W. J. FRAZIER.

AUTOMATIC VALVE.

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1,117,993.

Patented Nov. 24, 1914.

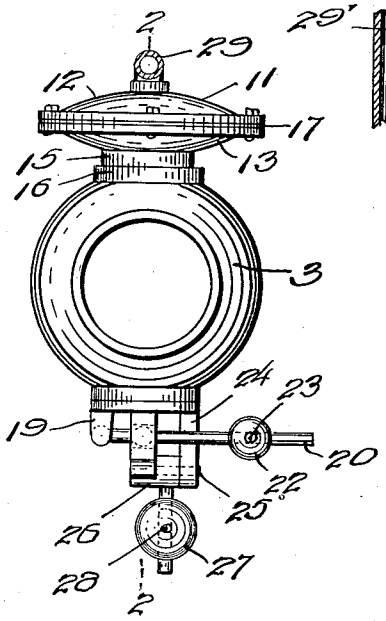


Fig. 1

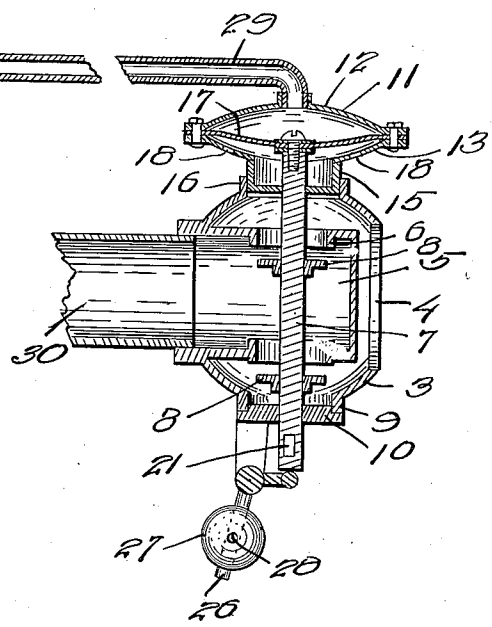


Fig. 2.

WITNESSES:

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AUTOMATIC VALVE.

1,117,993. Specification of Letters Patent. Patented Nov. 24, 1914.

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To all whom it may concern:

Be it known that I, WILLIAM J. FRAZIER, a citizen of the United States, residing at New York, in the county of New York and State of New York, have invented certain new and useful Improvements in Automatic Valves, of which the following is a specification.

My invention relates to an automatically operated device to control the relative volumes of gas and air supplied to the cylinder or cylinders of an internal combustion engine, whereby the quality of the mixture is kept constant.

An important object of this invention is to provide novel means to regulate the volume of air supplied to the engine cylinder, such means being operated by the changes in degree of suction or pressure in the gas supply pipe.

A further object of this invention is to provide novel means whereby a greater gradual resistance is offered to the movement of the control valve, when the same moves toward its seat, thus requiring a corresponding gradual increased suction of force to close the control valve.

A further object of this invention is to provide a device of the above mentioned character, which may be readily adjusted to permanently change the relative volumes of air and gas contained in the mixture.

A further object of my invention is to provide a device of the above mentioned character, which is automatic in operation, simple in construction, durable and cheap to manufacture.

Other objects and advantages will be apparent during the course of the following description.

In the acompanying drawings forming a part of this specification and in which like numerals are employed to designate like parts throughout the same, Figure 1 is a side view of the device, and, Fig. 2 is a sectional view taken on line 2—2 of Fig. 1.

My device is particularly well adapted for use in connection with stationary engines using illuminating, natural, producer, blast furnace, or coke oven gas, but of course it is not solely restricted to such use.

In the drawings wherein is illustrated a preferred embodiment of my invention, the numeral 3 designates a main outer shell or body portion, provided at one end with an air inlet 4. Disposed within the main outer shell 3 is a horizontal inner shell 5, having its end adjacent the opening 4 formed closed and its opposite end open, as shown. The inner shell 5 is provided with preferably diametrically arranged upper and lower annular valve seats 6, forming openings for the passage of the air from the shell 3 into the shell 5, as shown.

Mounted to reciprocate through the shells 3 and 5 is a valve stem 7, carrying circular valves 8, adapted to be moved toward and away from the annular valve seats 6 to control the passage of air therethrough. The lower portion of the main shell 3 is provided with an annular flange 9, to receive the inner portion of a cap or head 10, the same being connected therewith by any suitable means. This cap or head is provided with a central opening to receive the valve stem 7 and serves as guide means for the same. The numeral 11 designates a diaphragm casing or housing, formed of upper and lower sections 12 and 13, which are connected at their edges by bolts or the like. The lower section 13 comprises a cylindrical portion 15, fitting snugly within an annular flange 16 formed upon the shell 3, as shown. Any suitable means, if necessary, may be employed to hold the cylindrical portion 15 against slipping within the annular flange 16. The cylndrical portion 15 has its end apertured to receive the upper portion of the valve stem 7 and serves as guide means for the same. Connected with the upper end of the valve stem 7 is a diaphragm 17, which is mounted in the diaphragm casing 11 in the usual manner. The section 13 of the diaphragm casing is provided with an air vent 18, as shown. It is thus seen that suction within the diaphragm casing 11 above the diaphragm 17 will cause the valve stem 7 to be elevated, whereby the valves 8 are moved toward their valve seats 6.

Depending from the cap or head 10 is a bracket 19, with which is pivotally connected an arm or lever 20, passing through an opening 21 formed in the lower end of the valve stem 7, as shown. Longitudinally adjustably mounted upon the lever or arm 20 is a weight 22, which may be cramped to said lever in adjustment at different positions by proper manipulation of a clamping screw 23 or other suitable device. It is thus seen that the lever or arm 20 and its

weight 22 tend to move the valve stem 7 downwardly and add to its weight. Depending from the cap or head 10 is a bracket 24, disposed at a right angle to the bracket 19. At its lower end this bracket 24 carries a horizontal pin or stub-shaft 25, which serves to pivotally connect a bell-crank lever 26 with said bracket 24. The upper arm of this bell-crank lever is disposed to engage the lower end of the valve stem 7 while its lower arm is arranged at a slight inclination from the perpendicular when the valve stem occupies its lowermost position, as shown in Fig. 2. Mounted upon the lower arm of the bell-crank lever 26 is a weight 27. This weight is preferably adjustably mounted upon the arm and may be clamped in adjustment at different positions by proper manipulation of a clamping screw 28.

In the practice of my invention I have found it advantageous to have the weight 27 of a sufficient size to balance the weight of the valve stem 7, valves 8, lever 20 and weight 22, when such valve stem occupies its lowermost position. When the lower arm of the bell-crank lever 26 moves toward its perpendicular position, it is obvious that the lifting force that the bell-crank lever exerts upon the valve stem 7 is gradually reduced at the same time that the valves 8 are moving nearer their valve seats 6. It is thus seen that when the valves 8 are moved near their valve seats the bell-crank lever and its weight are over-balanced by the valve stem and associated elements, whereby it will take an increased suction in the diaphragm casing 11 above the diaphragm to finally bring the valves 8 closer or into engagement with their seats. It is thus seen that means are provided whereby the force necessary to move the valves toward their seats must be gradually increased as the valves move closer to or in engagement with such valve seats.

Connected with the section 12 of the diaphragm casing 11 is a suction pipe 29, which is connected with the gas supply pipe 29′, preferably near the fuel manifold, the gas supply pipe being preferably connected with the manifold pipe, but the same may be connected with the cylinder or cylinders of the engine by other suitable means. The numeral 30 designates an air supply pipe, having one end in free communication with the inner shell 5 and its opposite end connected with the fuel manifold.

It is to be distinctly understood that the gas supply pipe 29′ is connected with the outlet side of a carbureter (not shown) to receive a previously formed gas or explosive charge, for supplying the same to the cylinder or cylinders of the engine, but is not connected with the intake side of the carbureter, to supply air or vaporized hydrocarbon, or a mixture of both to the carbureter. The air supply pipe 30 has no connection with the carbureter to supply air thereto, but is connected with the manifold pipe of the engine, for supplying non-carborated air to the cylinder or cylinders thereof, in the presence of the previously formed gas or explosive charge. It is thus seen that my apparatus serves to dilute the previously formed gas or explosive charge, at or about the time that it is being supplied to the cylinder or cylinders, such dilution being controlled by the degree of suction in the gas supply pipe, and by the gas supply pipe is meant, the pipe through which previously formed gas or explosive charge is passing.

The operation of the apparatus is as follows: The carburated air is drawn into the cylinder or cylinders of the engine by suction, occurring therein upon the down stroke of the piston or pistons. The gas is supplied to the pipe or manifold of the cylinder through the pipe 29′, while the air is supplied thereto through the pipe 30. Now when the suction increases in the gas pipe 29′, due to either a partial failure in the supply of the gas or an increased demand upon the same, as the engine speeds up, the suction or vacuum in the cylinder, following the course of least resistance, would tend to draw too great an amount of air through the pipe 30, the supply of air offering comparatively little resistance. It is thus seen that means must be provided to offer resistance to the supply of air in proportion to the increase of resistance in the supply of gas. This is just what my apparatus does. Upon the increase of suction within the pipe 29′, the vacuum or suction is increased upon the upper side of the diaphragm 17, whereby the valve stem 7 is elevated and the openings 8 partially closed, to effect a corresponding increase in the suction in the pipe 30. As the valve stem 7 continues to be elevated, the bell-crank lever 26 and its weight will gradually exert a less lifting force upon the valve stem, as the lower arm of the bell-crank lever moves toward the perpendicular. The valve stem 7 and associated elements now over-balance the bell-crank lever 26 and this over-balancing gradually increases with the rise of the valve stem, whereby a gradual increase in vacuum above the diaphragm is required to further elevate the valve stem 7 and valves 8. By this construction it is obvious that there must be an increase in suction or vacuum in the gas supply pipe and suction pipe 29 to further move the valves 8 toward their valve seats, with a correspondingly increased suction in the pipe 30 to draw air past the valves 8 as they are moved nearer to their valve seats.

It is to be understood that the form of my invention herewith shown and described, is

to be taken as a preferred example of the same and that certain changes in the shape, size, and arrangement of parts may be resorted to without departing from the spirit of the invention or the scope of the subjoined claims.

Having thus described my invention, I claim:—

1. The combination with a gas supply pipe to be connected with the outlet side of a carbureter to receive a previously formed explosive charge and to be connected with the cylinder of an internal combustion engine to supply the previously formed charge thereto, of a separate air supply pipe being free from connection with the carbureter and the gas supply pipe and to be connected with the cylinder to supply non-carborated air to the cylinder to dilute the previously formed explosive charge fed thereto from the gas supply pipe, a valve to move toward its closed position to reduce the volume of non-carborated air passing through the separate air supply pipe, and automatic means connected with the separate gas supply pipe and operated by increase of vacuum in said gas supply pipe to move the valve toward its closed position upon the increase of vacuum in the gas supply pipe, whereby the volume of air is reduced in proportion to the increase of vacuum within the gas supply pipe.

2. The combination with the gas and air supply pipes of an internal combustion engine, of a valve to control the passage of air into the air supply pipe, a diaphragm casing, a diaphragm mounted therein and connected with the valve, means of communication between the diaphragm casing and the gas supply pipe, a pivoted weight to move the valve in the direction to seat the same, and a pivoted weight to move the valve in a reverse direction.

3. In a device of the character described, an air supply pipe, a valve to control passage of air into the same, a valve stem connected with the valve, a diaphragm casing, a diaphragm mounted in the diaphragm casing and connected with the diaphragm, a weight in the form of a pivoted bell-crank lever having its upper arm engaging one end of the valve stem, and a pivoted weight engaging the valve stem to move the same downwardly.

4. In a device of the character described, an outer main shell provided with an air inlet, an inner shell disposed therein and provided with an air supply passage, a valve stem, a valve carried by the valve stem to control the flow of air through the air supply passage, a diaphragm casing connected with the main shell, a diaphragm disposed therein and connected with said stem and a bell-crank lever weight pivotally mounted below the main shell and having one arm thereof engaging the valve stem to elevate the same.

5. In a device of the character described, a conduit provided with an air inlet opening, a valve stem, a valve carried by the valve stem to be moved toward and away from the air inlet opening, means to move the valve stem to bring the valve nearer the air inlet opening, a pivoted bell-crank lever weight to elevate the valve stem, and a pivoted weight to lower the valve stem.

In testimony whereof I affix my signature in presence of two witnesses.

WILLIAM JEROME FRAZIER.

Witnesses:

MARTIN KLETT,

EDMUND CRAUTZ.