

Jan. 9, 1968

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3,362,694

CARBURETOR

Filed May 17, 1965

4 Sheets-Sheet 2

FIG. 4.

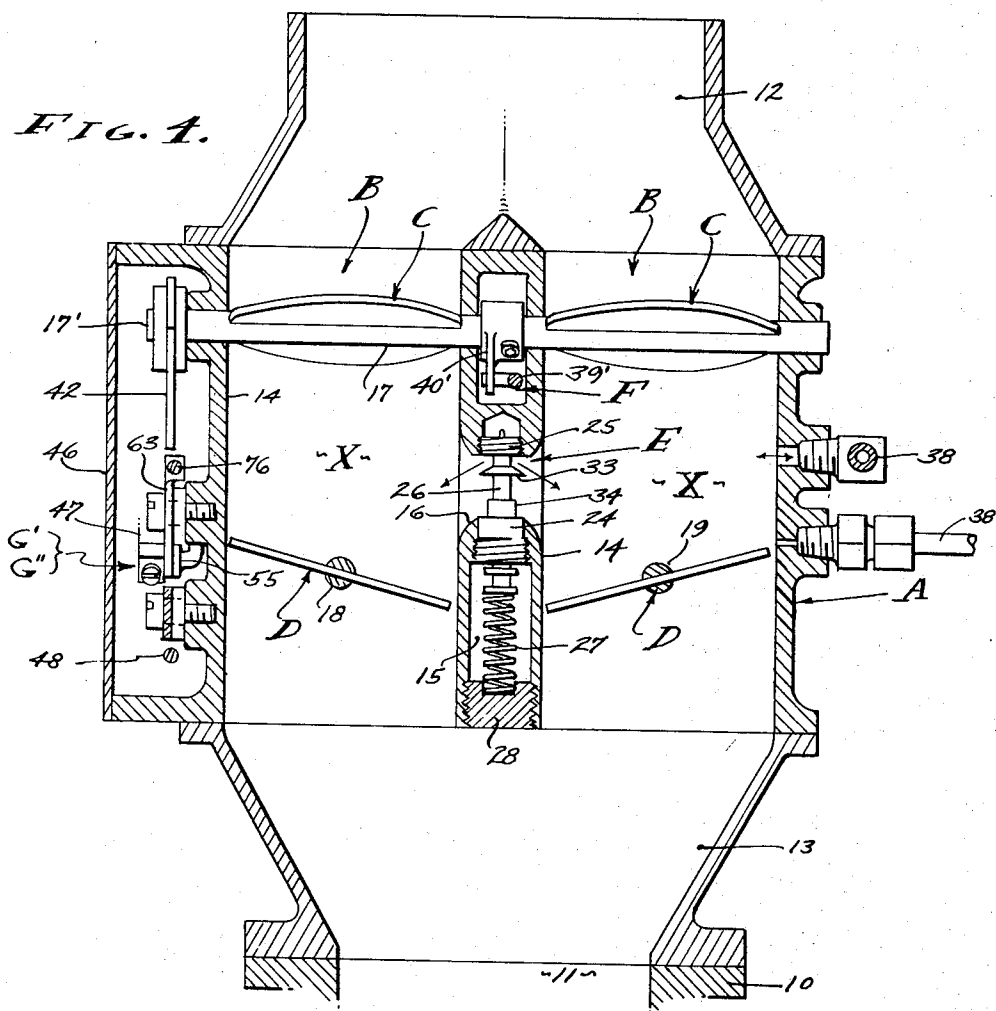
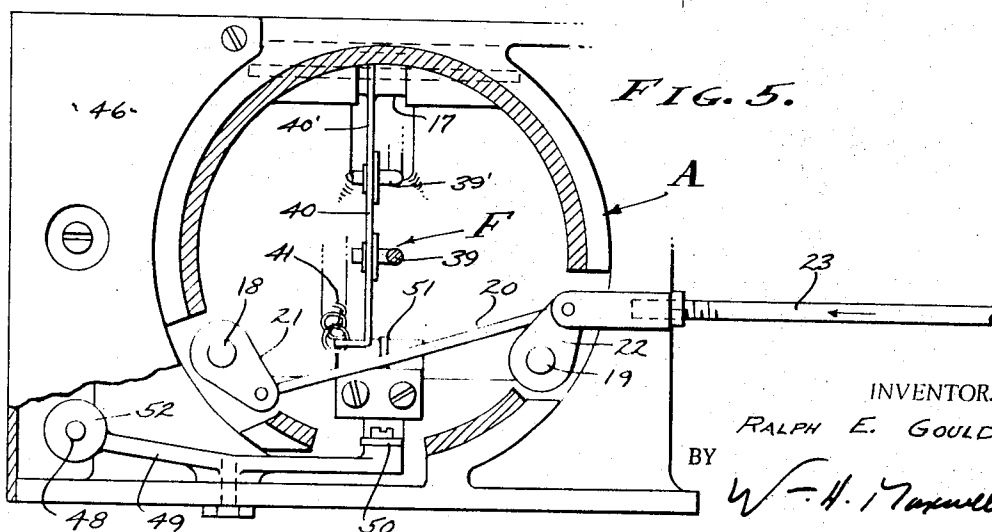


FIG. 5.



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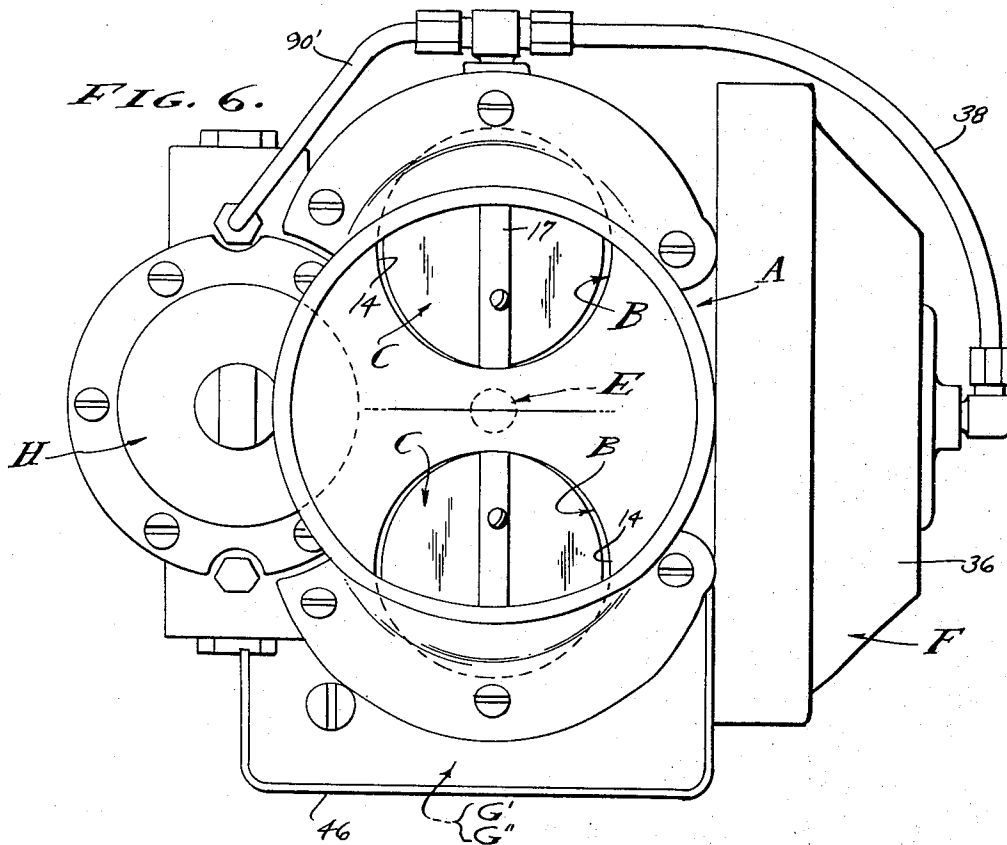
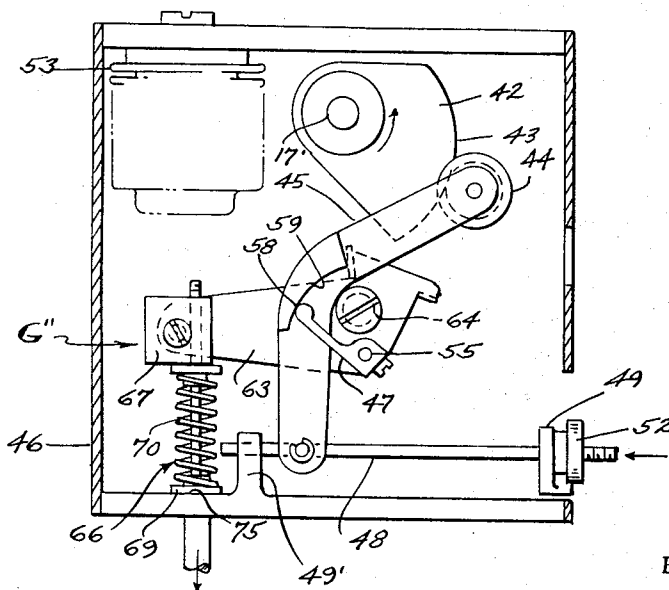
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4 Sheets-Sheet 3



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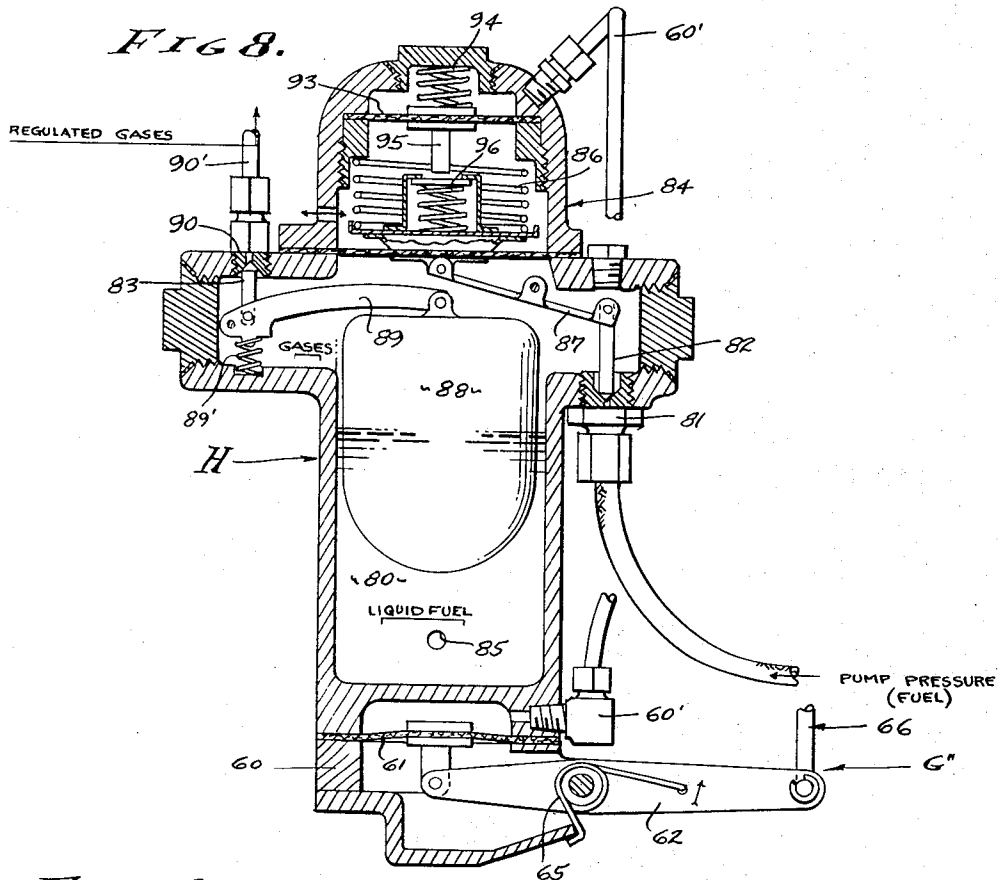
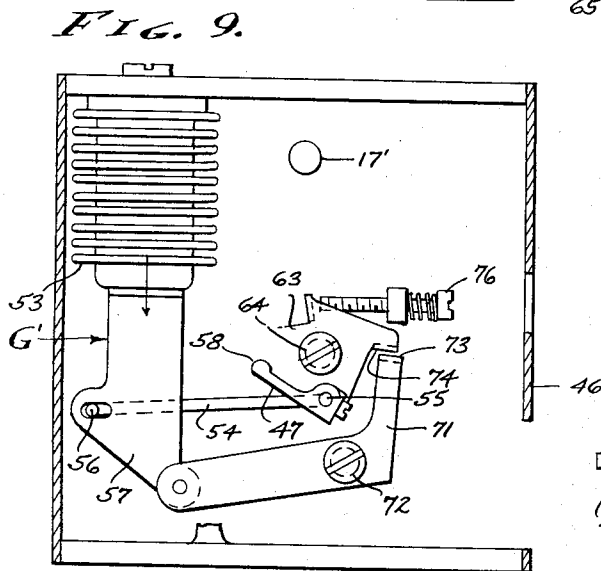
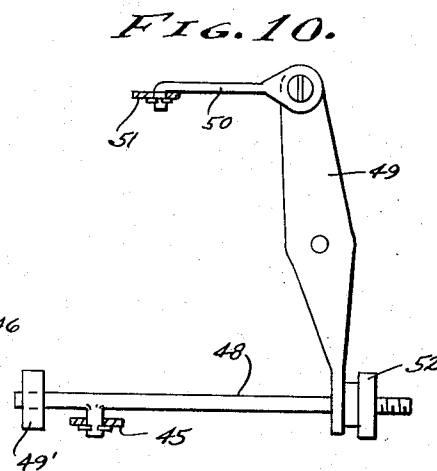
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4 Sheets-Sheet 4



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8 Claims. (Cl. 261—23)

ABSTRACT OF THE DISCLOSURE

This invention has to do with a carburetor that involves generally, straight and/or cylindrical induction tubes, a diaphragm controlled air metering valve coordinated with a fuel metering valve, and a pressure regulated fuel supply. And, in addition to these general characteristics there are other novel features among which is environmental control which automatically maintains proper air to fuel adjustments, improved atomization of fuel which virtually eliminates detonation and the necessity of the usual chokes and atmospheric venting, and the shut-off of fuel above idling speeds when power is not demanded.

The prior art and generally accepted carburetor is characterized by a high operating pressure drop that is normally measured as twenty inches of water column, and by a venturi throat with a fuel injection nozzle therein that draws from a vented float chamber through a low speed and/or a high speed jet. Further, the usual carburetor is also characterized by having accepted necessities such as a choke and an acceleration pump, and atmospheric and/or environmental control is either very limited or alternately very complicated as and when provided. As a result of employing the commonly accepted constructions; fuel-to-air mixture is usually limited to idling and running (two separately operable jets) and the running mixture can be manually and/or sometimes automatically controlled, but not according to infinitely variable power demands associated with atmospheric environments, and therefore fuel-to-air mixture (by weight) is usually fixed and does not vary with each change in environment and/or throttle setting; fuel metering is usually accomplished by the use of a choke or venturi so as to produce sufficient vacuum surrounding the injection nozzles and consequently internal combustion engines cannot reach maximum power potential since as much as 9.05% of the air intake capability is blocked; so that maximum power of the engine is never available with ordinary carburetion even by employing acceleration pumps and choke mechanisms. There are other compromises and drawbacks in the usually accepted carburetor, all of which will come to light by comparison with the carburetor hereinafter described and which virtually eliminates the above mentioned objections as well as many others that will become apparent and do not require mention.

It is an object of this invention to provide a carburetor that adjusts to the fuel-air mixture requirements of an engine as a result of changing conditions and loads imposed thereon, and as well in response to atmospheric pressure and temperature changes. With the carburetor that I provide there is both an air metering valve and a fuel metering valve which are automatically controlled by a diaphragm that positions said two valves in response to the differential between internal carburetor pressure, and also manifold pressure, as compared with surrounding atmospheric pressure. As a result, a proper mixture can be maintained throughout the range of engine operation, without resort to idling jets and adjustments, and sudden opening of the throttle does not result in starving the engine of fuel and which normally requires an acceleration pump.

It is another object of this invention to provide a car-

2

buretor which in itself is not subject to vapor lock to which ordinary carburetors are prone. Ordinarily, gas evaporates from the fuel in the carburetor passages and float chamber and like compartments, and especially when a heated engine is stopped. This gas accumulates in pockets and often blocks the fuel passages so as to interfere with proper functioning of the carburetor. With the present invention a fuel pressure regulating means is provided and which is operative to release any surplus of evaporative mixture from the fuel supply, to be retained within the induction system, whereby only liquid fuel is available to the fuel metering system.

It is also an object of this invention to provide a carburetor that is operative without a venturi tube and which is operable at low pressure drop values, for instance with three and one-half inches of water column pressure drop as compared with the ordinary twenty inches previously referred to. With the system that I provide the fuel-air mixture induction tube is straight without restriction, with spaced air metering and throttle valves, and with a fuel valve supplied with degassed liquid fuel at a controlled pressure.

It is still another object of this invention to provide a carburetor of the character thus far referred to which is environmentally compensated; by means responsive to altitude or atmospheric pressure changes; by means responsive to temperature changes; by means responsive to both internal carburetor and manifold pressure changes; and all of which means are correlated in function in the combined elements forming the carburetor that I provide.

The various objects and features of this invention will be fully understood from the following detailed description of the typical preferred form and application thereof, throughout which description reference is made to the accompanying drawings, in which:

FIG. 1 is a transverse sectional view taken through the center of the carburetor and showing the fuel pressure supply means in elevation, and FIG. 2 is a transverse sectional view taken forward of the section plane of FIG. 1 and showing mechanism at the side of the carburetor. FIG. 3 is an enlarged fragmentary view showing the fuel metering and atomizing valve. FIG. 4 is a sectional view taken as indicated by line 4—4 in FIG. 1, and FIG. 5 is a sectional view taken forward of the section plane of FIG. 4 in order to show mechanism at the side of the carburetor. FIG. 6 is a plan view taken as indicated by line 6—6 on FIG. 1. FIG. 7 is a view similar to FIG. 2 and shows the movement of parts in the control means at the side of the carburetor, and particularly the parts of the secondary performance demand control means. FIG. 8 is an elevational view of the fuel pressure supply means and taken substantially as indicated by line 8—8 on FIG. 1. FIG. 9 is a view similar to FIG. 2 and shows the movement of parts in the control means at the side of the carburetor, and particularly the parts of the primary temperature and atmospheric pressure control means. And, FIG. 10 is a plan view of linkage taken as indicated by line 10—10 on FIG. 2.

The carburetor that I provide comprises cooperatively related means adapted to automatically respond to infinitely variable demands of an internal combustion engine or the like, and to infinitely variable environmental conditions. In the drawings I have shown a typical embodiment of my carburetor and which involves generally, a body A, induction tubes B, air metering valves C, throttle valves D, a fuel metering and atomizing valve E, metering control means F, and environmental control means G' and G". The body A is of course the framework which is fashioned to establish the induction tubes B and to support and/or accommodate the remainder of the parts and elements. The air metering valves C are characteristically positioned at the intake end of the induction tubes, while

the throttle valves D are positioned at the discharge end thereof. In accordance with the preferred form of the invention the fuel metering and atomizing valve E is positioned intermediate the valves C and D and receives degassed fuel from a fuel pressure supply means H which is unique. The metering control means F is also unique in that it primarily controls the air metering valves, and also secondarily controls the fuel metering and atomizing valve E, while the environmental control means G' and G'' correlate the combined effect by imposing a differential in the effect as applied individually to the valves C and E. Each of these elements and means will now be described:

The body A that provides the framework and support of the structure is preferably a casting made of metal such as aluminum and it has various and suitable features for its adaption to installation on an engine manifold 10. The interior or induction passage 11 of the manifold is shown in FIG. 1, it being understood that the internal combustion engine has the usual features and characteristics, such as for example those of an automotive gasoline engine. Although this carburetor can be single barreled, it is preferred to combine a pair of like and substantially identical barrels or induction tubes B, said tubes being straight cylindrical bores or throats disposed on axes parallel with each other. The disposition of this carburetor can vary and is shown as a vertically disposed down-draft structure with an uppermost intake section 12 of inverted Y formation that channels air equally to the two induction tubes B and a lowermost outlet section 13 of upright Y formation that channels carbureted air equally from the two induction tubes B and into the passage 11 of manifold 10. The body A is provided with bearings, bosses and other features that will be described as they become necessary to the various means hereinafter described.

The induction tubes B are straight cylindrical bores with no restriction at any point therealong, and in accordance with this invention the walls 14 thereof are spaced so that there is room between the two tubes. That is, there is space between the tubes B for the accommodation of other elements and namely the fuel metering and atomizing valve E. As shown, the body A is chambered at 15 intermediate the tubes B for the accommodation of the valve means E and linkage thereto, and in accordance with the invention the body A is characterized by a window 16 that extends openly between the two tubes and which is accessible to the said chamber at 15. As shown, the window 16 is positioned toward the upper end of the induction tubes but below the air metering valves C.

In accordance with the invention I provide the air metering valve or valves C which are characteristically positioned at the intake and in this instance at the top of the structure. Thus, in the case under consideration there is an air metering valve C at the uppermost end of each induction tube B, just below the intake section 12. The valves C at the two tubes B operate together or in unison and are preferably carried by a common metering shaft 17 that is normal to and which intersects the axes of the two tubes. As is shown, the shaft 17 has a projecting portion 17' at the compensation control side of the carburetor structure. The valves C per se are usual in that they are butterfly-type valves, or gates, adapted to revolve from the closed position shown to an open position where they are disposed in planes substantially parallel with the axis of the induction tube in which they operate. Thus, it will be apparent that the variable valves on shaft 17 function to meter the intake of air into the induction tubes B, depending upon the opening thereof as caused by the partial vacuum source created within the manifold 10, as will be described.

The throttle valve or valves D are usual and characteristic of carburetors, however, and in accordance with the invention they are related to the above described air metering valves C so as to establish pressure controlled chambers X therebetween (see FIG. 4). That is, each induction tube B has a pressure controlled chamber X that is established intermediate the upper and lower valves C and

D. Further, the chambers X of the two tubes B are of equalized controlled pressure due to the intercommunication provided by the window 16. The valves D per se are usual in that they are butterfly-type valves adapted to revolve from closed positions shown to an open position where they are disposed in planes substantially parallel with the axis of the induction tube in which they operate. As is clearly illustrated, the throttle valves D operate entirely independent of the air metering valves C and are preferably installed so as to revolve at right angles to the valves C. As is shown, the throttle valves are characteristically positioned at the outlet and in this instant at the bottom of the structure, and on parallel throttle shafts 18 and 19 that are disposed in a common horizontal plane. The shafts 18 and 19 revolve oppositely and in unison, being tied together by a link 20 extending between oppositely disposed levers 21 and 22. A control rod 23 extends to one of the said levers to revolve the valves D from the position shown in order to satisfy the demands of the engine as circumstances require. Thus, it will be apparent that the valves on shafts 18 and 19 function to throttle the intake of fluid (air and fuel vapor) from the induction tubes B, as caused by the partial vacuum created within the manifold 10.

The fuel metering and atomizing valve E is a characteristic feature of the invention and which virtually eliminates detonation of fuel mixture within the cylinders of internal combustion engines. As its designation indicates, the valve E functions to both meter and atomize the fuel and to this end depends greatly upon its position within the chamber structure. Generally, the valve E is adapted to discharge into either or both chambers X and in the case illustrated it discharges from the window 16 simultaneously into the two chambers X. As above stated, the chamber 15 accommodates this valve means and in FIGS. 1 and 4 I have shown this arrangement wherein there is a valve body 24 inserted upwardly through the chamber 15 and positioned at the bottom of window 16, and a valve seat 25 also inserted upwardly through the chamber 15 and positioned at the top of window 16. The two parts 24 and 25 are threaded into the body A and are coaxial with each other, there being a valve stem 26 reciprocally carried in the valve body 24 and adapted to cooperatively engage the seat 25. The stem 26 slides freely in body 24, without a gland or packing, and is biased toward the seat 25 by means of a spring 27 supported by a plug 28 that closes the bottom of chamber 15. The seat 25 has a sized orifice 29 surrounded by a downwardly disposed face 30, while the stem 26 has a tapered nose 31 projecting upwardly from a shoulder 32. The shoulder 32 is adapted to be biased by spring 27 into sealing engagement with face 30, and to permit increased fluid to flow from orifice 29 as it is retracted downwardly. To this end the nose 31 is tapered gradually and thereby acts as a needle valve. From this, it becomes apparent that the fuel is channeled through the body A as indicated and discharges peripherally from the parts 25 and 26, and said fluid being under pressure as later described is sprayed laterally from the valve and into the chambers X. Additionally, there are refinements in the stem 26 and body 24 which include a deflector 33 projecting radially from the body 24, so as to prevent liquid flow down and along the said stem. In actual practice, the fuel discharged under pressure at one pound per square inch cruising pressure or at 1½ pounds per square inch power and/or acceleration pressure sprays downwardly in cylindrical form and strikes the shoulder 32 so as to be deflected radially in a fan shape. Thus, said spray of fuel is simultaneously metered and atomized as it enters the chambers X from both sides of the window 16.

The metering control means F is provided to establish the desired mixture of carburetion and has both a primary and a secondary function. Primarily, the means F controls the intake of air into the chamber or chambers X

and secondarily the means F controls the discharge of atomized fuel into the chamber or chambers X.

Concerning the primary function of the control means F and as clearly illustrated throughout the drawings, said means F comprises a pressure responsive element subject to differential between atmospheric pressure and internal carburetor pressure. More specifically, the means F involves a diaphragm 35 open at one side to atmosphere and at the other side to the pressure condition existing in chambers X. In the particular embodiment shown there is a disc shaped housing 36 with a chamber 37 in open communication with chambers X through a tube or passage 38. The operational axis of the diaphragm 35 is normal to and offset from the metering shaft 17, and the operating stem 39 thereof is connected to a centrally located and depending lever 40 that is biased by a closing spring 41. The lever 40 is coupled to shaft 17 between the induction tubes B by a lever 40' and link 39' and spring 41 revolves the shaft 17 so as to normally close the air metering valve C. Therefore, the operating stem 39 is urged by the diaphragm 35 to move the lever against said bias and so as to open the valves C, said valves being balanced gate type valves. Thus, the greater the volume demand the greater is the movement and opening of said metering valves C, thereby establishing an infinitely variable air metering gate at the intake of the carburetor.

Concerning the secondary function of the control means F, said means comprises a corresponding and correlating metering of the fuel discharge at the fuel metering and atomizing valve hereinabove described. Again, the fuel is metered according to differential between outside atmospheric pressure and internal carburetor pressure within chamber or chambers X, and therefore the secondary function can employ the diaphragm 35 for its operation. Specifically, it is the stem 26 of the fuel valve that is to be retracted downwardly as the air metering valves are simultaneously opened. However, the requirements of valve E are not ordinarily the same as those of valves C, and actually are quite different. Therefore, a fuel metering cam 42 having an ever increasing radius 43 is carried on end portion 17' of metering shaft 17 and is engaged by a follower 44 that withdraws the stem 26 from the said seat 25. There are various ways by which said motion can be transferred from follower 44 and the preferred form involves a variable control lever 45 located within a cover 46 at the compensation side of the carburetor. As is shown in FIG. 2, the lever 45 pivots at one side against a fulcrum 47, said fulcrum being moved by various means later described, to shift a control rod 48. In the case illustrated, the shifting of said rod 48 is transferred to stem 26 through a rocking lever 49 that shifts a link 50 which is in turn coupled to the stem 26 through a bell crank 51. Rod 48 is carried by the lever 49 and a guide 49' on the body A. As shown in each instance, the rod 48, link 50 and stem 26 is pulled by rocking of the lever 45, lever 49 and bell crank 51 respectively. Thus, as the diaphragm 35 moves to open the air metering valves C, there is a simultaneous and ever increased opening of the fuel metering and atomizing valve E.

From the above described and basic structures, the fundamentals of this carburetor will be understood. When the carburetor stands idle the valve E remains in a shut-off condition (shown in FIGS. 1 and 2) and there is no storage of fuel within the carburetor as such; for example no storage within a reservoir such as a float chamber. Upon starting motion of the internal combustion engine a partial vacuum is created within manifold 10 and this reduced pressure is communicated to chambers X accompanied by opening of the throttle valves D. Immediately, therefore, a reduced pressure occurs within the chamber X and which is operable upon diaphragm 35 and which is instantly followed by a movement of operating stem 39

and opening of the air metering valves C and simultaneously opening of the fuel metering and atomizing valve E. The amount of opening of the valves C and E is established by the bias employed by spring 41 and particular requirements of the fuel is adjusted to by a thumb nut 52 on the control rod 48. The opening action of said two valves is infinitely variable from closed to full open, depending upon opening of the throttle valves D and the resulting requirements of the internal combustion engine. In practice, the pressure in chambers X start to operate at about one inch and increase to three and one-half inches at wide open position, in inches of water column pressure.

The environmental control means G' and G'' are provided to correlate the combined effect of the structure thus far described by imposing a differential in the individual affects as applied by the valves C and E, and these means G' and G'' are located at what I have termed the compensation control side of the carburetor. Specifically, the control means now under consideration modifies the secondary functions of the control means F relative to the primary function thereof, and namely the fuel metering relative to the air metering. Therefore, the control means G' and G'' are associated with the parts of the control F and preferably with those parts located within the cover 46 at the compensation control side, and particularly the control lever 45. It is the said lever 45 that moves the linkage to valve stem 26, and in accordance with the invention it is the fulcrum 47 which is affected by the control means G' and G'' to compensate for temperature and/or atmospheric pressure differences and also to compensate for performance demand differences. Therefore, I provide independent means, the temperature and atmospheric pressure control means G' which is primary in its function to position the fulcrum 47, and the performance demand control means G'' which is secondary in its function to position the fulcrum 47. That is, in the embodiment illustrated the means G' directly supports the fulcrum 47 while the means G'' indirectly supports said fulcrum.

The primary temperature and atmospheric pressure control means G' is a temperature and pressure responsive device in which the sensor may vary as circumstances require. In the drawings I have shown a bellows type of sensor 53 that is hermetically sealed with a charge of suitable fluid therein, and which operates to expand and to contract along its axis in response to variations in temperature as well as pressure. That is, the sensor 53 is responsive to the surrounding and ambient temperature and atmospheric pressure conditions and extends and/or retracts in axial dimension so as to mechanically reflect the existing conditions. The means G' is thus characterized by transmission of motion from the sensor 53 to the fulcrum 47 and in the embodiment shown involves a beam 54 shiftably carried on a part of the means G'' and connected to the sensor 53 at 56, being pivoted to a plate 57 depending from the sensor 53. As shown, the axis of the sensor 53 is vertically disposed in which case the plate 57 reciprocates vertically. The beam 54 is carried by said part of means G'' on a pivot 55 disposed on an axis parallel with air metering shaft 17 and normal to the plane of the control lever 45. The fulcrum 47 is a lever-like part that projects radially from the pivot 55, rigid with the beam 54, and has a rounded edge 58 adapted to bear against a bearing 59 on and intermediate the ends of lever 45. The bearing 59 is concave to a semi circular cam shape suitable for the conditions to be encountered, a typical shape being shown. The pivot 55 remains substantially concentric with the arc of the bearing 59. Thus, it will be seen that the fulcrum 47 will shift discriminately through a limited arc as determined by extension and retraction of the sensor 53, so as to vary its effective engagement with the bearing 59.

The secondary performance demand control means G'' is a vacuum responsive device sensitive to the manifold pressure within the internal combustion engine. In the

drawings I have shown a diaphragm unit 60 offset to the side of the body A and wherein the closed chamber thereof is open into the passage 11 through a tube or passage 60' in manifold 10. The diaphragm 61 of unit 60 is coupled by means of a rocker 62 to a control plate 63 that shiftably journals the pivot 55 above described. The control plate 63 is pivoted at 64 to the body A so as to adjacently underlie the lever 45, and the journal axis of the pivot 55 is radially offset from the pivot at 64 and in such a position that movement of control plate 63 about the pivot 64 shifts the fulcrum 47 in a direction that substantially parallels the axis of control rod 48, for example. The diaphragm 61 and rocker 62 are biased by a spring 65 to oppose the vacuum and the rocker is connected to the control plate 63 by means of a coupler 66. In accordance with the invention the coupler 66 is three-fold in its functions to permit a starting condition, to variably establish a running condition, and to permit shut-off of fuel when in said running condition responsive to increased vacuum in the manifold of the engine. To this end, the coupler 66 comprises a rod extending pivotally from a radial lever point on the control plate 63. In practice there is a pivot block 67 on plate 63 and which backs a spring seat, and there is a shoulder 68 on the coupler 66 that slideably supports a spring seat 69 opposing the first mentioned seat. A vacuum compressed shut-off spring 70 extends between the said seats to be depressed and permits movement of the control plate when vacuum increases abnormally in the engine manifold. Thus, the control plate 63 revolves discriminately through a limited movement to a shut-off position as determined by relatively high or abnormal engine vacuum pressure and returns to a running position as determined by normal engine vacuum pressure, so as to establish shut-off of fuel when the engine is decelerating under compression, for example.

In addition to the foregoing fuel flow function of the control means G'' the said means establishes a starting condition, and to this end involves a latch 71 pivoted to the body A at 72. The latch 71 operates to engage its abutment 73 with a stop 74 on control plate 63, to thereby hold the control means G'' out of the starting condition and inoperative. As shown, the latch 71 has an arm that is pinned to the plate 57 so that increase in temperature and extension of the sensor 53 permits engagement of the stop 74 with abutment 73 (see FIG. 9). In this, the metering of fuel is maintained at a generous value conducive to engine starting when the engine is cold. As shown, the spring seat 69 is normally spaced by the shoulder 68 from a stop 75 on body A. Therefore, upon starting and consequent establishment of a normal vacuum in the engine manifold, the spring seat 69 is drawn onto the stop 75 and thereby permits the latch 71 by operation of control means G'' to be engaged under abutment 73. Further, a manually operable start control screw 76 is provided so as to adjustably position the rotative placement of the control plate 63.

The fuel pressure supply means H is unique and is provided to accurately control the fuel supply pressure whereby determinable operation of the carburetor is gained. As hereinabove stated, the fuel is discharged at pressures between one pound per square inch and one and seven-eighths pounds per square inch as determined by operational requirements. In accordance with the invention the air metering is accurately controlled by the control gates established by the valve C while fuel metering by the valve E is dependent upon accurately controlled fuel supply pressure. Firstly, it is important that a running or cruising pressure of say one pound per square inch be maintained under running or cruising conditions, and secondly that a power of acceleration pressure of say one and seven-eighths pounds per square inch be maintained under pressure or accelerating conditions, said pressures being typical examples. Further, the fuel supply pressure is shiftable between said two extremes.

Concerning the first and cruising pressure of one pound

per square inch, the fuel pressure supply means H involves a fuel pressure regulator which comprises a closed chamber 80 supplied with fuel through a fitting 81 from a pressure pump (not shown), a fuel admitting valve 82, a gas release valve 83, and a pressure responsive means 84 governing the action of valve 82. The closed chamber 80 can be located as desired, either remotely from or as a part of the carburetor, and is adapted to receive a limited volume of fuel. Since it is an object to provide degassed liquid fuel, that is free of gas, and because it is known that volatile fuels such as gasoline become gassed when pumped and/or agitated, the chamber 80 is essentially a coalescing chamber into which the fuel is introduced for separation into liquid and gas that percolates from the fuel. To this end the fuel introduced into the chamber 80 will seek a level therein, above which percolating gasses will accumulate so as to displace and lower the liquid level. Therefore, the fuel discharge 85 is at the lower extremity of chamber 80 leading to the valve E. The fuel admitting valve 82 is shown as a lever operated element engageable with the fitting 81 to stop the admission of fuel while the pressure responsive means 84 is a diaphragm subject to pressure within the chamber 80 and biased by a spring 86 to shift a lever 87 and thereby open valve 82. Therefore, pressure developing within chamber 80 compresses spring 86 and shifts the lever 87 to close the valve 82. In accordance with the invention the gas release valve 83 is a float controlled valve that exhausts the accumulated gasses from the chamber 80 and into chamber or chambers X, and involves a float 88 guided by and operating a lever 89 that retracts the valve 83 from an exhaust seat 90 when the liquid level in chamber 80 drops as a result of gas accumulated therein. The lever 89 and valve 83 are assisted to a closed position by a spring 89' and the exhaust seat 90 is in communication with the chambers X through a tube or passage 90' so that evaporated fuel is vented into the engine manifold 10 through the valves D.

Concerning the second and powered pressure of one and seven-eighths pounds per square inch the fuel pressure supply means H involves a diaphragm unit 92 superimposed over the fuel admission valve diaphragm and operable to modify the action thereof. As shown, the diaphragm unit 92 has a closed chamber open into the manifold 10 of the engine through tube or passage 60' and so that normal or running vacuum pressure operates to retract a diaphragm 93 against a spring 94. Said diaphragm 93 reciprocates a plunger 95 that normally releases a spring 96 as and when sufficient vacuum is applied. In practice, the spring 94 is substantially stronger than the spring 96 and as a result reduced vacuum permits the spring 96 to urge the plunger 95 in pressured engagement with the spring 94 in order to add bias to the above mentioned spring 86, thereby establishing the second powered pressure of one and seven-eighths pounds per square inch.

From the foregoing, both the structure and function of this carburetor will be clear. Characteristically, the carburetor involves one or more straight through cylindrical induction tubes or throats with an air metering gate or gates at the intake and with a throttle or restriction gate at the outlet. Another characteristic feature is the pressure responsive control which is peculiarly sensitive to the vacuum pressure intermediate the air metering gates and throttle gates, and it is this pressure responsive control which maintains the substantially constant pressure value between said gates and within the chamber or chambers X. Also, and an important feature for successful operation of this carburetor is the pressure regulated fuel supply which is accurately maintained at substantially constant pressure values. By arriving at accurate and reliable control of both (1) air intake pressure separate from outside atmospheric pressure and also separate from internal manifold pressure, and (2) fuel supply pressure separate from pump supply pressure, it is then possible to arrive at a controlled and desired air to fuel mixture of,

for example, fourteen to one or twelve to one as may be required.

In practice, (1) the spring 41 which biases the diaphragm of the control means F can be calibrated so as to maintain a substantially constant $3\frac{1}{2}$ inches of water pressure vacuum in the chamber or chambers X, and (2) the fuel pressure supply means H is biased firstly by spring 86 so as to maintain a fuel supply pressure of one pound per square inch and secondly by spring 96 so as to add bias and maintain a fuel supply pressure of one and seven-eighths pounds per square inch. Thus, said two fuel supply pressures are effective in establishing the two air fuel mixtures of 14 to 1 or 12 to 1 above referred to. It is a diaphragm unit 92 which is responsive to engine manifold vacuum pressure that shifts according to engine demands, to either press or release the spring 96 and which in actual practice is set by calibration of spring 94 to occur within a short range ($\frac{1}{8}$ -inch of water) of pressure at 10 inches of water vacuum pressure.

With the carburetor hereinabove described, the environmental control means G' and G'' automatically set the fuel metering and atomizing valve E at the required opening relative to the opening of the two gates established by the valves C and D. The primary temperature and atmospheric pressure control G' is characterized by the extension of its linkage due to either or both temperature increase and atmospheric rarification (pressure decrease). These two phenomenon are compatible in the means G' as a primary control since it is advantageous that temperature and atmospheric pressure increases work inversely. That is, temperature increase lengthens the linkage so as to variably restrict fuel flow, while atmospheric pressure increase shortens the linkage so as to variably increase fuel flow. These two functions are, thereby, accomplished in a single means G'.

The secondary performance demand control means G'' is characterized by retraction of diaphragm 61 against a relatively light bias of spring 65 which permits the control plate 63 to assume an operating position with the spring 70 backed by the stop 75. This initial function is for starting of the engine when cold, after which the spring 70 is compressed as vacuum increases so as to variably close the fuel valve E. Therefore, as the engine throttle D is opened for power and/or acceleration the manifold pressure drops and consequently the fuel valve opens relatively to richen the mixture.

The fuel pressure supply means H is operative to supply both a running and a power mixture as above described, and also operates to degassify the fuel. The percolation of gas from the liquid fuel is disposed of while being advantageously employed so as to establish the fuel supply pressure required. Therefore, the means H is essentially a pressure accumulator which effectively removes vapor from the liquid fuel. Therefore, any tendency toward a vapor lock is eliminated in this carburetor immediately preliminary to introduction of the liquid fuel to the fuel valve E.

A spark retard connection is provided for at 38 (FIG. 4) and which opens into the chamber X just above the throttle valve D when said valve is substantially closed. Upon opening of valve D any appreciable amount the connection at 38' is subject to manifold pressure below the said valve.

Proper mixture or break-up of liquid fuel into the air is a feature of this carburetor, and as a result, induction of fuel droplets into the engine is avoided and this virtually eliminates detonation. Firstly, degassified liquid fuel is delivered under exacting pressures to the fuel metering and atomizing valve E, where the fuel is discharged into the chambers X as a spray. Secondly, the spray is picked up by the air flow and disperses into the same as said air flow circulates turbulently around or by the throttle gate valves D. Thirdly, the two valves D, as shown, open and close convergently and thereby direct two columns of air and fuel spray or mist to impinge at accel-

erated speed one with the other, and resulting in further turbulence having a mixing action. As a result, thorough break-up of the air fuel mixture is realized, and characterized by the delivery of a uniform and finely divided air-fuel vapor. Further, the usual cleaning procedures employed with usual carburetors are virtually eliminated, inasmuch as there are no jets or orifices to keep clean, the fuel being under pressure and the one fuel valve E being characterized by the needle valve which results in a self cleaning action.

Having described only a typical preferred form and application of my invention, I do not wish to be limited or restricted to the specific details herein set forth, but wish to reserve to myself any modifications or variations that may appear to those skilled in the art and fall within the scope of the following claims:

Having described my invention, I claim:

1. A carburetor for the admixture of liquid fuel to air and having a fuel pressure supply, and including:

- (a) a body with straight spaced and parallel and unrestricted induction tubes therethrough with opposite ends opening from the body at a common inlet and outlet openings;
- (b) variably opening air metering valves at one end of the tubes and selectively opened throttle valves at the other end of the tubes, said metering and throttle valves forming chambers therebetween within the tubes respectively;
- (c) means comprising a window occupying the space between the tubes and openly communicating the chambers between the air metering and throttle valves, and a fuel flow metering valve occupying the window and supplied with fuel under controlled spraying pressure and discharging atomized fuel from said window and into said chambers respectively;
- (d) an air metering and fuel flow metering control comprising a diaphragm shiftable and linked to said air metering valve and biased to close the same, and responsive to pressure in said chambers and positioning said air metering valve, and a lever means extending from the air metering valve to the fuel flow metering valve to position the same, said lever means having a shiftable fulcrum;
- (e) a temperature and barometric pressure responsive means comprising a hermetically sealed metallic bellows containing a fluid and adapted to extend with increased temperature and to cooperatively retract with increased atmospheric pressure and shifting the said fulcrum;
- (f) and said fuel pressure supply comprising:
 - (1) a closed fuel storage chamber having a lower and open fuel discharge passage;
 - (2) a gaseous fuel admitting valve opening into the chamber from a source of said gaseous fuel under pressure;
 - (3) an upper gas release valve opening from the chamber;
 - (4) a pressure responsive means subject to fluid pressure within the chamber to open the gaseous fuel admitting valve against a pressure determining bias, to regulate the fuel pressure supplied into the chamber from the discharge passage;
 - (5) and float means subject to liquid level within the chamber and controlling the gas release valve to regulate the accumulation of gas within the chamber.

2. A carburetor for the admixture of liquid fuel to air and including:

- (a) a body with straight unrestricted and unobstructed induction tubes therethrough with opposite ends opening from the body;
- (b) a variably opening air metering valve at one end of each tube, and a selectively opened throttle valve

- at the other end of each tube, said valves forming a chamber therebetween;
- (c) means comprising a window openly communicating into the and at the sides of the induction tubes intermediate the air metering valves and throttle valves, and a fuel flow metering valve and spray means occupying said window and atomizing fuel directly into said chamber for commingling with air passing therethrough;
- (d) an air metering and fuel metering control comprising means responsive to pressure in said chamber and positioning said air metering and fuel metering valves;
- (e) and pressure control means supplying fuel at spraying pressure to said fuel metering valve.
3. An atmospheric pressure controlled carburetor for the admixture of liquid fuel to air and including:
- (a) a body with a straight unrestricted induction tube therethrough with opposite ends opening from the body;
- (b) a variably opening air metering valve at one end of the tube, and a selectively opened throttle valve at the other end of the tube, said two valves forming a chamber therebetween;
- (c) a fuel flow metering valve directing fuel into said chamber for commingling with air passing therethrough;
- (d) an air metering and fuel metering control comprising, means responsive to pressure in said chamber and positioning said air metering valve, and a lever means extending from the air metering valve to the fuel metering valve to position the same, said lever means having an intermediate shiftable fulcrum;
- (e) and a barometric pressure responsive means shifting the said fulcrum.
4. An atmospheric pressure controlled carburetor as set forth in claim 3 and wherein; the barometric pressure responsive means comprises a hermetically sealed metallic bellows containing a fluid and adapted to extend with increased temperature and to cooperatively retract with increased atmospheric pressure and shifting the said fulcrum.
5. A carburetor for the admixture of liquid fuel to air and including:
- (a) a body with straight parallel and unrestricted induction tubes therethrough with opposite ends opening from the body at common inlet and outlet openings;
- (b) variably opening air metering valves at one end of the tubes and selectively opened throttle valves at the other end of the tubes, said metering and throttle valves forming chambers therebetween within the tubes respectively;
- (c) an air metering control comprising means responsive to pressure in said chambers and positioning said air metering valves;
- (d) and means comprising a window openly communicating the chambers within the tubes, and a fuel flow metering valve within said window and occupying space between the tubes, and a controlled pressure fuel supply means supplying fuel at spraying pressure to the metering valve and discharging atomized fuel from said window and into said chambers respectively.

6. The carburetor as set forth in claim 5 and wherein; the fuel flow metering valve has a stem retractible from a seat positioned within said window and supplied with fuel under controlled pressure and discharging from said window and into said chambers respectively.

7. A gas eliminating fuel to pressure supply for a carburetor of the character described and including:

- (a) a closed fuel storage chamber having a lower and open fuel discharge passage;
- (b) a liquid fuel admitting valve opening into the chamber from a source of fuel under pressure, said fuel containing and liberating gas;
- (c) an upper gas release valve opening from the chamber;
- (d) a pressure responsive means subject to fluid pressure within the chamber and opening the fuel admitting valve against a constant-pressure determining biasing means to regulate the fuel pressure supplied into the chamber and from the discharge passage;
- (e) and float controlled means regulating the volume of gas accumulation within the fuel storage chamber and opening the gas release valve to discharge the same.

8. A fuel pressure supply for a carburetor as set forth in claim 7 and wherein; the pressure responsive means has a first pressure determining bias against opening of said liquid fuel admitting valve to regulate to a running pressure fuel supplied into the chamber and from the discharge opening, and a second pressure responsive means subject to pressure at the outlet of the carburetor and imposing a second pressure determining bias against opening of said liquid fuel admitting valve to regulate fuel pressure supplied into the chamber and from said discharge opening.

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