United States Patent

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[54] **CARBURETOR**
3 Claims, 2 Drawing Figs.

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[50] **Field of Search** 261/69, 69.1, 51, 67

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ABSTRACT: A carburetor having a body, an induction passage formed through the body with a variably positionable throttle valve situated therein and a main fuel supply system for discharging fuel into the induction passage, fuel valve means actuated in response to engine-developed vacuum being reduced below a predetermined value for supplying additional quantities of fuel to the induction passage, is provided with additional valve means actuated in accordance with throttle valve position for causing the fuel valve means to be opened to provide such additional quantities of fuel whenever the throttle valve attains a preselected degree of opening regardless of the value of the then engine-developed vacuum.

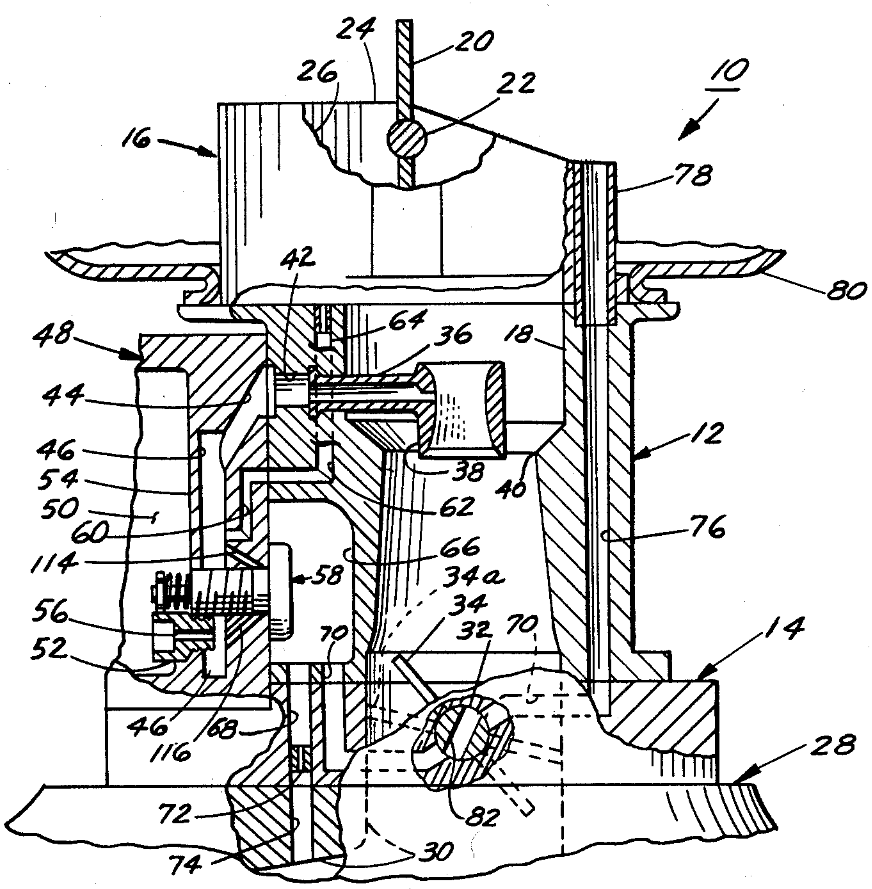

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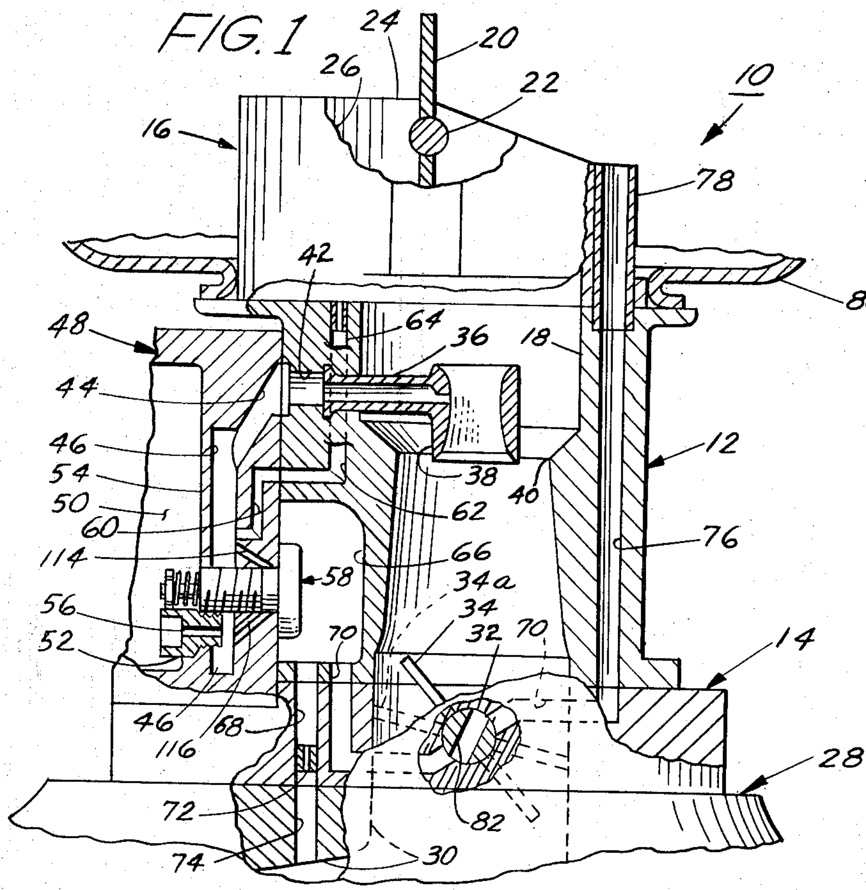
FIG. 1



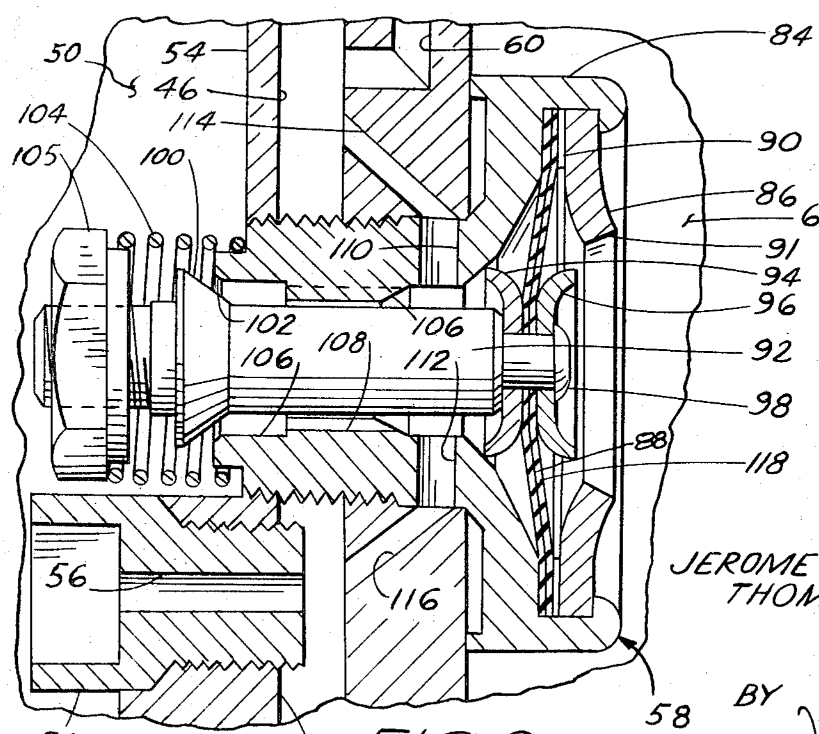


FIG. 2

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CARBURETOR

BACKGROUND OF THE INVENTION

It has been accepted practice to provide, in carburetor structures, a power fuel enrichment system comprised of a power valve assembly carried by the carburetor in a manner so as to be affected by engine manifold vacuum. The manifold vacuum acting on the diaphragm, which is connected to the valve member of the power valve assembly, at idle or normal load conditions, as well as during engine deceleration, is strong enough to overcome a spring resistance and maintain the valve member closed. When high power demands place a greater load on the engine and manifold vacuum drops below a predetermined value, the power valve spring overcomes the reduced vacuum opening the valve member. Consequently, fuel flows through the open valve member and ultimately into the carburetor induction passage thereby enriching the otherwise normal fuel-air mixture. As engine demands are reduced manifold vacuum again increases. The increased vacuum acts on the diaphragm finally overcoming the spring resistance and closing the valve member. This shuts off the added supply of fuel which is no longer required.

However, because of greater emphasis recently placed on exhaust emissions, it has generally been necessary to calibrate the power valve assemblies so as to be fully closed at manifold vacuum values of the order of 3.0 inches of mercury (Hg) and to open only when the manifold vacuum decreased below such a value. This is in contrast to prior practice where, for example, the power valve assembly would be opened when the value of manifold vacuum dropped to 6.0 inches Hg.

Consequently, it has been found that many engines even when operating at a relatively high speed and under heavy loads still produce or generate a manifold vacuum of a value sufficient to maintain the power valve assembly closed even though engine demands are such as to require richer fuel-air mixtures. Such too-lean mixtures often cause engine damage as by burning of the valves.

Accordingly, the invention herein disclosed and claimed directs itself to the solution of such problems.

SUMMARY OF THE INVENTION

According to the invention, a carburetor for an internal combustion engine comprises a body, an induction passage formed through said body for the passage of air therethrough, a fuel supply system for discharging fuel into said induction passage to form a combustible mixture with said air, a variably positionable throttle valve situated within said induction passage for controlling the flow of said combustible mixture from said induction passage to said engine, valve means responsive to indicia of engine load for at times supplying additional fuel to said fuel system for enriching said combustible mixture, and additional modulating means responsive to the attainment of a preselected position by said throttle valve for causing said valve means to supply said additional fuel regardless of the load experienced by said engine.

Accordingly, a general object of this invention is to provide, in a carburetor having a valve for at times enriching the fuel-air mixture delivered by the carburetor, means for modulating the operation of the fuel enriching valve.

Another object of this invention is to provide, in a carburetor having a valve for at times enriching the fuel-air mixture delivered by the carburetor, means for modulating the operation of the fuel enriching valve when the carburetor throttle valve attains a preselected position.

Other objects and advantages of the invention will become apparent when reference is made to the following detailed description considered in conjunction with the accompanying drawings.

DESCRIPTION OF THE DRAWINGS

In the drawings:

FIG. 1 is a side elevational view, with portions thereof cut away and in cross section, of a carburetor embodying the invention; and

FIG. 2 is an enlarged cross-sectional view of a fragmentary portion of certain details of FIG. 1.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now in greater detail to the drawings, FIG. 1 illustrates a carburetor 10 comprising a body 12 with a throttle body 14 and air intake 16, secured thereto at opposite ends thereof, with an induction passage 18 formed therethrough adapted to be controlled at one end by a choke valve 20 secured for rotation with a choke shaft 22 suitably journaled in the walls 24 and 26 of air intake 16. The choke valve 20 and shaft 22 may be positioned as by an automatic choke mechanism many types of which are well known in the art.

Throttle body 14, suitably secured to an induction or intake manifold 28 of an internal combustion engine, continues to define the induction passage 18 and places the induction passage 18 in communication with the intake passage 30 of the engine intake manifold 28. A throttle shaft 32, journaled in the walls of throttle body 14, has secured thereto, for rotation therewith, a throttle valve 34 which is illustrated in a partly open or "part throttle" position thereby permitting a controlled flow of combustible mixtures to flow through the induction passage 18, past throttle valve 34 and into passage 30 of intake manifold 28. Throttle shaft 32 may, of course, be connected to suitable throttle actuating mechanism, as is well known in the art, as for manual actuation thereof.

A main fuel nozzle 36 having its discharge end 38 situated generally within the throat of a main venturi 40, formed in the induction passage 18, communicates at its other end with a passage 42 which, in turn, is in communication with passageway or conduit 44 and a main well 46. Conduit 44 and main well 46 may be formed in the metering section of an associated fuel supply or fuel bowl assembly 48 suitably secured to the carburetor body 12.

The fuel bowl assembly 48, provided with a suitable fuel inlet, defines a fuel reservoir or chamber 50 for containing therein a quantity of liquid fuel the level of which may be determined as by any suitable means such as a float-controlled fuel inlet valve arrangement many of which are well known in the art.

A main fuel restriction 52, threadably received through a wall 54 in fuel bowl assembly 48, has a calibrated restriction or passageway 56 formed therethrough for communication between chamber 50 and main well 46. A power valve assembly 58, also threadably received through wall 54, is adapted to at times complete communication between chamber 50 and well 46 so as to thereby complete a second passage means between fuel chamber 50 and well 46 paralleling restricted passageway 56. Further, passage means, comprised of a conduit portion 60 formed in wall 54 and a conduit portion 62 formed in carburetor main body 12 and containing a restriction 64 therein, functions as a high speed air bleed to the main well 46.

A cavity 66, formed in carburetor body 12 generally, surrounds one end of power valve assembly 58 and is in communication with conduits 68 and 70. Conduit 68, provided with a suitable restriction 72 therein, communicates with a conduit 74 formed in intake manifold 28 and communicating with intake passageway 30.

As can be seen in FIG. 1, conduit 70 extends through throttle body 14 in a manner so as to have the throttle shaft 32 extend transversely therethrough. The other end of conduit 70 is in communication with a conduit portion 76 formed through carburetor main body 12 and having an upwardly disposed extension 78 which communicates with a source of atmospheric air such as the interior of an air-cleaner assembly 80 suitably secured to the upper portion of the carburetor 10. A valving passageway or conduit portion 82 formed transversely of and through throttle shaft 32 is positioned, with respect to the throttle valve 34, so as to complete communication through conduit 70 when throttle valve 34 and shaft 32 are rotated to a predetermined position as generally illustrated in FIG. 1.

FIG. 2 illustrates, in enlarged cross-sectional view, the power valve assembly **58** as being comprised of a housing **84** which cooperates with a coverlike member **86** to peripherally secure a pressure responsive diaphragm member **88** therebetween. A sealing gasket **90** may be provided in order to prevent damage to the periphery of diaphragm **88**. The area generally between diaphragm **88** and cover member **86** is vented to the pressure within chamber **66** as by an opening or aperture **91** formed in cover **86**.

A stem member **92** secured at one end thereof to diaphragm **88**, as by oppositely disposed plates **94** and **96** and a peened-over portion **98**, carries a valve portion **100** thereon which is adapted to at times seat against a valve seat **102** formed in the end of housing or body **84**. At other times, a spring **104** engaging, an abutment **105** carried by stem **92**, moves stem **92** and valve member **100** away from seat **102** so as to complete communication between fuel bowl chamber **50** and the interior chamber **106** of valve housing **84**. A plurality of generally axially extending flutes or guides **108** may be formed within chamber **106** so as to generally guide the movement of stem **92** without in any material way restricting flow from the inlet, defined by opened valve **100** and seat **102**, to the radially directed passageways or conduits **110** and **112** formed in power valve housing **84**. Conduits **110** and **112**, in turn, respectively communicate with conduits **114** and **116**, formed in wall **54**, which communicate with main well **46**.

OPERATION

Generally, it is well known in the art that the value of manifold vacuum generated by the engine will vary depending on such factors as engine speed, road load and throttle valve position. For example, with the engine operating at idle, a relatively high value of manifold vacuum will be generated because, at such time, the throttle valve **34** is in its nominally closed position illustrated in phantom line at *34a*. During such time, as is well known in the art, the principal means for supplying fuel to the induction passage **18** and intake manifold **28** is by suitable conduitry and metering means collectively referred to as the idle fuel system. Such idle fuel systems are well known in the art and, for purposes of clarity, are not illustrated herein since the practice of the invention is not in any way limited to or by an associated idle fuel system. During such idle engine operation the manifold vacuum may be of a value in the order of 16.0 to 19.0 inches of mercury (Hg).

As the vehicle is started into motion by the movement of the throttle valve **34** (in the clockwise direction in FIG. 1) in the opening direction, the load placed on the engine increases and because of the throttle valve **34** being moved toward a more fully opened position the value of the manifold vacuum decreases. The amount of decrease will depend on the load placed on the engine as well as the rapidity with which the throttle valve **34** is rotated from its nominally closed position toward a more fully opened position. If the engine load is sufficiently great and the opening movement of the throttle is sufficiently rapid, the manifold vacuum may, during this time, decrease to a value in the order of 1.0 to 4.0 inches Hg.

Further, when the vehicle is decelerating with the throttle valve nominally closed and the vehicle driving the engine, the value of the generated manifold vacuum may well substantially exceed that established at idle engine operation and be in the order of 21.0 to 22.0 inches Hg.

Accordingly, it can be seen that manifold or engine-generated vacuum is related to engine operation and as such may be employed as not only an actuating force but also as a control parameter for related devices. Further, it can be seen that chamber **66** and one side **118** of diaphragm **88** will be exposed to manifold vacuum of a varying value, depending upon throttle position and engine load, by virtue of the communication established by serially situated conduits **68** and **74**.

The main fuel system, comprising restriction **52**, main well **46**, conduits **44**, **42** and main nozzle **36** serves to supply fuel to the induction passage **18** generally during normal off-idle engine operation, as is well known in the art. Further, the manifold vacuum acting on diaphragm **88** at conditions of idle, normal load conditions or deceleration is sufficient to overcome the force of spring **104** thereby holding valve member **100** shut against valve seat **102**. However, when demands for higher power place a greater load on the engine and manifold vacuum decreases below a predetermined value, spring **104** overcomes the pressure differential across diaphragm **88** and moves valve **100** off seat **102** thereby permitting additional fuel to flow from chamber **50** through the power valve inlet, interior chamber **106** and out through radial passages **110**, **112** and communicating passages **114**, **116** into main well **46**. It should be mentioned that it is often accepted practice to form passages **114** and **116** of a calibrated cross-sectional area in order to provide the desired metering characteristics thereto. The rate of fuel flow from the fuel bowl chamber **50** to main well **46** being thusly increased by the opening of the power valve assembly **58** causes an enrichment of the flow through the main fuel discharge nozzle **36** resulting in, of course, the ultimate enrichment of the fuel-air mixture being supplied to the induction passage **18** and intake manifold passageway **30**. As engine power demands are reduced, manifold vacuum increases; when the vacuum has sufficiently increased, the pressure differential created across diaphragm **88** overcomes the force of spring **104** and again closes valve **100** against valve seat **102**. This results in the rate of fuel flow being again controlled primarily by the effects of restriction **52**.

Now, for purposes of illustration, let it be assumed that passageway or conduit **82**, formed through throttle shaft **32**, is so positioned as to start to become aligned with and communicate between the respective portions of conduit **70** when the shaft **32** and throttle valve **34** are rotated in the opening direction to a position whereat throttle valve **34** is inclined at 50° with respect to a plane passing normal to the centerline of induction passage **18**. This condition is represented by throttle valve **34** and conduit **82** in FIG. 1.

Of course, as throttle valve **34** is rotated to the position shown, atmospheric air (high pressure with respect to the manifold vacuum) is admitted through conduit extension **78**, conduit **76**, conduit **70** and conduit **82**, and into chamber **66** to which diaphragm **88** is exposed. Because of the presence of restriction **72** in conduit **68**, chamber **66** remains at substantially atmospheric pressure until such time that passage **82** of throttle shaft **32** initiates termination of communication through conduit **70** by rotation out of alignment therewith.

As long as chamber **66** is maintained at a substantially higher pressure by the alignment of conduits **82** and **70**, the power valve assembly **58** will be open permitting additional quantities or an increased rate of fuel flow to exist from fuel bowl chamber **50** to main well **46** and the discharge nozzle **36**.

It should be apparent that the rotatable conduit portion **82** and passageway **70** combine to cooperatively define a valving means or mechanism which is actuated or positioned generally in accordance with throttle valve position so as to complete communication therethrough. Arrangements other than that specifically disclosed are of course possible. For example, suitable rotary valve means not directly carried by the throttle shaft but operatively connected to the actuating linkage associated therewith may be employed. Further, lost motion connecting means (such as a suitable cam or other lost motion linkage) may be employed and positioned by the throttle shaft or actuating linkage associated therewith for operatively engaging and actuating a related valve mechanism to an open position upon the throttle valve reaching a predetermined opened position.

The essence of the invention resides in the provision of modulating means for causing the power valve to move to the open position, whenever the throttle valve is in a predetermined opened position, regardless of the value of manifold vacuum. Such modulating means, which could be responsive to some other engine operating condition, serves as a protection against the power valve closing at high engine speeds and heavy loads, or at some other time when the valve should be open.

This becomes an important consideration in engines which because of their design characteristics and ratings develop high manifold vacuums. For example, in many large truck engines a manifold vacuum of a value sufficient to maintain the power valve closed may well be developed even though the engine is operating at relatively high speed and heavy load. In such situations if the throttle valve is opened to an angle of say 50°, with the power valve closed, the resulting fuel-air often becomes too lean and causes burning of the engine valves.

Accordingly, it can be seen that the invention as herein disclosed provides effective means for modulating the operation of the power valve so as to assure a proper fuel-air ratio during such engine operating conditions by causing the power valve to become opened and supply additional fuel whenever the throttle valve has attained a preselected open position (assumed herein to be 50°) regardless of the value of the manifold vacuum generated by the engine.

It should be mentioned that preferably the relative angle of conduit **82**, the cross-sectional area and configuration of communicable conduit sections **70** are so selected as to continue venting of chamber **66** to the atmosphere from the moment that throttle valve **34** first attains its preselected position up to and including further opening of the throttle valve resulting in a wide-open throttle position.

In summary, it can be said that the invention, under heavy engine loads, provides a more precise enrichment when it is needed for power and engine cooling while during turnpike driving or the returning of empty vans where manifold vacuum may be high, the invention permits safe, lean and economical part-throttle operation.

Although the invention has been disclosed as being embodied within a single bore or induction passage carburetor, it should be apparent that it can be equally well employed in not only a multibore single stage carburetor but also in a multibore multistage carbureting device. In multibore carburetors it is often accepted practice to provide a separate main discharge nozzle and separate related main fuel wells. In such situations, a single power valve may be employed for supplying increased fuel flow to both wells and such single power valve would be modulated in the manner herein disclosed.

Although only one preferred embodiment of the invention has been specifically disclosed and described, it is apparent that other embodiments and modifications of the invention are possible within the scope of the appended claims.

We claim:

1. A carburetor for an internal combustion engine, comprising a body, induction passage means formed through said body for the passage of air therethrough, a fuel source and a main fuel passage between said induction passage and said fuel source, said main fuel passage having a fixed metering restriction therein and being free of any variable restrictions, a parallel fuel passage connecting said fuel source with said main fuel passage downstream from said fixed metering restriction, a fuel valve controlling said parallel fuel passage, said fuel valve having resilient means tending to open the same and pressure responsive means for closing said valve against the force of said resilient means, constantly open vacuum passage means for communicating engine generated vacuum to said pressure responsive means, said vacuum passage having a calibrated fixed restriction therein, a throttle shaft pivotally mounted in said induction passage, air bleed passage means for communicating substantially atmospheric pressure to said pressure responsive means, valve means controlling said air bleed passage for closing the same when said throttle is closed and until said throttle valve is opened to a predetermined position.

2. A carburetor such as that recited in claim **1**, wherein said valve means controlling said air bleed passage is formed in said throttle valve shaft.

3. A carburetor such as that recited in claim **1**, wherein said air vacuum passage restriction causes a delay in closing of said parallel fuel passage when said air bleed passage valve is closed.