May 21, 1929. G. W. McKEE 1,713,707

CONTROL DEVICE

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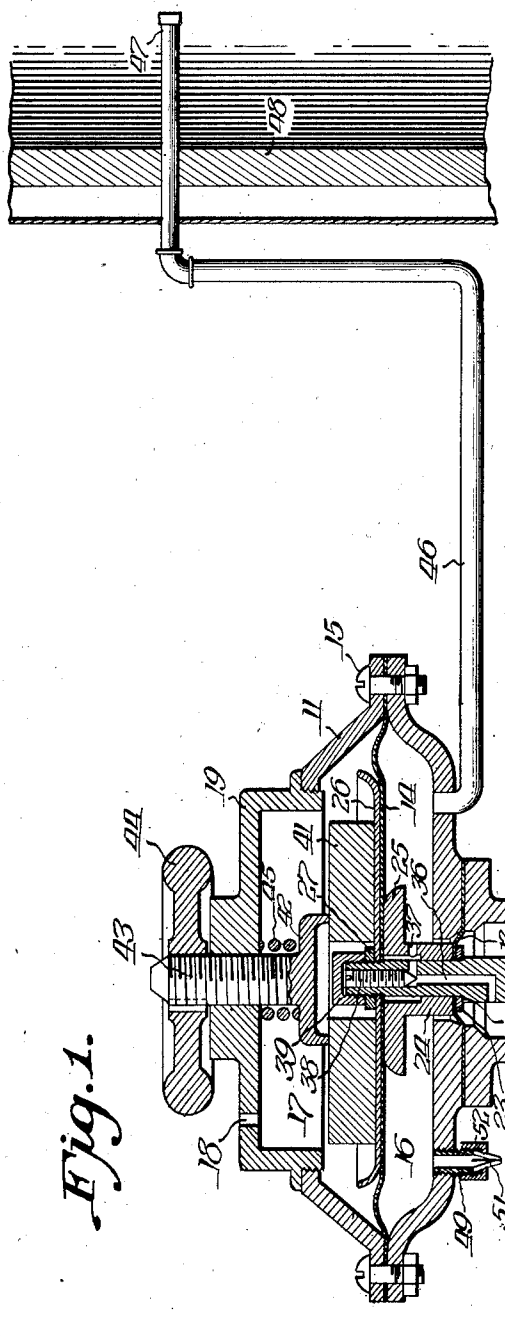


Fig. 1.

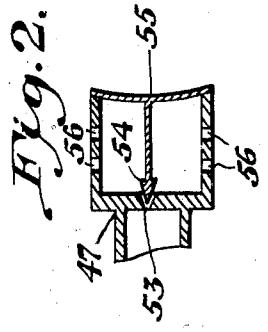


Fig. 2.

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CONTROL DEVICE.

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This invention pertains generally to control devices and has more particular reference to a device for controlling or regulating the flow of a fluid.

While the principle of my invention may be embodied in control devices adapted for various purposes, the particular form of the invention shown herein is designed to control the flow of fluid such for instance, as air or gas to a suitable burner located, for instance, in a furnace.

One of the primary purposes of this invention is the provision of a device which is capable of being thermostatically actuated so as to deliver fuel or air, as the case may be, to the furnace in accordance with the temperature requirements thereof, the device being designed to increase the fluid flow upon decrease of furnace temperature and to decrease the flow upon increase of furnace temperature, beyond a predetermined point.

Another object is to provide a device of the character indicated which can be regulated to time the closing movement of the control valve to a fine degree of nicety, and which is capable of adjustment or regulation for this purpose, from an accessible position outside the housing as well as from the inside thereof.

A further object of my invention is to provide a device which can be readily assembled and which will not come apart or be liable to get out of order when in use.

Still another object is to provide a device which can be economically manufactured with a minimum amount of machining and delicate work, and which will be thoroughly reliable, durable, and efficient in operation.

For the purpose of facilitating an understanding of my invention I have illustrated on the accompanying drawings a preferred embodiment thereof, from an inspection of which, when considered in connection with the following description, my invention and many of its inherent advantages should be readily understood and appreciated.

On the drawing, Fig. 1 is a vertical sectional view through a control device constructed in accordance with my invention.

Fig. 2 is a longitudinal central section of a thermostatically controlled outlet used with this invention.

Referring to the drawing more in detail: Reference character 5 indicates generally a valve casing to which is connected the supply pipe 6 communicating with any suitable source of fluid supply under pressure, and a delivery pipe 7 adapted to conduct the controlled fluid to a mixing burner or a gas and air mixing device of suitable construction. The casing is shaped to provide a dividing wall 8 provided with a valve seat 9 preferably of the removable type.

A housing indicated generally by 11 is secured to the casing and free communication between the inlet chamber 12 of the casing and the housing is prevented by a diaphragm 13 interposed and clamped between the opposed faces of the casing and housing. A diaphragm 14 disposed within the housing has its margins clamped between the peripheral flanges of the upper and lower portions of the housing, bolts 15 being preferably employed to hold the housing sections together with the diaphragm clamped between them. The diaphragm 14 divides the housing into a pressure chamber 16 and a chamber 17 communicating with atmosphere through one or more ports or openings 18 preferably formed in the cap 19 of the housing.

A valve stem 21 extends upwardly from the valve casing into the housing and this stem is provided with an annular shoulder 22 upon which is seated clamping ring 23. This ring is adapted to engage the lower face of the diaphragm 13 through which the valve stem 21 extends, and the margins of the opening in this diaphragm are clamped between the ring 23 and a member 24 which surrounds the valve stem above this diaphragm and is provided at its upper end with an enlarged head 25 adapted to afford a bearing surface of substantial area engaging the diaphragm 14 through which the upper end of the stem 21 also projects. The member 24 serves as a spacing member between the diaphragms 13 and 14 and maintains them in a predetermined position relatively to each other. The diaphragm 14 is clamped between the head 25 of the spacing member and a disc 26 dis-

posed above the diaphragm and secured by a nut 27 threaded onto the upper end of the stem 21.

Near its lower end, the valve stem 21 is equipped with a valve 28 adapted to seat upwardly against the valve seat 9. For the purpose of maintaining the valve in proper alignment with respect to its seat, the projecting end 29 of the stem beneath the valve 28, is slidably disposed in and guided by a guide member 31 threaded into and projecting upwardly from a tapped bore 32 formed in the casing closure plug 33. This guide member 31 performs the additional function of limiting the opening movement of the valve and, in order that the extent of maximum opening of the valve may be subject to regulation and control, the lower end of the member 31 within the port is provided with a kerf 34 into which a screw driver or other tool may be inserted for adjustment purposes. Normally, access to member 31 from outside the casing is precluded by a plug 35 threaded into the lower end of the port 32.

In order to permit a restricted and regulatable flow of fluid from the inlet or pressure side of the valve casing into the pressure chamber 16 below the diaphragm 14, the valve stem 21 is provided with a passage 36 extending longitudinally of the stem and opening laterally at one end into the chamber 12 of the casing and at its other end, through a port 37 formed in the member 24, into the pressure chamber 16. The flow of fluid through this passage is controlled by an adjustable needle valve 38 threaded into the tapped upper end of the bore formed in the valve stem. This needle valve may be adjusted by a screw driver or other means before the structure is completely assembled and when it has been properly adjusted it is covered and protected by a cap 39 threaded onto the upper end of the stem 21 and adapted to serve also as lock-nut for the clamping nut 27.

A weight 41, resting upon the disc 26 tends to urge the diaphragm and valve downwardly against the force of the pressure in the chamber 16, and upward movement of the diaphragm is limited by an adjustable abutment head 42 carried upon the lower end of an adjustable stem 43 which is equipped outside the housing with a hand wheel 42. This abutment is preferably so adjusted that the valve 28 will be prevented from closing snugly against its seat 9 and when thus adjusted, a very slight flow of fluid past the valve is permitted. A spring 45 interposed between the head 42 and the housing cap 19 yieldingly retains the abutment against accidental displacement and also prohibits the rattling and jarring of the stem 43.

The pressure chamber 16 is connected to a pipe 46 which is provided with a suitable thermostatically controlled outlet. This outlet may be of any preferred construction and I have therefore shown conventionally, merely for illustrative purposes, an outlet in the form of a tube 47 projecting into a furnace, a fragmentary portion of which is indicated by 48. The orifice is adapted to close as the temperature within the furnace rises, and to correspondingly open as the furnace temperature diminishes. The flow of fluid from the pressure chamber 16 through the pipe 46 is therefore increased to permit the depression of the diaphragm 14 and the valve 28 under the influence of the weight 41 after the furnace temperature diminishes, and is decreased to cause the raising of the diaphragm and the closing of the valve by the increased pressure in the chamber 16 as the furnace temperature is increased or diminished in accordance with the fall and rise respectively of the furnace temperature.

In order to provide for regulation of the opening and closing movements of the valve from an accessible position outside the housing and in addition to the adjustment provided for by the needle valve 38, I prefer to equip the housing with an adjustable discharge orifice indicated generally by reference character 49. This orifice comprises merely a longitudinally slotted tip or nipple 51, the slots of which may be opened or closed by adjusting an apertured cap 52, threaded onto the nipple. When a fluid, such as air, the escape of which into the room in which the device is located, is not objectionable, is used, the orifice may be regulated to control the closing speed of the valve 28. When, however, the device is employed to control the flow of gas or other noxious fluid, the adjustable orifice should be completely closed and the regulation of the closing movements of the valve should be affected by adjustment of the needle valve 38.

The thermostatically controlled outlet 47 is illustrated as having a valve seat 53 which receives the valve 54. The valve 54 is connected to an expansible diaphragm 55 which is adapted to expand toward the valve seat as the temperature in the furnace increases. When the temperature in the furnace decreases the valve moves away from its seat and the fluid, being usually air or gas will pass the valve and issue through the outlets 56.

The operation of my improved control device is substantially as follows:

Assuming that the furnace temperature is below normal, the thermostatically controlled delivery orifice from the tube 47 is open so that pressure in the chamber 16 is low. The valve 28 is therefore disposed away from its seat under the influence of the weight 41, and flow of fluid from the pipe 7 is permitted. After the temperature in the furnace increases, the outlet orifice will be decreased so

that fluid under pressure from the chamber 12 will be delivered through the passage 36 into the chamber 16 faster than it is delivered from the chamber through the pipe 46. The rate at which the pressure will build up in the chamber 16 will be determined by the adjustment of the needle valve 38 and also by the extent of opening of the adjustable orifice 49 in case this orifice is in use. The increase of pressure in the chamber 16 will raise the diaphragm 14, thereby lifting the valve 28 toward its seat to restrict the flow of fluid through the pipe 7.

It will be evident from the foregoing that the fluid flow is automatically controlled by my invention so that the fluid will be delivered in accordance with the requirements of the furnace as evidenced by the fluctuation of temperature therein and that the speed at which the valve will be closed can be controlled by adjusting the needle valve 38 or regulating the adjustable discharge orifice 49. It should furthermore be apparent that when the device is assembled as described the working parts are all securely locked together in proper relative relation so that they cannot accidentally become displaced. The device is therefore durable and reliable in operation and can be manufactured and assembled economically.

I have shown and described a preferred embodiment of my invention and it should be manifest that the construction and arrangement of the various parts are capable of considerable modification and variation without departing from the essence of my invention as defined in the following claims.

I claim:

1. In a control device the combination of a valve casing provided with a valve, a diaphragm housing provided with two compartments separated by a pressure actuated diaphragm, a sealing diaphragm between said casing and said housing, a stem extending through said sealing diaphragm connecting said valve with said pressure actuated diaphragm, adjustable means for admitting a fluid from said casing through said stem into one of said compartments, and temperature controlled means for discharging a fluid from the last said compartment.

2. In a control device the combination of a valve casing provided with a valve, a diaphragm housing provided with two compartments separated by a pressure actuated diaphragm, a sealing diaphragm between said casing and said housing, a stem extending through said sealing diaphragm connecting said valve with said pressure actuated diaphragm, adjustable means for admitting a fluid from said casing through said stem into one of said compartments, and manually adjustable means for discharging a fluid from the last said housing.

3. In a control device the combination of a valve casing provided with a valve, a diaphragm housing provided with two compartments separated by a pressure actuated diaphragm, a sealing diaphragm between said casing and said housing, a stem extending through said sealing diaphragm connecting said valve with said pressure actuated diaphragm, adjustable means for admitting a fluid from said casing through said stem into one of said compartments, temperature controlled means for discharging a fluid from the last said compartment and manually adjustable means for discharging a fluid from the last said compartment.

4. In a control device the combination of a valve casing, a valve within said casing, a diaphragm housing having two compartments separated by a pressure actuated diaphragm, a sealing diaphragm between said housing and said casing, a stem extending through said sealing diaphragm connecting said valve and said pressure actuated diaphragm, a passage through said stem establishing communication between said casing and one of said compartments, means for regulating the effective area of said passage, temperature controlled means for discharging a fluid from the last said compartment and manually adjustable means for discharging a fluid from the last said compartment, a shoulder on said stem beneath said sealing diaphragm, a spacing member surrounding the stem between the diaphragms, and a cap disposed over the upper end of said stem for covering said means and for clamping said diaphragms in a fixed relation to said stem.

5. In a control device the combination of a housing, a valve casing, a sealing diaphragm interposed between the housing and casing, a stem extending through said diaphragm into said housing and casing, a pressure diaphragm in the housing, a shoulder carried by said stem beneath the sealing diaphragm, a spacing member surrounding the stem between the diaphragms, a clamping nut threaded onto the upper end of the stem to fixedly secure said diaphragms to the stem, a passage through said stem establishing communication between the casing and the housing, a needle valve threaded into the upper end of said stem for controlling the effective area of said passage, and a cap disposed over the upper end of said stem for covering said needle valve and locking said clamping nut.

6. In a control device the combination of a valve casing, a valve within said casing, a diaphragm housing having a pressure actuated diaphragm and upper and lower compartments separated thereby, the upper compartment being open to the atmosphere, a removable weight in said upper compartment resting on the top of said diaphragm, adjustable means above said diaphragm for limiting the upward movement of said diaphragm, a sealing diaphragm between the housing and

the casing, a stem extending through said sealing diaphragm and connected with the valve and the pressure actuated diaphragm, a passage through said stem establishing communication between the valve casing and said lower compartment, means extending into said stem from above the pressure actuated diaphragm for regulating the effective area of said passage, temperature controlled means for discharging the fluid from said lower compartment and manually adjustable means for discharging a fluid from said lower compartment.

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