AUTOMATIC ADJUSTING ATOMIZING DEVICES FOR CARBURETORS

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Fig. 1

Fig. 2

Fig. 3

Fig. 4

Fig. 5

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This invention relates to automatic adjusting atomizing devices for carburetors of internal combustion engines and especially those of automotive vehicles, and relates more particularly to spray nozzle devices for improving atomization and efficiency of combustible fuel, most commonly gasoline, employed in such engines.

In internal combustion engines in such automotive vehicles, carburetors of various types for vaporizing liquid combustible fuel are well known, the invention herein being adapted especially for those well-known types of carburetors having the orifices preferably including a Venturi tube, for passing a flow of air therethrough, and a fuel injection atomizing feed nozzle having its discharge feed end in the mixing chamber. In employment of the present invention, the other structural parts of the carburetor may be conventional and perform their respective functions according to the established mechanical laws of their own being.

It will be recognized that for practical purposes of operation of internal combustion engines by carburetion and combustion of liquid fuel, such as gasoline, it is necessary, at least as a practical matter, to atomize and vaporize the liquid fuel in a stream of air in suitably adjusted proportions.

The invention may be briefly described as comprising a tubular fuel injector spray nozzle having one end connected in communication with the liquid fuel supply and having a discharge end portion extending into a mixing chamber of the fuel vaporizing carburetor, in the path of an air flow through the mixing chamber induced by suction of the engine cylinders, the tube of the nozzle being at least partially closed at the terminal discharge end, and having relatively spaced orifices or discharge ports intermediate the length of said discharge end portion of the nozzle. Mounted upon the outer circumference of the nozzle is a sleeve snugly slideable axially upon the nozzle, the sleeve moving against the tension of a coil spring which is circumferential of the nozzle tube, the sleeve having at its opposite ends radially extended flanges which are thereby subject to the current of air in transit through the mixing chamber, so that the sleeve reciprocates upon the nozzle against the tension of the spring proportionally to the air flow and thereby automatically opens and closes the fuel discharge orifices of the nozzle proportionately to said air flow. The mounted end portion of the nozzle which is connected to the source of fuel supply is preferably imperforate, and when the engine and carburetor are at rest, or under operating conditions such as not to move the sleeve against the spring tension, the sleeve overlies the imperforate portion of the nozzle, and the orifices are fully open. The term "tension" is used herein in the broad sense meaning a component of elastic force, whether the force be of compression or expansion.

Having in mind that in the ever-changing conditions of normal driving, it is desirable to provide a ratio (by weight) of air to gasoline of approximately 12 to 1 as a rich mixture for maximum power, and 16 to 1 as a lean mixture for maximum economy (the "1" representing a good quality of gasoline), and also bearing in mind that a lean mixture consistent with the necessary power is the most efficient use of the liquid fuel, the invention of the present invention to provide means operative responsive to the air flow through the carburetor mixing chamber for automatically adjusting the relative proportions of the atomized fuel and the air, which are vaporized and fed to the intake manifold, and to the combustion chambers of internal combustion engines.

Another object is to provide automatically operative means for increasing and decreasing the quantity of fuel fed from a carburetor spray nozzle proportionately to the R.P.M. speed of the engine and of air flow through the mixing chamber responsive thereto.

Another object is to provide in a carburetor for internal combustion engines a simple and effective automatically operative fuel feed nozzle for adjusting the feed of liquid combustible fuel in proportion to an air intake induced by speed of the engine.

With the foregoing and other objects in view as will be more fully set forth, one form in which the invention may be embodied is described herein and illustrated in the accompanying drawing which is made a part hereof.

In the drawing:

FIG. 1 is a vertical transverse view of the invention, partly in section and partly broken away.

FIG. 2 is a horizontal transverse section on line 2—2 of FIG. 1.

FIG. 3 is a perspective view of a nozzle yoke bar shown in FIG. 1.

FIG. 4 is a fragmental enlarged vertical section of portions of structure shown in FIG. 1, showing a sleeve at a different operative position.

FIG. 5 is a horizontal transverse section on line 5—5 of FIG. 4.

FIG. 6 is an enlarged horizontal transverse section on line 6—6 of FIG. 5.

Referring to the drawing in which like reference characters indicate corresponding parts in the several views, FIG. 2 indicates generally a carburetor device for fuel in an internal combustion engine. The carburetor may be of any suitable type having at one end a tubular primary air intake portion 11 generally called an air horn, and may be termed a choke chamber having an air choke 11a therein. The air horn communicates freely with one end portion of a mixing chamber 12, preferably of a well-known Venturi type, the opposite end of the mixing chamber 12 in turn communicating with a throttle valve chamber or barrel 13, which is provided with an outlet tube 14 to the engine intake manifold (not shown).

A float chamber bowl and reservoir 15 for a suitable atomizable liquid fuel is normally closely spaced adjacent to the mixing chamber 12, being provided with a float control 16 and a regulating feed jet 17 for the feeding of fuel from the float chamber to the mixing chamber by suitable conduit means. Such a conduit means is exemplified as a tubular or canized well and passageway 18, which extends through the body wall of the mixing chamber and is canized through a yoke or nozzle bar member 19 mounted transversely across the end of the mixing chamber 12 at the end of the mixing chamber which is adjacent to the primary air intake or air choke portion 11. Within the nozzle bar member 19 the canized passageway 18 is provided with an open end vent 20 which communicates with the tube of an elongated tubular spray nozzle 22. The tubular spray nozzle 22 extends from the nozzle bar 19 axially into the mixing chamber 12. At the communicating juncture of the vent 20 and the tube of the spray nozzle 22, there is threadedly mounted an aspirator valve member 21 having a tube bore 21a therethrough aligned with the tube of the spray nozzle, the tubular bore 21a of the aspirator communicating with the primary airflow intake through the air choke chamber 11, and thereby providing an aspirator for atomizing liquid fuel in the tube of the spray nozzle 22. The yoke 19 is a relatively narrow bridge extending across the upper portion of the mixing chamber 12 and substantially adjacent to the air horn 11, its width being preferably as...
narrow as practicable so as not to interfere with the free flow therepast of the primary air from the air horn or choke chamber 11 to the mixing bowl or chamber 12. The well passageway 18 also serves as a fuel feed for an idling fuel system of any suitable type, by means of an idling tube 23 and a separate canal tube 24 which passes around the regulating aspirator orifice element 21. A throttle plate valve 25 of any conventional type is mounted in the throttle chamber or barrel 13 and operates in the well-known conventional manner responsive usually to a foot-operated accelerating pedal for feeding atomized and vaporized fuels from the carburetor to the engine intake manifold, and simultaneously controlling the primary air flow through the mixing chamber responsive to the suction or reduction of pressure generated in the mixing chamber by the partial vacuum induced in the intake manifold by the down or suction intake stroke of the engine cylinders.

Preferably the mixing chamber 12 is itself formed as a Venturi barrel 26, as shown in FIG. 4, which, as well known, comprises a short tube in any flow line, wherein the internal surface consists of two truncated conical portions connected at the abutting ends of the lesser or constricted diameter and forming thereat a point or portion generally called the throat 27. Such a Venturi may however be a separate structural part as it is in many carburetors. The utilizable structural factor of the Venturi is that it increases the velocity of the flow therethrough at the constricted throat, on the theory that the quantity of air or mixture which passes any cross section of the Venturi at a given time is the same, but its velocity is inversely proportionate to the areas of those sections.

It will be observed that the bridged yoke 19 extends across the mixing chamber in spaced relation to the throat of the Venturi, and that the tubular spray nozzle 22 extends from the yoke axially through the length of both truncated sections of the Venturi, and manifestly through the throat of constricted diameter, substantially the longitudinal center of the spray nozzle being at the cross section of the Venturi throat.

That half-length portion of the tubular spray nozzle 22 which is between the constricted throat 27 of the Venturi and the supporting yoke 19, is cylindrical and imperforate as at 28, whereas that half-length free end portion of the spray nozzle between the Venturi throat 27 and the opposite free end of the Venturi of greater diameter, at 29, is provided with axially spaced orifices 30 which are preferably also relatively spaced at 90 degrees circumferentially of the nozzle. At the free terminal end of the nozzle the orifice bore is substantially closed by an end plate 31, which may if desired have a similar orifice 32 therethrough of relatively small diameter compared with the diameter of the tube of the nozzle. It will be noted that the end plate 31 is of greater diameter than the tubular nozzle and thereby provides a radially extended flange 33 closely adjacent to the free terminal end of the nozzle, the radial orifices 34 spaced at 90 degrees therein, substantially in the plane of the open terminal end of the Venturi. Orifices 30, 32 and 34 communicate with the nozzle tube.

Mounted circumferentially and slideable axially upon the cylindrical spray nozzle 22 is an elongated sliding sleeve generally indicated 35 which is substantially one-half the length of that portion of the spray nozzle on which the sleeve is slidable, making due allowance for space occupied by a fully compressed tensioned coil spring, as will be described. The sliding sleeve 35 has a hollow cylindrical imperforate portion 36 intermediate its ends, and provides its opposite ends with radially extended flanges, respectively designated lower flange 37 and upper flange 38, as herein exemplified in the drawing, though it is contemplated that the mixing chamber and spray nozzle may be differently positioned, which might, to that extent, change that description of those flanges.

The flanges 37, 38 may be termed air flanges, and it should be manifest that they are of lesser maximum diameter than the diameter of the mixing chamber and throat 27 of the Venturi.

A coil spring 39 is mounted circumferentially of the spray nozzle between the lower air flange 37 of the sleeve and the terminal flange 33 of the spray nozzle. Normally this coil spring 39 is expanded and by its tension raises the sleeve to a position overlying and enclosing the imperforate portion 25 of the spray nozzle, and the lower air flange 37 is substantially at the plane of the Venturi throat. When the sleeve is moved to a position overlying and enclosing the orifices 30 responsive to pressure of the air flow through the mixing chamber, the spring is compressed. To make allowance for the space which will be occupied by the compressed coils of the spring around the nozzle adjacent nozzle flange 33, and the fact that its coils will thereby be spaced more closely together, the perforated half-length portion of the spray nozzle may be made slightly longer than the sleeve.

In operation the direction of air flow through the mixing chamber is indicated by arrows. The coil spring normally maintains the lower flange 37 of the sleeve in the plane of the throat 27 of the Venturi. In starting or operating the engine the upper plate valve 11 may be partially or completely closed and the air flow through the air horn and mixing chamber is relatively little and the coil spring maintains the sleeve enclosing the imperforate end portion 25 of the nozzle, in a position wherein the lower air flange 37 is at the plane of the throat of the Venturi, the full capacity of the orifices 30 being open. At this position of the sleeve, the carburetor functions primarily as the conventional carburetor, except that the atomizing of the gasoline fuel is accomplished more completely by spacing orifices 30 at 90 degrees circumferentially as well as the longitudinal spacing thereof.

As the revolutions of the motor are increased, the air choke valve 11a is opened, manually or automatically, and the air volume and velocity through the mixing chamber are increased responsive to the suction intake of the engine cylinders, the increased air flow through the Venturi and mixing chamber exerting proportionately greater pressure against the flanges 37, 38, and more especially on the lower flange 37 which is at the throat of the Venturi where velocity of air flow is greatest. Thus the sliding sleeve is moved against the expansive tension of the spring proportional to the velocity of the air flow and thereby initially closes the upper or more adjacent nozzle orifices 30. As the revolutions of the motor are further increased, and providing a greater air velocity through the mixing chamber and the Venturi, the sliding sleeve will move progressively to enclose additional lower or more remote orificed portions of the nozzle in proportion to the air volume and velocity, until the compressed coils of the spring prevents further movement of the sleeve, at which time all of the orifices of the nozzle will be closed, excepting the orifices 32 and 34 which are not affected by operation of the sleeve. Upon reducing the speed or revolutions of the engine the air flow through the mixing chamber is correspondingly reduced and the spring tension is effective to raise the sleeve and thereby open additional orifices. Thus the ratio of gasoline fuel consumption as compared to the conventional carburetor is constantly automatically regulated by the movements of the sleeve induced by the respective increase and decrease of the engine speed.

In employing the orificed spray nozzle and sliding sleeve axially of a Venturi tube the greater efficiency in burning the fuel is believed to be due to the increase of the air velocity at the Venturi throat and the decreased velocity between the throat and its larger end, with relation to the positioning of the lower flange 37 of the sleeve at the throat-position of greatest air velocity when the engine speed is relatively slow, and automatically moving the sleeve and flange to a position of lesser effective air velocity when the engine speed is increased, thereby simul-
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Simultaneously respectively increasing or reducing the number of fuel feed orifices which are open in the spray nozzle. Since the quantity of the feed of fuel from the spray nozzle is responsive to suction of air passing through the mixing chamber, or the Venturi, there is not as great a feed of fuel when the speed of the motor is relatively slow and, though the mixture of air and fuel may be relatively rich, this fuel is more completely vaporized because of a larger number of openly exposed orifices in the spray nozzle. As the speed of the engine is further increased, there is greater suction and air velocity through the mixing chamber, (and if a Venturi is employed, a greater air velocity at the throat thereof), at which time the sleeve will be moved against the tension of spring 39 by the increased air velocity to a position which closes a number of the orifices 30 and thus reduces the quantity of the fuel feed and provides a leaner mixture of atomized and vaporized fuel to the engine intake manifold.

It has been noted that the spring 39 would by its expansive tension urge the sleeve toward the upper or air-intake end portion of the mixing chamber 12. Where the spray nozzle is axial of a Venturi, the so-called lower flange 37 would be positioned at the throat of the Venturi. Therefore, when the sleeve is moved from such a position and thereby compresses the spring, the lower flange 37 will have moved into an area of decreased air velocity in the Venturi. It is desirable, therefore, to at least partially counteract this increase of spring compression. For this reason the second or upper flange 38 is employed at the upper opposite end of the sleeve and is effective to counterbalance the increased compression resistance of the spring 39, since, as the lower flange 37 moves away from the zone of greater air velocity, the upper flange 38 moves into that zone.

Having described the invention, what is claimed as new and patentable is:

1. A liquid fuel carburetor having a fuel-mixing chamber communicating at its opposite ends, respectively, with an air intake means, and with a fuel intake manifold for combustion cylinders of an internal combustion engine, the combination therewith of means for feeding combustible liquid fuel to said mixing chamber including an elongated tubular spray nozzle for fuel positioned in said mixing chamber in the path of the airflow through the mixing chamber, said tubular spray nozzle having one end of its tube communicating with the liquid fuel supply, an aspirator at said one end of said tubular nozzle for atomizing said fuel in the nozzle responsive to air drawn through the aspirator simultaneously with the feed of fuel to the nozzle, the opposite free terminal end of the tube being at least partially closed, said nozzle having an imperforate side wall portion adjacent to said aspirator and being provided with orifices through the side wall thereof adjacent said free terminal end portion, and a spring-tensioned sleeve circumferential of the nozzle and slidable longitudinally thereof, said sleeve having a flange extending radially from the sleeve into the path of the air passing through the mixing chamber, the sleeve being spring-biased to normally overlie the imperforate portion of the nozzle, and being thereby adapted for automatically opening the tube orifices responsive to the expansive tension of the spring, and said sleeve being adapted for automatically closing said orifices by compression of the spring and movement of the sleeve responsive to pressure of the airflow against said flange of the sleeve.

2. An automatic adjusting fuel feed for carburetors as set forth in claim 1, said mixing chamber including a venturi tube portion, and the spray nozzle having its orificed portion axially beyond the constricted throat of the venturi tube in the direction of the airflow through the venturi tube.

3. In carburetors for internal combustion engines, an automatic adjusting fuel feed as set forth in claim 2, and in which the sleeve has a radially extended flange at each of its opposite end portions.

4. An automatic adjusting fuel feed for carburetors which have a fuel mixing chamber provided with an airflow therethrough, said fuel feed comprising an elongated tubular fuel-atomizing spray nozzle positioned in said mixing chamber in the path of the air flow through said mixing chamber, said tubular spray nozzle having an imperforate side wall at an end portion communicating with a liquid fuel supply and having its tube at least partially closed at the opposite free end of the spray nozzle, said spray nozzle having relatively spaced orifices through its side wall adjacent to its free end portion, a spring-tensioned sleeve circumferential of the nozzle and slidable longitudinally thereof, said sleeve being normally spring-biased towards its imperforate portion of the nozzle and having a radially extended flange at its end portion which is more nearly adjacent to the orificed portion of the spray nozzle, and a coiled spring circumferentially of the spray nozzle, said spring being under compression between the orificed free end portion of the nozzle and the said radial flange of said sleeve whereby said sleeve is normally spring-biased towards said imperforate end of said nozzle.

5. An automatic adjusting fuel feed for carburetors as set forth in claim 4, and in which the mixing chamber of the carburetor includes a venturi tube, and the spray nozzle is mounted axially longitudinally of the venturi tube, the imperforate portion of the nozzle being an air intake end of the venturi tube and the orificed portion of the nozzle being at the opposite end portion of the venturi tube beyond the throat of the venturi tube.

6. In an automatic adjusting fuel feed for carburetors of internal combustion engines as set forth in claim 5, the said sleeve having a pair of radially extended flanges relatively spaced adjacent to each of the respective opposite end portions of the sleeve.

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