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Page et al.

[11] **3,848,858**

[45] **Nov. 19, 1974**

[54] **VELOCITY-ACTUATED FUEL CONTROL VALVE**

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[52] **U.S. Cl.** **261/63,** 261/DIG. 56, 138/46

[51] **Int. Cl.** **F02m 7/06**

[58] **Field of Search** . 261/62, 63, DIG. 56, DIG. 57; 138/46

[56] **References Cited**

UNITED STATES PATENTS

1,751,461	3/1930	Austin	261/63
1,808,843	6/1931	Francis	261/63
1,884,360	10/1932	Sturm	261/63
1,895,456	1/1933	Farmer	261/63
1,929,234	10/1933	Anderson	261/63
2,525,083	10/1950	Stresen-Reuter	261/DIG. 56
2,789,801	4/1957	Durbin	261/63
3,680,846	8/1972	Bickhaus et al.	261/62
3,715,108	2/1973	Denton	261/DIG. 56

FOREIGN PATENTS OR APPLICATIONS

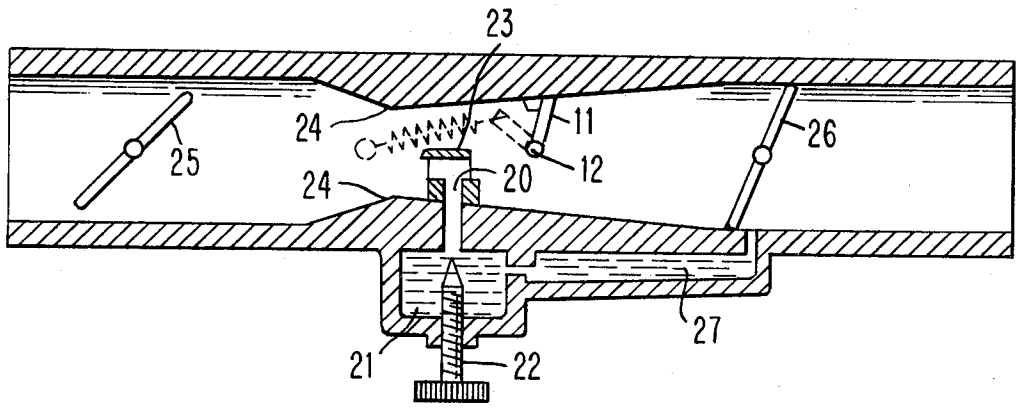
24,297	5/1906	Great Britain	261/DIG. 56

Primary Examiner—Tim R. Miles

[57] **ABSTRACT**

A velocity-actuated valve placed in the intake manifold of an internal combustion engine is described. It consists of a pivotally supported, spring-biased, semicircular disc subjected to the impact velocity of the air stream for variable angular displacement.

2 Claims, 4 Drawing Figures



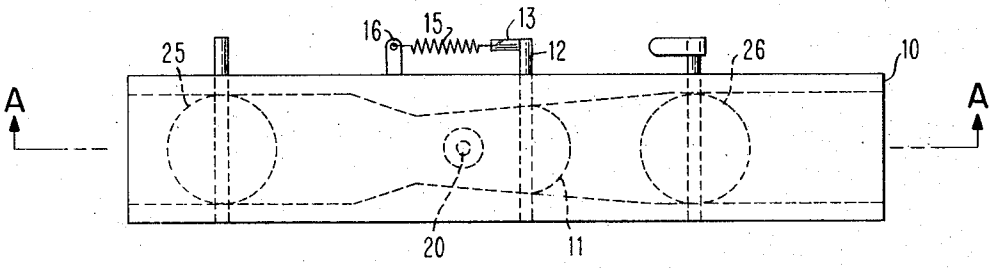


FIG. 1

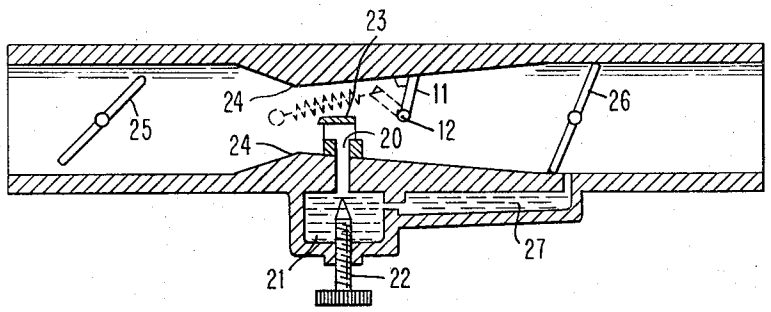


FIG. 2

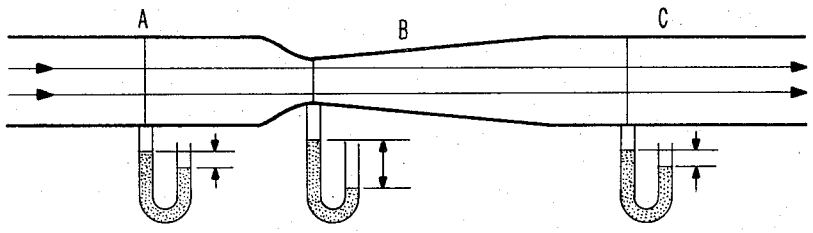


FIG. 3

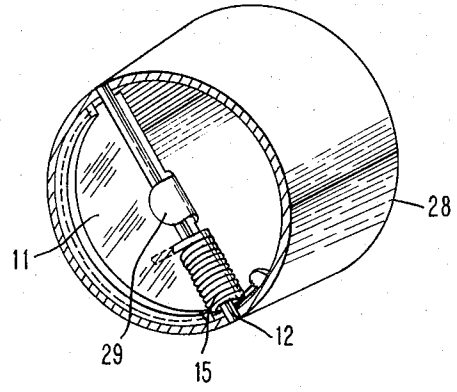


FIG. 4

VELOCITY-ACTUATED FUEL CONTROL VALVE

FIELD OF THE INVENTION

This invention relates to the regulation of fuel supply for internal combustion engines and, particularly, to the automatic compensation of fuel intake upon sudden demand.

DESCRIPTION OF THE PRIOR ART

The problem of smooth operation of internal combustion engines under varying conditions of speed and, particularly, upon acceleration, has been the subject of intensive study since the introduction and universal popularity of motor cars and other vehicles propelled by such engines.

The fuel for conventional internal combustion engines consists of a mixture of air and finely atomized gasoline particles. The ratio of air to gasoline determines the effective usefulness of this mixture at any particular working condition of the engine. The working condition includes, inter alia, the heat of the engine, the speed to be obtained, and the load to be carried. These, as well as other variable factors enter into the fuel mixture requirement.

Various improvements in connection with controls of fuel supply and vaporization thereof in carburetors may be found in the prior art. These generally employ auxiliary devices mechanically interconnected with functional elements of the engine for automatically controlling the fuel-to-air ratio under certain operating conditions.

Representative of such devices is the arrangement shown, for example, in U.S. Pat. No. 1,684,550 to Mallory, wherein an auxiliary choke is pivotally supported ahead of the normally present choke in the induction pipe of the engine, preceding the atomizer nozzle of the carburetor. The auxiliary choke is mechanically actuated by a piston which operates in accordance with the vacuum produced by the cylinders.

U.S. Pat. No. 3,320,938 discloses a shuttle-type piston in combination with fuel-injection-type feed operated by the manifold vacuum.

SUMMARY OF THE INVENTION

This invention relates to improvements in carburetors and, more particularly, to an auxiliary fuel valve actuated by the velocity of the air stream in the intake manifold.

It is a primary object of this invention to provide auxiliary regulation of the fuel mixture automatically, upon demand, without mechanical interlinkage between the regulative element and the engine.

It is a particular feature of the invention that the regulation is effected by a simple valve placed in the intake manifold and located in the Venturi portion thereof.

A particular advantage of the invention is that the valve constructed in accordance therewith may form a complete and independent assembly adapted to be inserted in the intake manifold of various types of carburetors by persons not necessarily skilled in mechanical work.

Other objects, features and advantages will be apparent from the following description of the invention, pointed out in particularity in the appended claims, and taken in connection with the accompanying drawing, in which:

FIG. **1** is a schematic view of the induction pipe portion of an intake manifold with certain functional elements outlined in phantom view;

FIG. **2** is a sectional view taken along long A—A of FIG. **1**;

FIG. **3** is a diagram illustrating the scientific principles of operation of the Venturi portion of an induction pipe; and

FIG. **4** is a view, in perspective, of the auxiliary fuel valve constructed to serve as a self-contained, insertable assembly.

Referring to the drawings, FIG. **1** is a schematic representation of a portion of a conventional induction pipe **10,** generally used as part of the inlet manifold of internal combustion engines.

The above figure, together with FIG. **2** which is a sectional view thereof taken along line A—A, should be considered in connection with the following description.

The velocity-actuated fuel valve, in accordance with the invention, comprises a semi-circular plate member **11** mounted on a shaft **12.** The latter extends transverse to the pipe **10,** terminating in a crank **13.** A spring **15,** anchored in a lug **16** attached to the side of the pipe **10,** is hooked to the crank **13** in order to exert a rotational force to the shaft **12** in such direction as to keep the plate member **11** in a position partially closing the pipe orifice.

The location of the valve **11** within the pipe **10** is of considerable importance and will be explained in connection with the operation of the invention.

Referring further to FIGS. **1** and **2,** it is seen that for the sake of completeness of the fuel feed system there is shown the portion of a conventional carburetor, namely, the fuel supply orifice at **20,** the fuel chamber **21** and the atomizing jet valve **22.** The wall **23** forms the primary Venturi. The conventional choke shutter is indicated at **25** and the throttle shutter at **26.** A bypass for the idling fuel supply is shown at **27.**

Prior to describing the operation of the invention residing in the provision of the velocity-actuated auxiliary valve **11,** some consideration shall be given to the principle of the operation of the induction pipe in the intake manifold of internal combustion engines.

It is well known that the combustion of the mixture in the cylinder of an engine requires oxygen. This is present in the air drawn into the cylinder when the piston descends. The air is passed through a pipe attached to the intake manifold, generally referred to as the induction pipe in which the gasoline is carried along with the stream of air. This effect is based on the law of physics known as Bernoulli's equation, which states that for a gas or other fluid flowing through a pipe, the sum of the static pressure and the dynamic pressure is constant. This means that when the velocity and, therefore, the dynamic pressure, is increased, the static pressure decreases. If the induction pipe is narrowed to a reduced diameter at one particular section, the velocity of air at that section will be increased while the static pressure will diminish to a negative value in relation to the surroundings. In other words, a suction is developed there which causes the gasoline to be sucked out of the fuel supply orifice and be atomized.

The diagram of FIG. **3** illustrates the pressure distribution in an induction pipe having a reduced diameter at one point. The portion of reduced diameter is generally referred to as a Venturi. The pressure gauges sche-

matically shown as columns of a liquid, for example, mercury, are distributed along the pipe and indicate the pressure differences by the relative height of the columns. It is seen that in the portion A, the air stream has low velocity and therefore feeble suction; in the portion B, namely, the Venturi portion, the air stream is at high velocity and therefore powerful suction is present; whereas, in the portion C, which is of the same diameter as portion A, there is low velocity and therefore feeble suction.

As a rule, induction pipes have primary and secondary Venturi portions. This is seen in FIG. **2** where the wall **23** over the fuel supply orifice forms the primary Venturi, producing an air flow of extremely high velocity. The secondary Venturi is formed by the narrow diameter of the pipe at **24** and **24'**.

It is to be noted that the spring-biased valve **11** is placed beyond the fuel supply orifice **20** in the secondary Venturi portion of the pipe **10** at a point where the air velocity is high. Consequently, the actuation of the valve **11** is effected by the air stream impinging upon it and the degree of angular movement is correlated to the force exerted upon the surface of the plate member **11** and the retentive force of the spring **15.** The latter is a constant. The velocity of the air stream depends upon the opening of the throttle shutter **26.** A sudden opening produces a powerful air stream as the fuel mixture is sucked in by the vacuum of a descending piston. The valve **11,** actuated by the velocity of air flow, is caused to move angularly, allowing more air flow, thereby modifying the fuel-to-air ratio at the time of sudden demand.

Upon a steady flow, when the throttle shutter **26** remains in a position for any length of time, the valve **11** may assume either a certain angular position or return to the closed position, depending upon the relative air intake, the surface configuration of the valve, and the biasing force exerted by the spring. It is a matter of design consideration to control the valve action in any desired manner. In practice it was found that a valve having a biasing force which permitted movement thereof in proportion to operating conditions gave a smooth monitoring of fuel intake at various speeds of the engine, maintaining a fuel-to-air ratio for economical operation. The biasing force may of course be easily controlled by providing variable tensioning of the spring **15** in any desired manner.

The control valve herein described is particularly intended for small two-cycle or four-cycle internal combustion engines, such as are used for snowmobiles. As such, it may be installed in existing carburetor assemblies. The embodiment shown in FIG. **4** is intended for such installations.

The plate member of the valve **11** is mounted in a tubular sleeve **28,** and is shown as slightly tapered so as to be insertable in the Venturi portion of the pipe **10.** Obviously the tapering is not necessary in certain types of induction pipes where the Venturi portion consists of a ring-like constriction.

The shaft **12,** over which the valve **11** rotates, is set within the sleeve **28.** The plate member comprising the valve **11** is provided with a lip **29** which is bent back over the shaft **12.** The lip **29** thus serves as a pivotal support for the valve **11.** The biasing spring **15** is of the torsion type and is anchored at one end to the sleeve **28** and, at the other end, rests against the plate of the valve **11.**

The above-described, self-contained assembly may be inserted in the induction pipe of a carburetor by simply removing the throttle shutter **26** and placing it in the secondary Venturi portion. It will fulfill the same function as the one shown in FIGS. **1** and **2,** which represent a permanent mechanical construction in the manufacture of carburetors. The installation of the assembly shown in FIG. **4** may be effected by the use of simple tools and requires no particular mechanical skill.

The invention in its broader aspects is not limited to the specific embodiments herein shown and described but changes may be made within the scope of the accompanying claims without departing from the principles of the invention and without sacrificing its chief advantages.

What is claimed is:

1. In combination with the intake manifold of an internal combustion engine, said manifold having a fuel supply inlet and a Venturi portion, an independent valve assembly comprising a semi-circular disc located in a sleeve and pivotally supported over a shaft transversely positioned in said sleeve, a coil spring wound around said shaft engaging at one end said disc and at the other end said sleeve, said assembly being adapted to be inserted in the intake manifold of an internal combustion engine.

2. The combination in accordance with clalim **1** wherein said sleeve is of such configuration as to conform to the shape of the Venturi portion of the intake manifold.

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