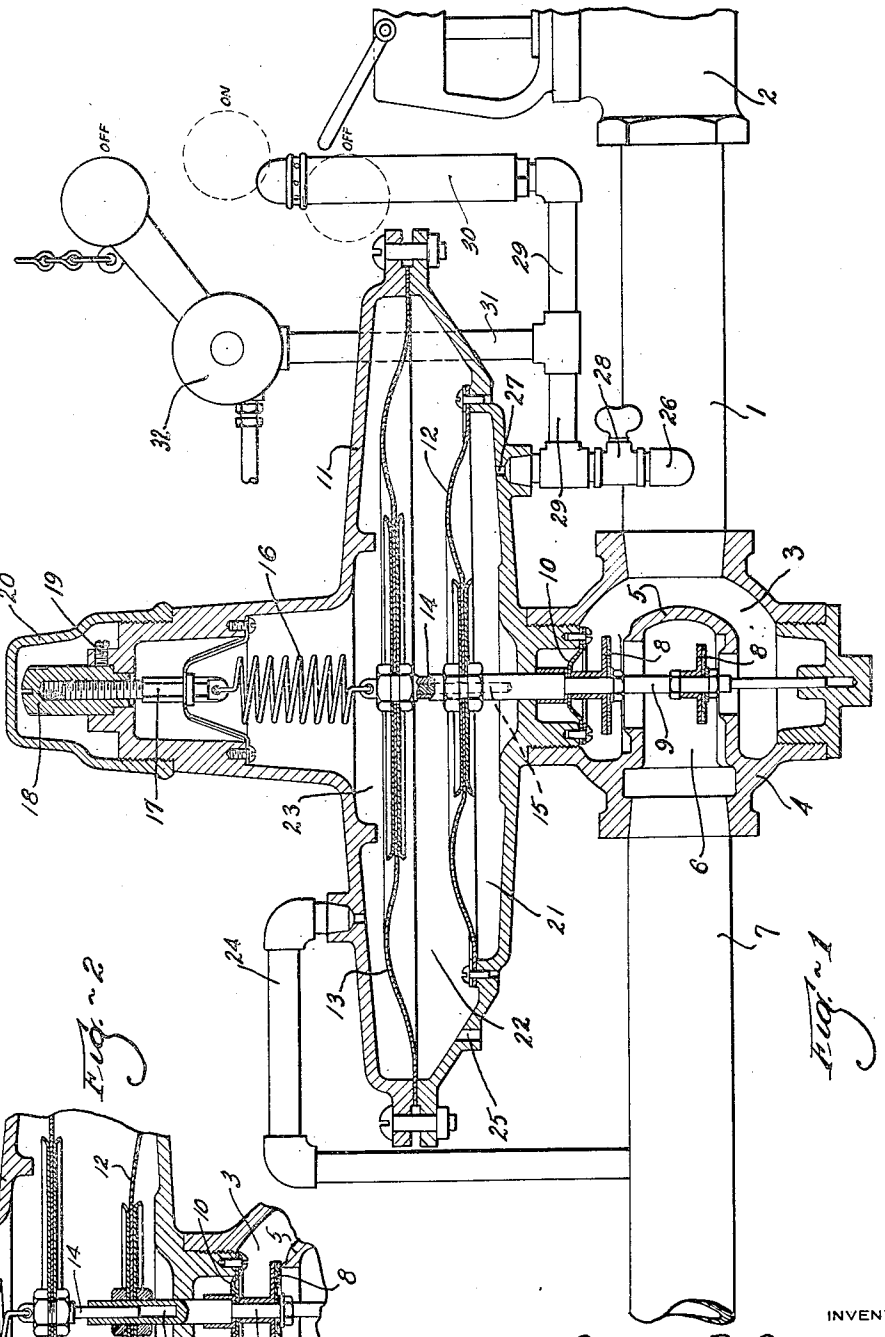


Fig. 1

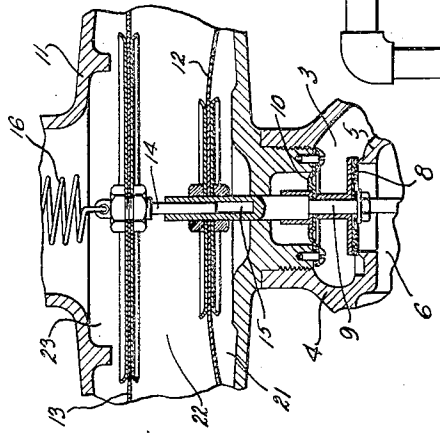


Fig. 2

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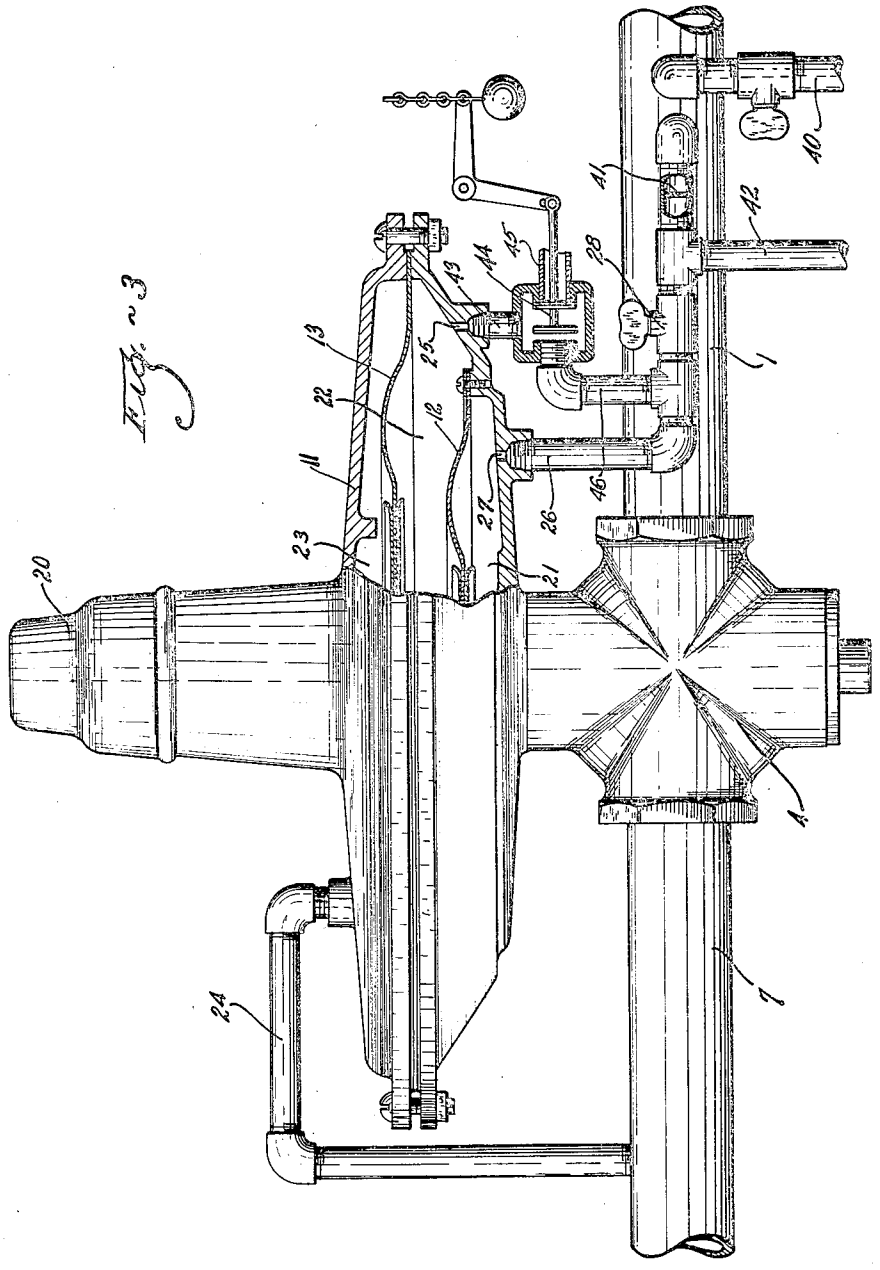
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Fig. 3



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COMBINED REGULATING AND SNAP ACTION GAS VALVE

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3 Claims. (Cl. 137—153)

This invention relates to a combined regulating and snap action valve of the type utilized for controlling the flow of fuel gas to a burner, although it is useful in many other places where fluid pressure control is desirable.

The object of the invention is to provide an improved valve mechanism of simple construction which is not likely to get out of order and which combines the features of both a snap action cut-off valve and a pressure regulating valve; which mechanism is arranged for convenient adjustment of the pressure to be maintained and for positive operation as a cut-off valve; and which valve mechanism includes two diaphragms located in the same chambered casing and operating at times independently of each other and at other times conjointly, all for the purposes herein described.

Further objects of the invention are in part obvious and in part will appear more in detail hereinafter.

In the drawings, Fig. 1 is a sectional elevation illustrating one embodiment of the invention; Fig. 2 is a similar view of a part of the mechanism, illustrating another position of the parts; and Fig. 3 is a view partly in side elevation and partly in section, corresponding to Fig. 1 and illustrating another arrangement of the controlling features.

While the drawings, for purposes of illustration, show the valve mechanism arranged to control the flow of fuel gas to a burner, it is to be understood that the invention is not so limited and that the mechanism may be employed for any purpose where cut-off or pressure regulation is desirable. As illustrated, the gas is led to the burner by way of a supply main 1 equipped with a suitable hand cut-off valve 2, beyond which the supply main communicates with a supply chamber 3 within a valve body 4 provided with the usual ported cross wall 5 separating the supply chamber 3 from the discharge chamber 6 which communicates by an outlet pipe 7 with the burner to be controlled. Within the valve body is a suitable valve member including, in the arrangement shown, two discs 8 cooperating with the ports in the cross wall and carried by a guiding stem 9 sliding in suitable guides and attached to a small diaphragm 10 for preventing gas leakage. The said stem extends into a hollow casing 11 where it is attached to a lower and smaller flexible diaphragm 12. Above said diaphragm is an upper larger diaphragm 13 attached to a stem 14 which has a reduced portion telescoping and sliding in an opening 15 of the stem 9, said upper diaphragm being yieldingly supported by a tension spring 16 attached to a rod 17 adjustable vertically in the casing by the adjusting nut 18 adapted to be held in any adjusted position by the set screw 19 and ordinarily concealed by the cover or cap 20.

As will be observed, the two diaphragms 12, 13, together with the walls of the casing 11, form three chambers within said casing, to wit, a lower chamber 21, an intermediate chamber 22, and an upper chamber 23.

Chamber 23 is at all times in communication with the discharge pipe, such as by means of a by-pass pipe 24. Chamber 22 at all times is in communication with atmosphere, such as by an open vent port 25. Chamber 21 is utilized as a control chamber as will appear, and therefore communicates at times with the pressure supply pipe 1 and at times with atmosphere by way of a suitable vent. In the arrangement shown, communication with the supply pipe 1 is by way of a by-pass pipe 26 and a port 27 opening into the lower chamber 21. The pipe 26 is provided with a control valve, such as a hand valve 28, and also communicates by way of a pipe 29 with an escapement burner 30. The pipe 26 also communicates by way of a pipe 31 with any suitable control valve, such as the valve conventionally illustrated at 32 and later to be referred to more in detail.

This arrangement, assuming the hand cut-off valve 2 closed, permits no gas flow to or through the valve mechanism, which, of course, is vented to atmosphere by way of the discharge pipe 7 and the main burner (not shown). Valve 8 is closed because its own weight is sufficient to cause it to drop to sealing position at the orifices in the cross wall 5. The diaphragm 12 is hence in its lowest position and the upper diaphragm 13 is elevated by the tension spring 16 to its uppermost position, which depends upon the adjustment of the pressure regulating nut 18. The parts as a whole are therefore in the position shown in Fig. 2.

When the hand valve 2 is turned on, pressure flows to the supply chamber 3 but no farther, because valve 8 is closed. By opening the hand cock 28 supply pressure flows by way of pipe 26 to the chamber 21 as well as to the escapement burner 30. The orifices of the latter require only a limited amount of gas, much less than can be supplied by pipe 26, so that notwithstanding the presence of the escapement burner substantially a full supply of main line pressure is transmitted to chamber 21, causing the

diaphragm 12 to rise and open the valve 8. Thereupon pressure flows through the main valve to the discharge pipe 7 and to the burner, and by way of the by-pass pipe 24 to the upper chamber 23 where it becomes effective upon the upper diaphragm 13. It will be observed that the two diaphragms differ in area. Diaphragm 12 is now subject on its lower face to the supply pressure and on its upper face to atmosphere, with the additional gravity effect tending to close the valve. The upper diaphragm is subjected on its lower face to atmosphere and is also subject to the lifting effect of the tension spring 16, and on its upper face is subjected over a larger area than diaphragm 12 to the pressure of the discharge main 7. The net effect of opening valve 28 is to cause diaphragm 12 to rise and diaphragm 13 to move downwardly, with the reduced extension 14 sliding in the opening of the valve rod 9 until all lost motion is taken up and the parts reach the position shown in Fig. 1, after which the two diaphragms function together or as a unit, moving up and down with tendencies of the discharge pressure to vary and thereby more or less opening and closing the valve 8 to maintain a definite pressure in the discharge pipe 7 leading to the burner. In this way, other things being equal, the valve mechanism described continues to function as a pressure regulator with, of course, the ability to regulate the pressure to be delivered through the pipe 7 by means of the adjusting nut 18.

Snap or cut-off action may be secured in various ways, but preferably by venting or starving the lower chamber 21 so as to reduce the pressure therein. This may be accomplished by cutting off the supply of gas to said chamber, such as by closing valve 28 either manually or automatically, or by providing the supply pipe 26 to said chamber with a vent passage which will divert the normal flow of gas elsewhere than to said chamber. The drawings show conventionally for the purpose the pipe 31 and valve 32, which valve is normally closed. When said valve is opened, it opens a relatively large vent from the pipe 26, robbing it of its supply of gas to such an extent that pressure will not be maintained in chamber 21, but, on the contrary, will fall to atmospheric or substantially so, whereby the valve 8, stem 9 and diaphragm 12 drop by gravity to closed position of the valve. The valve 32, while shown conventionally, may be of various forms or styles. It may be hand operated or automatic, such as one of the well known forms of thermostatic pilot valves which are normally closed when the pilot flame is burning, but which open when the pilot flame goes out, or it may be a valve which is moved back and forth between normally closed and open positions by any suitable mechanism, such as a pull chain connected to a room temperature thermostat motor, a device governed by the pressure of steam, the level of the water in the boiler, the temperature of the water therein or any like device. Of course, in all cases, gas vented through such a valve 32 will preferably be led to an escapement burner or to the furnace chamber and thence to the stack, for safety purposes.

After such a snap closing of the valve mechanism, closing of the vent so provided, either manually or automatically, will again permit the pressure to build up in chamber 21, causing the valve 8 to rise and continue the flow or supply of gas to the main burner, with the accompanying pressure regulating action, as before.

In the arrangement shown in Figs. 1 and 2, control of the valve mechanism for snap or cut-off purposes is entirely by venting or starving the lower chamber 21. Fig. 3 shows another arrangement of the valve mechanism in which the intermediate chamber 22 is also used for valve control purposes. In this construction the parts within the valve body 4 and within the hollow diaphragm casing 11 are of like form with those shown in Fig. 1. The supply pipe 1 communicates by way of a pipe 40 with a constantly burning ignition pilot burner. The pipe 26, which establishes communication between the supply pipe 1 and chamber 21, is provided with a hand valve 28, as before, and on the supply pipe side of said valve with a restricted port or orifice 41, which limits the possible flow of gas through pipe 26 to a small amount. Between orifice 41 and valve 28 a lateral connection 42 communicates with a normally closed thermostatic pilot burner, not shown. In other words, this thermostatic pilot burner is closed normally or when heated, but when it cools off it opens a vent from the pipe 42. In this arrangement, also, the opening 25, which in Fig. 1 communicated with atmosphere, now communicates by way of a pipe 43 with a two-way valve 44 (shown conventionally), by which connection of the intermediate chamber 22 may be established either to an escapement burner, by way of pipe 45, or to the by-pass pipe 26, by way of pipe 46. The valve 44 is normally in the position shown, establishing communication of chamber 22 to the escapement burner or, in other words, to atmosphere, and may be moved to its opposite position in any suitable manner, either by hand or automatically by one of the boiler accessories, as before. With this arrangement, assuming valve 44 in the position shown and valve 28 open, pressure flows by the pipe 40 to the ignition pilot burner and through the restricted port 41 and pipe 26 to the chamber 21. The flow at valve 44 is stopped. Pressure builds up in chamber 21 and the main valve opens, as before, it being understood of course that the discharge pressure is effective in the upper chamber 23 to move the upper diaphragm downwardly and produce pressure regulating operation, as in Fig. 1.

If the thermostatic pilot burner cools, so that a vent from pipe 42 is opened, the chamber 21 is vented faster than gas can be supplied through the restricted orifice 41, and the release of pressure beneath diaphragm 12 causes it to drop and close the main burner as before.

If valve 44 is turned to its second position, closing off the flow through the pipe 45 and opening communication between pipes 43, 46, snap or cut-off action also occurs, and in this case very promptly, the reason being that the weight of the diaphragm 12 and its attached parts is exerted downwardly on the gas in chamber 21, causing the same to flow by way of pipes 26, 46 and 43 into chamber 22, an effect which is supplemented by the flow through the restricted orifice 41. In any event, pressure is applied within the chamber 22, balancing the forces on opposite surfaces of diaphragm 12 and therefore closing the main valve by the application of pressure above the diaphragm rather than by venting the pressure from beneath it.

What I claim is:

1. Valve mechanism of the character described, comprising a valve body, a flow controlling valve therein, a hollow diaphragm casing connected thereto, two movable abutments in said casing

dividing the same into three chambers, one of said abutments being connected to said valve, one of the outer chambers communicating with the supply pressure and the other of the outer chambers with the discharge pressure, means for varying the pressure in the intermediate chamber to produce opening and closing movements of the abutment connected to said valve, yielding means in one of the outer chambers effective upon the other one of said abutments, stop shoulders limiting relative approach of said abutments, and a sliding connection between the two abutments, whereby under normal operating conditions the said stop shoulders are engaged and the two abutments move together as a unit for actuating said flow controlling valve to maintain definite pressure and upon equalization of pressures on opposite faces of the valve connected abutment said abutment may be caused to function independently of the other abutment to fully close said valve.

2. Valve mechanism of the character described, comprising a valve body, a flow controlling valve therein, a hollow abutment casing connected to said valve body, two movable abutments in said casing dividing the same into three chambers, means for subjecting one of the outer chambers to the supply pressure and the other outer chamber to the discharge pressure, means for varying the pressure in the intermediate chamber for causing opening and closing movement of said valve, stop shoulders limiting relative approach of said abutments, and a lost motion connection between said two abutments.

3. Valve mechanism of the class described, comprising a flow controlling valve, a movable abutment connected to said valve and subject on one face to the supply pressure and on its opposite face to an opposing pressure, the supply pressure tending to move the abutment and valve in the valve opening direction, valve means for controlling the distribution of pressures to opposite faces of said abutment to either equalize or unbalance said pressures for respectively producing closing and opening movements of said valve, a second movable abutment subject on one face to said opposing pressure and on its opposite face to unmodified discharge pressure, said discharge pressure tending to move the second abutment toward the first abutment, yielding means effective upon said second abutment for moving it in the opposite direction, said yielding means being ineffective upon said first abutment, and a lost motion connection between said abutments of such form as to permit unrestrained separation between them and including stop means limiting their motion toward each other, whereby under normal operating conditions the said stop means are engaged and the two abutments move together as a unit for actuating said control valve to maintain definite pressure and upon actuation of said valve means said first abutment may be caused to function independently of the second abutment to fully close said valve.

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