UNITED STATES PATENT OFFICE.

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GAS REGULATOR AND SAFETY DEVICE.

1,393,217.


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To all whom it may concern:

Be it known that I, TIMOTHY HALEY, a citizen of the United States, residing at Springfield, in the county of Clark and State of Ohio, have invented certain new and useful Improvements in Gas Regulator and Safety Devices, of which the following is a specification.

My invention relates to automatic fluid pressure regulators and more particularly to a construction adapted to automatically equalize the flow of fluid under pressure and which in the event of a cessation of the flow will automatically close and lock the fluid pressure passage. The device is particularly applicable to gas stoves or explosive engines, furnaces, or analogous applications using a fluctuating supply of gas. It is well recognized that an abnormal increase of gas pressure results in decreased efficiency of the gas burner and the loss of fuel which passes through the burner faster than it can be consumed. Likewise in the event that the gas pressure falls temporarily to an abnormally low pressure whereby the gas at the burner is extinguished and then the supply is later increased, there is grave danger of asphyxiation and explosion due to the escape of the gas.

The present construction is designed to meet both the aforementioned conditions by automatically regulating the gas pressure to permit the flow of only a predetermined maximum quantity of gas and in the event of the abnormal decrease, the device is adapted to close and lock such passage. Such automatic locking safety valves are not uncommon in the art, but those which have heretofore come under observation have been so constructed that the locking device tends to interfere with the freedom of movement and rapidity of action of the closure valve.

The object of the present invention is to simplify the structure as well as the means and mode of operation of such devices whereby they will not only be cheapened in construction, but will be more efficient in use, positive in operation, automatic in action, of simple durable construction, and unlikely to get out of repair.

A further object of the invention is to provide a single operating means capable of action under increased pressure to reduce the flow of gas, and under abnormal decrease of pressure to completely cut off the gas supply.

A further object of the invention is to provide locking means for the control valve so supported as to permit the valve unrestrained freedom of movement.

A further object of the invention is to provide a double acting control valve normally maintained in a balanced position and capable of reducing the flow of gas by its movement in either direction.

A further object of the invention is to provide means whereby the locking member when released will deliver a quick blow to the valve thereby affording a driving action by which complete closure is insured.

A further object of the invention is to provide means for manually adjusting the control valve whereby the quantity of gas permitted to pass at a given pressure may be varied.

A further object of the invention is to provide a construction in which the fluid pressure operated member shall be under the direct influence of the full pressure.

With the above primary and other incidental objects in view as will more fully appear in the specification, the invention consists of the features of construction, the parts and combinations thereof and the mode of operation, or their equivalents as hereinafter described and set forth in the claims.

Referring to the drawings, Figure 1 is a vertical sectional view of the assembled safety regulator forming the subject matter hereof in its normal or open condition. Fig. 2 is a side view thereof in the closed and locked position. Fig. 3 is a detail view of a modified double valve construction. Fig. 4 illustrates a further modification of the double acting valve and its co-acting seat. Fig. 5 is a diagrammatic view.

Like parts are indicated by similar characters of reference throughout the several views.

In constructing the device there is employed a diaphragm chamber 1 containing a flexible diaphragm 2, capable of fluctuations under varying gas pressure. The diaphragm chamber 1 is provided with a gas inlet orifice 3 in the bottom thereof, and an outlet orifice 4 leading laterally from the chamber beneath the diaphragm 2. By this construction the entire supply of gas must...
pass through the diaphragm chamber and the diaphragm is subjected to direct full pressure. In some constructions, heretofore devised the gas supply conduit was connected with the diaphragm chamber through a by-path or branch passage of comparatively small size. In such constructions gas tending to follow the line of least resistance will pass through the conduit directly to the burner and the pressure within the diaphragm chamber will not be the true pressure. The present construction wherein the gas is brought in contact with the diaphragm renders the regulator more sensitive and causes it to act more promptly under the influence of pressure fluctuations.

While any suitable form of valve seat for the regulating valve may be provided, there is shown in the construction a simple and easily manufactured form of device, in which the gas inlet orifice is through a screw threaded nipple or spud, the end of which is beveled to form a valve seat. Screw threaded upon the nipple or spud is a fitting having therein a second oppositely disposed valve seat. For economy of manufacture the fitting may be an ordinary reducing pipe coupling within which the valve seat is formed by any suitable machining operation.

Secured centrally to the diaphragm is a screw threaded nut in which is adjustably secured the screw threaded valve stem which extends through the inlet orifice and carries a valve head positioned intermediate the valve seats and. In Figs. 1 and 2 the valve head has been shown as a spherical rubber body which is held upon the stem by the contraction of such rubber body into a peripheral groove formed in the extermination of the stem. It will be obvious, however, that other forms of valve may be employed. In Fig. 3 there has been shown a modification embodying two tapered valve heads integrally formed upon the valve stem. In Fig. 4 there is shown a single beveled or tapered valve head, the tapered upturned face of which is adapted to act with the beveled seat while the flat face of which engages a rubber valve seat, located in the fitting.

Whatever the valve head construction may be such valve head normally occupies a balanced or medial position between the valve seats and. Upon the upward flexing of the diaphragm by an increase of the fluid pressure, the valve stem is drawn upward causing the valve head to approach the seat and so restrict the gas passage. Upon a downward flexing of the diaphragm permitted by a decrease of pressure below normal, the valve head approaches the lower valve seat, with which under abnormal conditions it makes contact to completely close the gas passage. The upper end of the valve stem is projected through the wall of the chamber and is otherwise accessible above the diaphragm wherein the stem may be rotated to adjust it within the nut to vary the normal relation of the valve head with either of its seats to a given degree of pressure. To facilitate this adjustment the exposed end of the valve stem is provided with a slot for the engagement of a screw driver. For the purpose of insuring the firm seating of the closure valve 11 upon the seat and to lock it in its closed position, there is provided a pivoted weighted arm journeled in suitable supporting lugs or ears formed upon the housing. At its pivotal point, the weighted locking arm is provided with a cam head 20, through which the pivotal staid 21 extends. The cam head 20 is positioned in a plane common with the valve stem 10 and projects into the path of travel of said stem. The cam head 20 has formed in the periphery thereof a notch 22 into which the exposed end of the valve stem 10 normally projects. The weighted locking arm is normally supported in an upright or substantially vertical position, the inclination from vertical being only sufficient to cause it to fall when released by the movement of the valve stem. Being vertically positioned, with the center of gravity but slightly removed out of vertical alinement with the pivotal point of the arm, the weight of the arm will be almost wholly carried by the pivotal staid. The cam head 20 is provided at one side of the center of the arm with a laterally projecting pin or staid, which engages one of the supporting lugs to limit the oscillation of the arm in one direction, while the shoulder 24 formed by the notch 22 by engagement with the protruding end of the valve stem normally prevents the fall of the weighted arm in the opposite direction. The weight of the arm being sustained almost wholly by the pivotal staid, the pressure exerted by the shoulder 24 of the notch 22 upon the end of the stem will be very slight, and will have little or no retarding action upon the movement of the stem, permitting it to reciprocate freely, with the fluctuations of the diaphragm.

Difficulty has been heretofore experienced in locking devices of this character due to the fact that the weights were not self-sustaining, but were inclined from the vertical sufficient to exert a retarding or brake-like action upon the valve stem and preventing the free movement thereof. This difficulty is overcome in the present instance by making the weighted locking arm self-sustaining by supporting the pressure so that it will effect no binding action upon the valve stem. In the present construction, the weighted arm is normally maintained in an almost balanced position, whereby the diaphragm
and valve stem are free to respond to the slightest fluctuations of pressure. To insure the complete seating of the valve, upon an abnormal decrease of pressure, the cam head 20 is so shaped that after being released by the retraction of the valve stem, the cam head and weighted arm will move initially independent of the valve stem, and the cam head engages the end of the stem only after the weighted arm has attained a considerable momentum and has reached a position where the weight of the arm will be most effective. To this end the cam head 20 is relieved by being flattened or preferably formed concentric, for a short distance adjacent to the shoulder 24 the contour of the head then being changed to form a driving surface at 25, which by its engagement with the end of the valve stem forces the valve stem further downward more firmly seating the valve. The weighted arm having gained momentum before the engagement of the driving surface 25 with the end of the valve stem, the action is such as to impart a quick sharp pressure to the valve stem under influence of the falling weight. Inasmuch as the temporary closing of the gas passage by complete engagement of the valve with the seat 6 under the influence of an abnormally high pressure would be equally disastrous as the abnormally low pressure, the opposite angular shoulder 26 of the cam head 20 forms a limiting stop for the upward movement of the valve stem. The relation of the shoulder 26 is such that the valve may approach quite closely to the valve seat to reduce the flow, but not so closely as to exhaust the gas. The timing of the valve operation relative to the gas pressure is regulated by the adjustment of the valve stem 10 through the screw threaded nut 9 by means of the screw driver slot in the exposed end of the valve stem. The nut 9 is provided with a compression collar 27, by which it is secured to the diaphragm. Obvious other methods of attachment may be employed.

From the above description it will be apparent that there is thus provided a device of the character described possessing the particular features of advantage before enumerated as desirable, but which obviously is susceptible of modification in its form, proportions, detail construction and arrangement of parts without departing from the principle involved or sacrificing any of its advantages.

While in order to comply with the statute the invention has been described in language more or less specific as to structural features, it is to be understood that the invention is not limited to the specific details shown, but that the means and construction herein disclosed comprise but one of several modes of putting the invention into effect, and the invention is therefore claimed in any of its forms or modifications within the legitimate and valid scope of the appended claims.

Having thus described my invention, I claim:

1. A fluid pressure control device, of the type wherein a control valve is actuated and from its seat by the fluctuations of a flexible diaphragm subjected to fluid pressure, characterized by an oscillatory weighted arm, a cam shaped pivotal head for said arm having a concentric portion and an eccentric portion merging one into the other, a notch in said cam head, a valve stem carried by the diaphragm and normally engaging in the notch to hold the weighted arm in upright position, the arm being adapted to fall upon the withdrawal of the valve stem from said notch, whereupon the concentric portion of the pivotal cam head first passes idly over the valve stem permitting the arm to gain momentum and assume a most effective position before the engagement of the eccentric portion of the cam head which thereupon positively actuates the valve stem to force the valve into firm engagement with its seat and so lock it.

2. In a fluid pressure control device, the combination with a housing a flexible weighted diaphragm therein, a valve controlled thereby and tending to move toward closed position under the influence of gravity upon relaxation of the diaphragm, a weighted arm directly controlled by the movement of the valve and normally held in elevated position by the valve stem, and released when the valve has descended to substantially closed position under the influence of gravity and means whereby the falling of the weighted arm affords a secondary seating impulse to the valve supplementary to its movement under gravity to insure full seating and locking of the valve in closed position.

3. The combination with the valve, a stem therefor, the diaphragm, and operative connections between the valve stem and diaphragm of a weighted arm normally maintained in elevated position by the direct engagement of the valve stem therewith adapted to fall upon withdrawal of the valve stem, and a cam head actuated by the falling arm operating independent of the valve stem during the initial falling movement and thereafter engaging the valve stem to force the valve upon its seat during the final movement of the weighted arm.

4. In an automatic control device for fluid pressure systems, a diaphragm housing having a fluid pressure inlet thereto and an outlet therefrom by which the entire volume of fluid is passed through said housing, a diaphragm therein subjected to direct pressure of the flow of fluid, two spaced valve
seats in the inlet passage to said housing, a valve stem carried by the diaphragm and extending in opposite directions therefrom, one end of said valve stem extending within the inlet passage and a valve head carried thereby intermediate the spaced valve seats and coating with either seat upon alternative movements to reduce the flow of fluid through the housing, the opposite end of the valve stem extending through an opening in the top of the housing, a supporting lug on the housing adjacent to the protruding end of the valve stem, a weighted arm pivoted to said lug, a cam head for said arm having a notch therein within which the protruding end of the valve stem normally extends to maintain the weighted arm in an upright position, said cam head having a concentric portion adjacent to said notch merging into an eccentric portion spaced from the notch, whereby upon withdrawal of the valve stem from the notch the weighted arm will fall, said initial concentric portion of the cam head passing the end of the valve stem idly during the initial falling movement of the arm whereby the arm is permitted to gain momentum, the stem being then engaged by the eccentric portion of the cam head to force the valve onto one of its seats under the influence of the falling weighted arm.

In testimony whereof, I have hereunto set my hand this 30th day of December, A. D. 1919.

TIMOTHY HALEY.

Witnesses:

John Dineen,

George C. Helwig.