United States Patent [19]

Kendig

[11] **3,752,451**

[45] **Aug. 14, 1973**

[54] **FUEL METERING DEVICE FOR INTERNAL COMBUSTION ENGINE**

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[73] Assignee: **Pollution Control Industries, Inc.**, Torrance, Calif.

[22] Filed: **Jan. 21, 1972**

[21] Appl. No.: **212,687**

Related U.S. Application Data

[63] Continuation of Ser. No. 45,037, June 10, 1970, abandoned, Continuation-in-part of Ser. No. 865,239, Oct. 10, 1969, abandoned.

[52] **U.S. Cl.** ..... **261/39 B**, 261/DIG. 58, 261/44 R, 261/50 A, 261/50 AA, 261/71

[51] **Int. Cl.** **F02m 9/08**

[58] **Field of Search** ..... 261/50 A, 50 AA, 261/44 R, 39 B, 71, DIG. 39, 65, 41 B, DIG. 56, DIG. 58, DIG. 59

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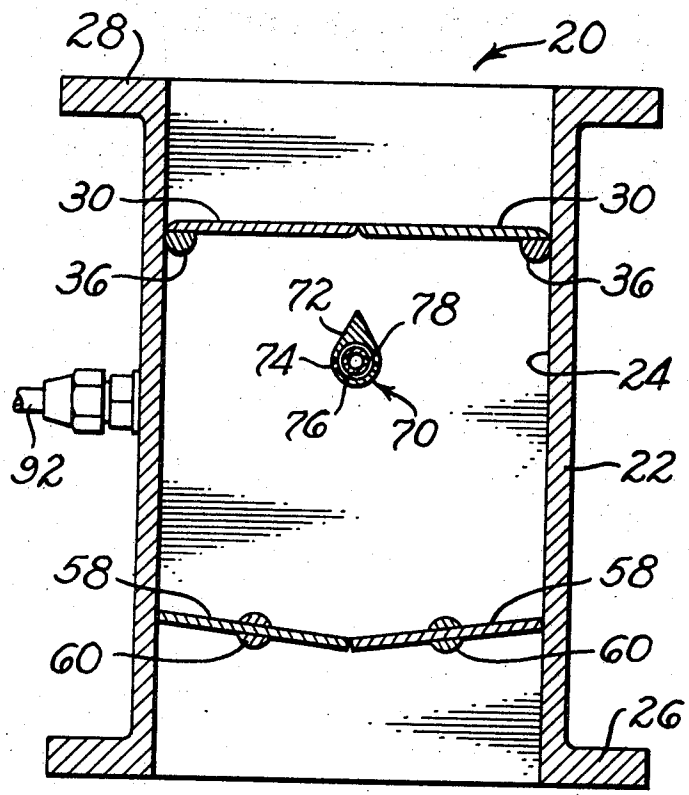
Primary Examiner—Tim R. Miles

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[57] **ABSTRACT**

A downdraft carburetor of the air valve type having a mixing passage provided at its upstream end with two pivoted plates or air valves forming a variable venturi, and provided with two pivoted throttle plates adjacent its downstream end. A fuel spray bar in the mixing passage between the venturi plates and the throttle plates discharges fuel into the mixing passage and is supplied with fuel by a pivoted pickup arm movable in a fuel chamber over a calibrated metering ramp which cooperates with the free end of the pickup arm to form a variable fuel metering clearance therebetween. The fuel chamber may be pressurized, or the level therein may be controlled by a float. The venturi plates are biased closed by springs, one of which is a bimetallic spring coming into operation only when the engine is cold to provide a choke.

8 Claims, 17 Drawing Figures



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SHEET 1 OF 3

Fig. 1.

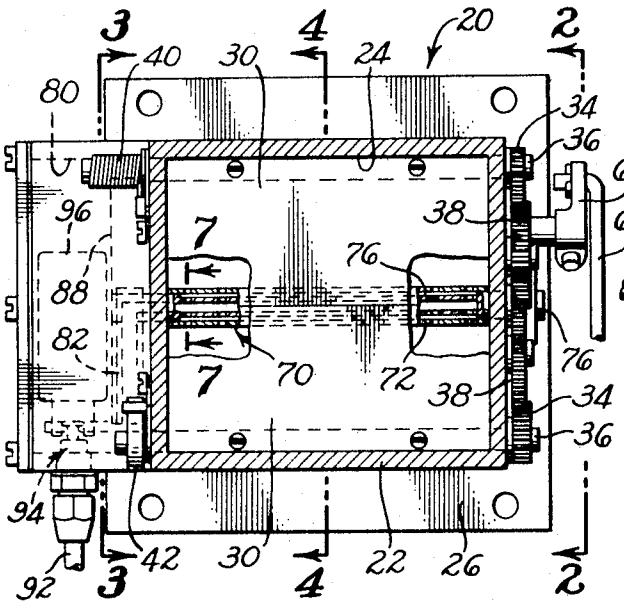


Fig. 2.

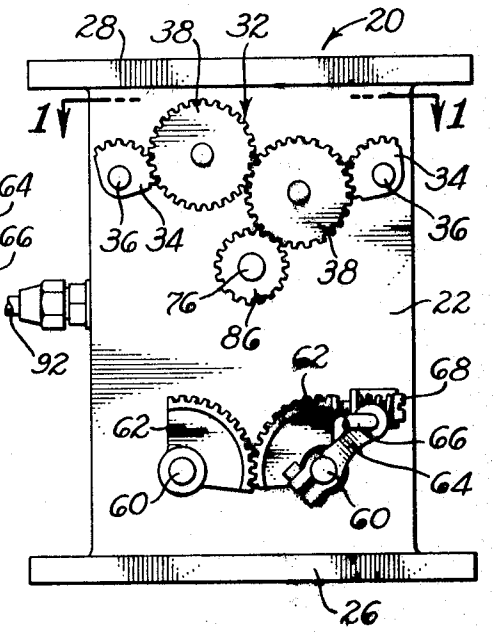


Fig. 3.

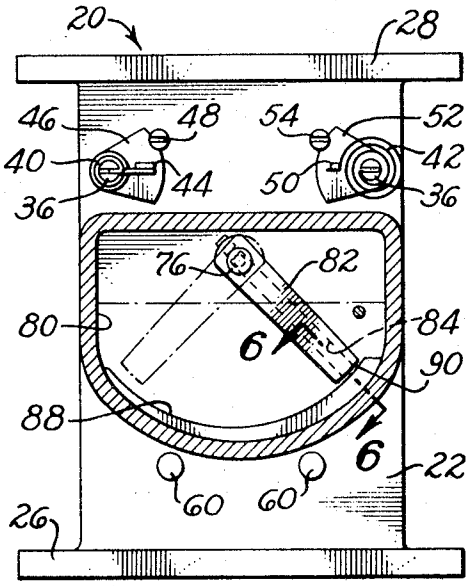


Fig. 4.

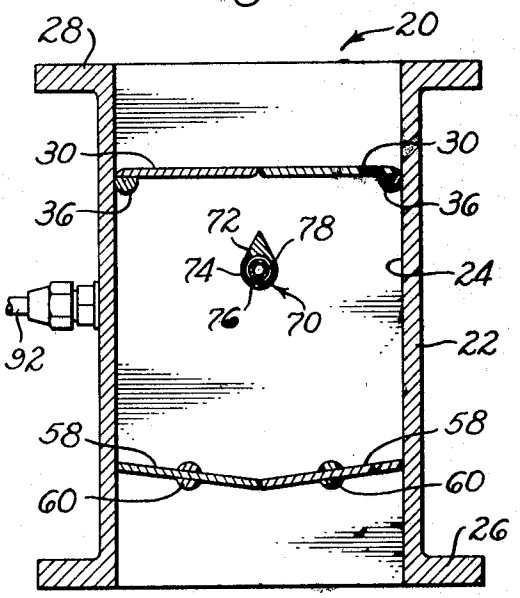
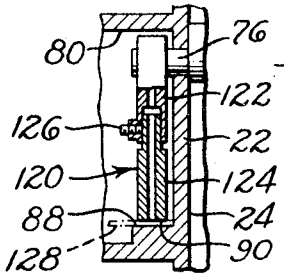


Fig. 12.



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Fig. 5.

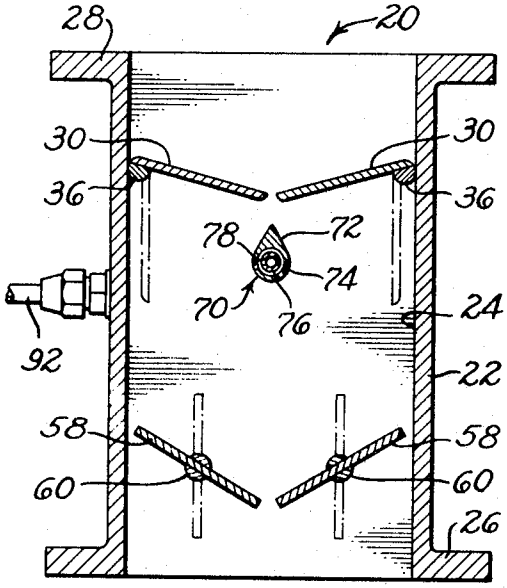


Fig. 6.

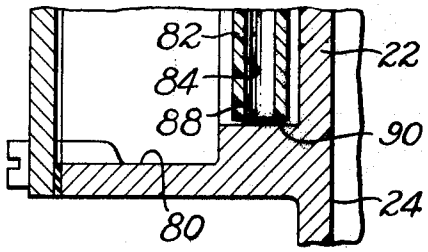


Fig. 7.

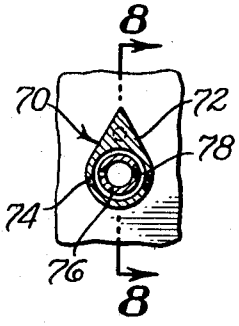


Fig. 8.

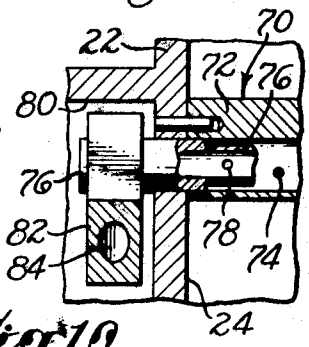


Fig. 9.

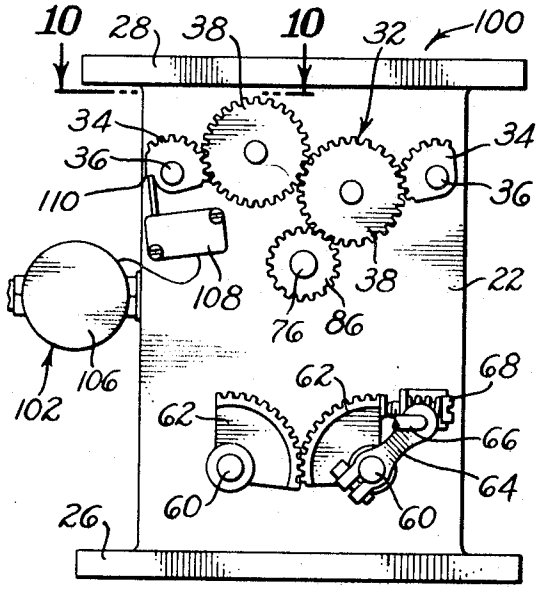


Fig. 10.

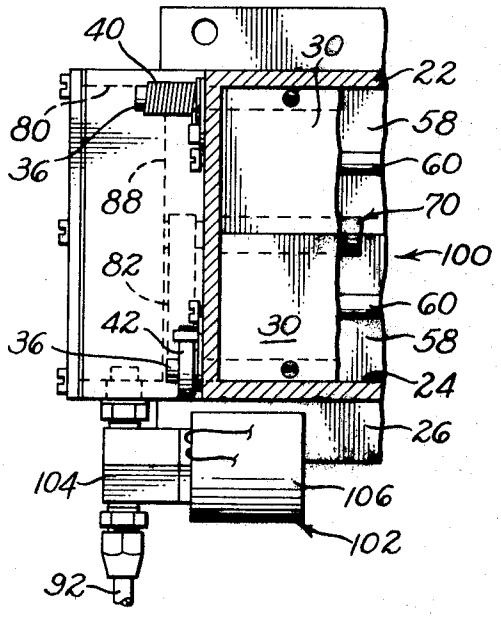
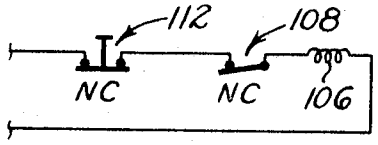


Fig. 11.



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FIG. 13.

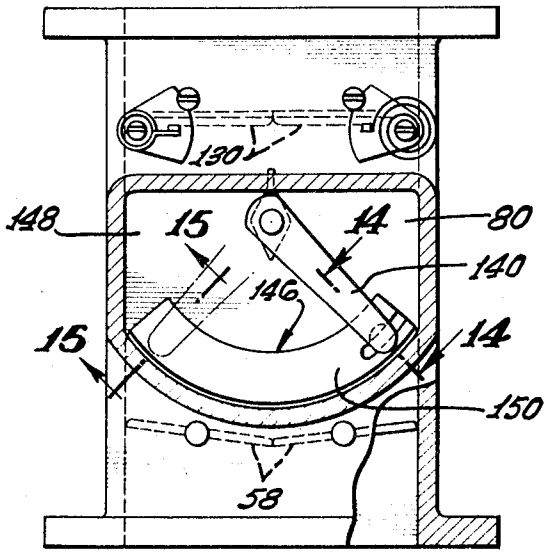


FIG. 14.

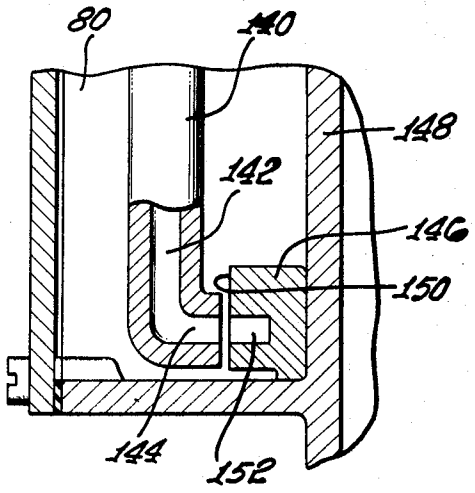


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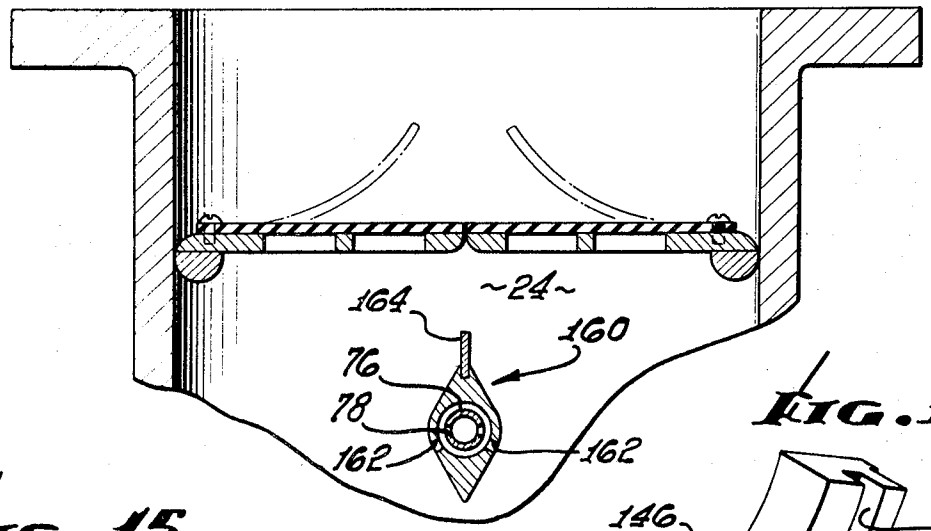


FIG. 16.

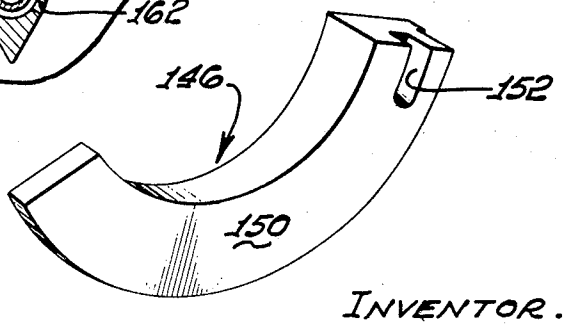
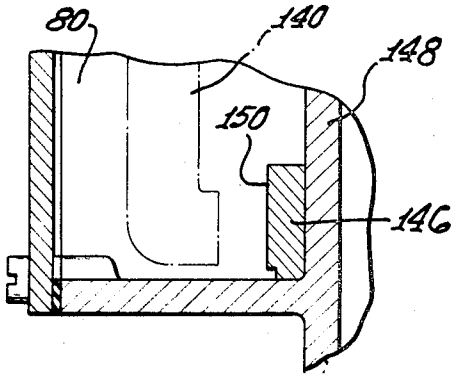


FIG. 15.



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FUEL METERING DEVICE FOR INTERNAL COMBUSTION ENGINE

This is a continuation of application Ser. No. 45,037, filed June 10, 1970 and now abandoned, which was a continuation-in-part of application Ser. No. 865,239, filed Oct. 10,1969 and now abandoned.

BACKGROUND OF INVENTION

The present invention relates in general to a fuel-air metering device for internal combustion engines, and more particularly, to a carburetor of the so-called air valve type.

Such a carburetor is provided at the upstream end of its mixing passage with at least one and preferably two pivoted plates or air valves forming a variable venturi the effective area of which is dependent on the engine-induced air flow through the mixing passage permitted by a throttle means at the downstream end thereof. More particularly, the two variable venturi plates are mounted in the housing of the carburetor at the upstream end of and on opposite sides of the mixing passage for pivotal movement about parallel axes, the plates being pivotable inwardly toward each other into closed positions and outwardly away from each other into open positions. The venturi plates are interconnected for concurrent movement between their closed and open positions and the fuel metering device includes means biasing them toward their closed positions in opposition to the action of an engine-induced vacuum downstream therefrom. A carburetor of this type also includes means for discharging fuel into the mixing passage and includes metering means controlled by the venturi plates or air valves for delivering fuel from a fuel chamber to the discharge means at a metered rate.

An example of the foregoing type of carburetor is disclosed in U.S. Pat. No. 3,342,462. In such carburetor, fuel flow is regulated by a metering rod which is moved in relation to an orifice in a discharge nozzle in response to movement of the air valves or plates through suitable linkage. To accommodate varying engine air-fuel mixture requirements, the linkage not only moves in response to the air plates, but also in response to an accelerator pump controlled by engine vacuum pressure below the throttle plate. One disadvantage of such system is due to the complexity of the provision of mechanism to effect an additional fuel flow through the discharge orifice. This mechanism includes a piston-cylinder assembly (accelerator pump) responsive to an increase in vacuum pressure below the throttle valve so as to actuate the linkage which moves the metering rod so as to increase the orifice area. Further mechanism is required for movement of the metering rod and linkage when the engine temperature is less than normal. Another disadvantage of prior art air valve carburetors is the failure to provide relief means for high pressure gases produced when the engine backfires.

Aside from the disadvantage of the general configuration of the above-described air valve carburetor, the conventional fuel metering system fails to provide the optimum fuel-air mixture through a wide range of engine speeds. A fixed venturi carburetor which provides a more efficient fuel metering system is disclosed in U.S. Pat. No. 2,236,595 and is generally referred to as a Fish carburetor. Such carburetor employs a fixed venturi area and a throttle plate pivotally mounted in the throat having a plurality of fuel discharge openings

therein. The throttle plate is connected to a pivotable arm that extends into the fuel chamber. A passage from the throttle plate apertures through the radial arm terminates at the end of the arm in spaced varying relation to the carburetor wall so that as the arm is rotated the orifice area increases to permit a greater fuel flow. In such carburetor the rate of fuel delivery may be matched to the position of the throttle plate. However, the Fish carburetor suffers from the disadvantage that the venturi area is fixed (at a given throttle setting) and thus the air flow is not responsive to engine demands. Moreover, there are disadvantages in discharging the fuel through a movable throttle plate at the throat of the venturi passage and to the auxiliary fuel discharge devices required in such carburetor. There are still other difficulties in the provision of a radial fuel pickup arm having its opening at the end of the arm in proximity to a spaced ramp due to expansion and contraction of arm length caused by temperature changes.

Other disadvantages of prior art carburetors will become evident from the following description of an exemplary embodiment of a carburetor constructed in accordance with the present invention.

SUMMARY AND OBJECTS OF INVENTION

Accordingly, it is a general object of the present invention to provide a variable venturi carburetor which maintains a constant fuel-air ratio under all engine operating conditions from idle to full throttle and which compensates for variation in air density, altitude, temperature and/or humidity without the provision of auxiliary fuel discharge devices required for acceleration and/or starting.

The present invention achieves the foregoing general objects by providing, and an important object thereof is to provide, a carburetor wherein the fuel discharge means is located in the mixing passage between the independent venturi plates and throttle means, and wherein the fuel metering means comprises a pivoted fuel pickup arm which is driven by the venturi plates and the free end of which is movable in a fuel chamber along a generally arcuate fuel metering ramp cooperating with the fuel pickup arm to provide therebetween a variable fuel metering clearance, such clearance increasing in the direction of pivotal movement of the pickup arm corresponding to opening movement of the venturi plates so as to increase the fuel metering rate with increasing air flow through the mixing passage.

Another important object of the invention is to provide a fuel metering ramp so calibrated for the carburetor and engine with which it is used as to provide the same air-fuel ratio for all angular positions of the venturi plates during operation under equilibrium conditions, ranging from idling to full throttle operation, which is an important feature of the invention. This construction also maintains the air-fuel ratio constant under equilibrium conditions despite variations in such things as air density, altitude, temperature, humidity, and the like, without specific compensating means for these variables, which is another important feature.

Still another important feature of the fuel metering device of the invention is that the richness of the mixture is automatically increased momentarily upon opening of throttle means so that no separate acceleration pump is required. More particularly, when the throttle means is opened, the resulting opening movement of the venturi plates is delayed very slightly due

to such things as inertia, friction, the resistance of the means biasing the venturi plates toward their closed positions, and the like. This momentary lag results in the development of a momentary vacuum in the mixing passage at the fuel discharge means to draw an increased quantity of fuel into the mixing passage until equilibrium is restored, thereby providing the desired effect of an acceleration pump without any necessity for one.

Another and also important object of the invention is to provide a resilient means for biasing the venturi plates toward their closed positions, which includes temperature responsive means having a biasing force which increases with decreasing temperature. A related object is to provide such a temperature responsive means comprising a bimetallic spring. With this construction, the resistance to opening of the venturi plates is increased when the engine is cold so that the engine induces a greater vacuum at the fuel discharge means between the venturi plates and the throttle means, thus drawing fuel at a greater rate than normal. Consequently, the carburetor of the invention has the effect of a choke at subnormal temperatures with no necessity for specifically providing one, which is an important feature.

A further object of the invention is to provide a carburetor wherein the fuel discharge means comprises a tubular spray bar parallel to the pivot axes of the venturi plates and spanning the mixing passage downstream from the closed positions of the venturi plates and upstream from the throttle means, the spray bar being provided with lateral discharge openings for effective mixing of the fuel with the air.

Additional objects of the invention are to provide a fuel metering device wherein the admission of fuel into the chamber containing the pickup arm is controlled by a float, or a fuel metering device wherein the fuel chamber is pressurized and the admission of fuel thereinto is controlled by an electrically operated valve means, such as a solenoid valve. Another object in connection with the latter is to provide means for preventing pressurization of the fuel chamber until such time as the venturi plates open a predetermined amount, thereby avoiding flooding.

Yet another object of the invention is to provide a throttle means which includes two interconnected throttle plates in side-by-side relation at the downstream end of the mixing passage and mounted in the housing for pivotal movement about axes parallel to the pivot axes of the venturi plates. Such dual throttles or throttle plates reduce the length of the mixing passage, which is a feature of the invention.

Yet one more object of the present invention is to provide an opening to atmosphere from the mixing chamber, for example by venturi plates provided with a plurality of openings, each of the plates being provided with conforming flexible covers so that high pressure gases produced by engine backfire may pass out of the carburetor through the openings by forcing the covers upward.

A still further object of the present invention is to provide a carburetor with a fixed spray bar supported in the mixing chamber having an aerodynamic configuration which promotes atomization of the fuel discharged therethrough.

The foregoing objects, advantages, features and results of the present invention, together with various other objects, advantages, features and results thereof which will be evident to those skilled in the carburetor art in the light of this disclosure, may be achieved with the exemplary embodiments of the invention illustrated in the accompanying drawings and described in detail hereinafter.

DESCRIPTION OF THE DRAWINGS

FIG. **1** is a horizontal sectional view of a fuel metering device or carburetor of the invention and is taken as indicated by the arrowed line **1—1** of FIG. **2**;

FIG. **2** is an end elevational view taken as indicated by the arrowed line **2—2** of FIG. **1**;

FIG. **3** is a vertical sectional view through a fuel chamber of the carburetor and is taken as indicated by the arrowed line **3—3** of FIG. **1**;

FIGS. **4** and **5** are vertical sectional views, taken as indicated by the arrowed line **4—4** of FIG. **1**, through the mixing passage of the carburetor and showing various parts in different operating positions;

FIG. **6** is an enlarged, fragmentary sectional view of a fuel metering means of the invention and is taken as indicated by the arrowed line **6—6** of FIG. **3**;

FIG. **7** is an enlarged, vertical sectional view of a fuel discharge means of the invention and duplicates a portion of FIGS. **4** and **5** on a larger scale, FIG. **7** being taken along the arrowed line **7—7** of FIG. **1**;

FIG. **8** is a view taken as indicated by the arrowed line **8—8** of FIG. **7**;

FIG. **9** is a view similar to FIG. **2**, but showing another embodiment of the invention;

FIG. **10** is a fragmentary horizontal sectional view taken as indicated by the arrowed line **10—10** of FIG. **9**;

FIG. **11** is a schematic wiring diagram of the embodiment shown in FIGS. **9** and **10** of the drawings; and

FIG. **12** is a fragmentary sectional view showing still another embodiment;

FIG. **13** is a vertical sectional view of a modified fuel metering device according to the invention;

FIG. **14** is a sectional view and is taken as indicated by the arrowed line **14—14** of FIG. **13**;

FIG. **15** is a sectional view and is taken as indicated by the arrowed line **15—15** of FIG. **13**;

FIG. **16** is a perspective view of fixed ramp means; and

FIG. **17** is a vertical sectional view through the mixing passage of the device shown in FIG. **13**.

DESCRIPTION OF EXEMPLARY EMBODIMENT OF INVENTION FIGS. 1 to 8

Designated generally by the numeral **20** in FIGS. **1** to **8** of the drawings is a downdraft fuel metering device or carburetor of the invention having a housing **22** provided therethrough with an upright mixing passage **24**. The housing **22**, which is illustrated as being of simple, rectangular construction, is shown as provided at its lower, downstream end with a mounting flange **26** for attachment to an intake manifold, not shown, and as provided at its upper, upstream end with a mounting flange **28** for attachment of an air filter, or like, to the carburetor.

Two rectangular plates or air valves **30** forming a variable venturi are pivotally mounted in the housing **22** at the upstream end of and on opposite sides of the mixing passage **24**, adjacent the corresponding sidewalls of the mixing passage. The variable venturi plates

30 are pivotable about parallel axes inwardly toward each other into closed positions, shown in FIG. 4, and outwardly away from each other into open positions. Partially open positions are shown in solid lines in FIG. 5, and fully open positions in broken lines.

The carburetor 20 includes means 32, FIG. 2, interconnecting the venturi plates 30 for concurrent movement between their closed and open positions. The connecting means 32 includes two sector gears 34 suitably fixed on shafts 36 carrying the venturi plates 30 and respectively meshed with intermeshed gears 38. With this construction, the venturi plates 30 move in unison through identical angular increments.

The carburetor 20 includes resilient means biasing the venturi plates 30 toward their closed positions in opposition to the action of an engine-induced vacuum downstream from the venturi plates tending to pivot them into open positions. Referring to FIGS. 1 and 3, the resilient means comprises two springs 40 and 42 encircling projecting ends of the respective venturi-plate shafts 36. The spring 40 is a rattrap spring having one end suitably connected to its venturi-plate shaft 36 and having its other end in engagement with a stop 44 on a sector 46 which is pivotable about the axis of the corresponding shaft 36 and which may be locked in any desired adjusted position, corresponding to a particular air-fuel ratio, by a screw 48.

The spring 42 is a bimetallic spiral spring having one end suitably connected to its venturi-plate shaft 36, and having its other end in engagement with a stop 50 on a sector 52 which may be locked in any desired adjusted position by a screw 54. The bimetallic spring 42 operates only below a selected temperature and, above that temperature, exerts no biasing force on the venturi plates 30. The bimetallic spring 42 applies a progressively increasing closing bias to the venturi plates 30 with decreasing temperature below the selected cutoff temperature, which bias may be adjusted by loosening the screw 54 and resetting the sector 52. As will be explained hereinafter, the bimetallic spring 42 causes the venturi plates 30 to produce a progressively decreasing choke effect up to the cutoff temperature.

The carburetor 20 includes a throttle means in the housing 22 at the downstream end of the mixing passage 24, such throttle means being shown as comprising two rectangular throttle plates 58 mounted intermediate their edges for pivotal movement, about axes parallel to the pivot axis of the venturi plates 30, between closed positions, FIG. 4, and open positions, the throttle plates being shown partially open in solid lines in FIG. 5 and fully open in broken lines. More particularly, the throttle plates 58 are carried by shafts 60 intermediate their lateral edges. As best shown in FIG. 2, projecting ends of the shafts 60 have fixed thereon intermeshed sector gears 62 which cause the throttle plates 58 to move in unison. One of the shafts 60 also has fixed thereon externally of the housing 22 an arm 64 connected by a suitable linkage 66 to an accelerator pedal, not shown, or other throttle control. One of the sector gears 62 is engageable with an adjustable stop screw 68 which determines the idling speed of the engine on which the carburetor 20 is mounted.

In the mixing passage 24 between the venturi plates 30 and the throttle plates 58 is a fuel discharge means 70 comprising a tubular spray bar 72. The latter parallels the axes of the venturi plates 30 and the throttle plates 58 and is located midway between the sides of the mixing passage 24, extending between the end walls of the mixing passage and being suitably secured thereto. Lateral discharge openings 74 spray the fuel transversely of the stream of air flowing through the mixing passage 24 for thorough mixing.

Rotatable in the tubular spray bar 72 is a tubular shaft 76 the interior of which is shown as communicating with the interior of the spray bar through radial ports 78, FIG. 8. One end of the tubular shaft 76 projects through an end wall of the mixing passage 24 into a fuel chamber 80 and has fixed thereon a fuel pickup arm 82 the free end of which is movable in the fuel chamber along an arcuate path. A fuel passage 84 extends from the free end of the pickup arm 82 to and communicates with the tubular shaft 76 so that fuel picked up by the arm 82 in a manner to be described is delivered to the interior of the spray bar 72.

The opposite end of the tubular shaft 76 is suitably closed and projects through the opposite end wall of the mixing passage 24. Such other projecting end of the tubular shaft 76 has fixed thereon a gear 86, FIG. 2, meshed with one of the gears 38 interconnecting the venturi plates 30. This construction provides a driving means interconnecting the venturi plates 30 and the fuel pickup arm 82 for pivoting the pickup arm concurrently with the venturi plates. Thus, as the venturi plates 30 pivot from their closed positions, FIG. 4, to their fully open positions, shown in broken lines in FIG. 5, the fuel pickup arm is moved concurrently from the solid line position of FIG. 3 to the broken line position thereof. The fuel chamber 80 contains a generally arcuate fuel metering ramp 88 adjacent and generally parallel to the arcuate path followed by the free end of the fuel pickup arm 82. The fuel metering ramp 88 and the free end of the fuel pickup arm 82 cooperate to provide a variable fuel metering clearance 90 therebetween. The spacing of the metering ramp from the arcuate path of the free end of the pickup arm 82 increases along the arcuate path in the direction of pivotal movement of the pickup arm corresponding to opening movement of the venturi plates 30, thereby increasing the fuel metering clearance 90 with increasing air flow through the mixing passage 24. The spacing of the metering ramp 88 from the path of the free end of the pickup arm 82 is so calibrated as to provide, for the engine on which the carburetor 20 is installed, the same air-fuel ratio for all angular positions of the venturi plates 30 during operation under equilibrium conditions.

In the embodiment under consideration, fuel is admitted to the fuel chamber 80 from a fuel line 92 by a valve means 94, FIG. 1, controlled or operated by a float 96 in a conventional manner.

OPERATION OF EMBODIMENT OF FIGS. 1 TO 8

As it will be apparent, the positions of the venturi plates 30, and thus the position of the fuel pickup arm 82, are determined by the air flow through the mixing passage 24, which is determined by the positions of the throttle plates 58. More particularly, as the throttle plates 58 are opened, an engine-induced vacuum builds up between the throttle plates and the venturi plates 30, so that the resulting pressure differential across the venturi plates causes them to assume corresponding positions. Thus, changes in the positions of the throttle plates 58 produce corresponding changes in the posi-

tions of the venturi plates **30**, and in the position of the fuel pickup arm **82**.

More particularly, when the throttle plates **58** are in their closed positions, the venturi plates **30** are also closed, being biased closed by the spring **40** (and by the bimetallic spring **42** at any temperature below normal operating temperatures, as will be discussed hereinafter). If the throttle plates **58** are opened, the result is an increased vacuum in the mixing passage **24** between the throttle plates and the venturi plates **30**, whereupon the venturi plates open correspondingly. This has the effect of moving the fuel pickup arm **82** along the fuel metering ramp **88** in the direction to increase the fuel metering clearance **90** to permit the rate of fuel flow to the spray bar **72** to increase nonlinearly in proportion to the increased air flow. As previously mentioned, the fuel metering ramp **88** is so calibrated that the fuel metering clearance **90** increases with increasing air flow as required to maintain the air-fuel ratio constant under all engine operating conditions, from idling to full throttle, which is an important feature of the invention. It will be understood, of course, that as the throttle plates **58** are closed, the reverse occurs. In other words, the venturi plates **30** close correspondingly as the throttle plates **58** are closed, thereby moving the fuel pickup arm **82** down the metering ramp **88** to progressively decrease the metering clearance **90** in proportion to the decreasing air flow. Thus, for any positions of the throttle plates **58**, the venturi plates **30** assume corresponding positions and, as they do, they correspondingly displace the fuel pickup arm **82** angularly relative to the fuel metering ramp **88** in a manner to maintain the air-fuel ratio of the mixture delivered to the engine constant, under equilibrium conditions.

The carburetor **20** of the invention will maintain the air-fuel ratio constant, under equilibrium conditions, irrespective of variations in altitude, variations in air density due to causes other than altitude variations, variations in temperature, variations in humidity, and the like, which are important features of the invention. It will be understood, of course, that the air-fuel ratio may be adjusted by adjusting the biasing force provided by the spring **40**.

Still considering the operation of the carburetor **20** with the engine in operation at normal operating temperatures, if the throttle plates **58** are opened, or if the degree of opening thereof is increased, the corresponding opening of the venturi plates **30** is delayed very slightly, due to such things as inertia, friction, the opposition offered by the spring **40**, and the like. Consequently, the pressure in the mixing passage **24** at the fuel discharge means **70** decreases so that the flow of fuel to the discharge means is increased before the venturi plates **30** move to cause the fuel metering clearance **90** to increase. This results in a momentary increase in the richness of the mixture produced in the mixing passage **24**, since the venturi plates **30** have not yet moved to increase the air flow, so that the effect of an acceleration pump is provided, without any necessity for a separate device of this nature.

Considering now the operation of the carburetor **20** at temperatures below the cutoff temperature of the bimetallic spring **42**, the venturi plates **30** are biased closed at such temperatures by both the spring **40** and the bimetallic spring **42**. Consequently, a given opening of the throttle plates **58** results in a higher vacuum at the fuel discharge means **70** than under normal temperature operation, since the venturi plates cannot open to maintain the constant air-fuel ratio achieved under normal operating temperature conditions. Thus, under such subnormal operating temperatures, the richness of the mixture produced in the mixing passage **24** is increased to provide the effect of a choke, for starting and warming up, without the provision of a separate choke, this being another important feature. It will be understood that this choke effect also takes place in starting the engine, cranking of the engine resulting in a reduction in pressure at the fuel discharge means **70**, because of the closed venturi plates **30**, to produce the richer mixture necessary for starting.

DESCRIPTION OF EXEMPLARY EMBODIMENT OF INVENTION FIGS. 9 TO 11

These figures of the drawings show a carburetor **100** which, in most respects, is identical to the carburetor **20**, the same reference numerals being applied to identical components. The carburetor **100** differs in that, instead of being provided with the float operated valve means **94** for admitting fuel into the fuel chamber **80**, it is provided with an electrically operated valve means **102** in the fuel line **92** for admitting fuel into the chamber **80**. More particularly, the electrically operated valve means **102** may comprise a valve **104** operated by a solenoid **106**. In this embodiment, the fuel chamber **80** is maintained at a superatmospheric pressure, instead of atmospheric.

In this embodiment, premature energization of the solenoid **106** could result in flooding of the engine, particularly if the latter were equipped with an electrically driven fuel pump, not shown. To prevent this, the solenoid **106** has connected in series therewith a normally closed microswitch **108** which is held open by a shoulder **110** on one of the venturi-plate sector gears **34** until such time as cranking of the engine during starting results in opening of the venturi plates **30** to a predetermined extent. At this point, the microswitch **108** closes to energize the solenoid **106** and thus pressurize the fuel chamber **80** to discharge fuel into the mixing chamber **24**. Preferably, another normally closed, manually openable, pushbutton switch **112** is also connected in series with the solenoid **106** to permit the operator of the engine to prevent the delivery of additional fuel to the carburetor **100** during cranking of the engine to eliminate a flooded condition. Upon releasing the switch **112**, it automatically closes again.

In all respects other than the foregoing, the carburetor **100** operates in the same manner as the carburetor **20** so that a further description is not necessary.

DESCRIPTION OF EXEMPLARY EMBODIMENT OF INVENTION FIG. 12

In this figure is shown a fuel pickup arm **120** similar to the arm **82**, but made of two telescoping parts **122** and **124** adjustably secured together by a set screw **126**. With this construction, the fuel metering clearance **90** may be adjusted to precisely the correct value at idling, for example, by loosening the set screw **126**, inserting a feeler gauge **128** between the arm **120** and the ramp **88**, and tightening the set screw, thereby compensating for manufacturing variations in the fuel arm length.

DESCRIPTION OF EXEMPLARY EMBODIMENT OF INVENTION, FIGS. 13–17

In these figures are shown a modification of the

pickup arm and fuel metering ramp disclosed in the preceding embodiments. A fuel pickup arm **140** has a fuel passage **142** in communication with the tubular shaft **76** so that fuel picked up by arm **140** is delivered to the interior of the spray bar. The arm is driven through gear means to the interconnected venturi plates **30** for concurrent pivotal movement therewith. The pickup arm **140** has a free end movable in the fuel chamber along an arcuate path. The fuel passage **142** terminates in a side opening **144.** The fuel chamber **80** includes a fuel metering ramp **146,** which may be integral with the wall **148,** adjacent the side opening **144** of pickup arm **140.** The face **150** of the ramp cooperates with the free end of the pickup arm to provide a variable fuel metering clearance **152** therebetween. The spacing of the ramp from the path of the free end of the pickup arm increases along the arcuate path in the direction of pivotal movement of the pickup arm (compare FIGS. **14** and **15**) corresponding to opening movement of the venturi plates **30** so as to increase the fuel metering clearance **152** with increasing air flow through mixing passage **24.**

The metering clearance is calibrated to provide the same fuel-air ratio for all angular positions of the plates **30** during operation of the engine on which the carburetor is installed. It will be appreciated that elongation of pickup arm **140,** due to temperature expansion, will not affect the metering clearance **152,** as in the previous embodiment. To provide a fuel rich mixture during starting, the face **150** of ramp **146** may be provided with a slot or groove **154** over a selected arcuate portion of the ramp (corresponding to low air flow through venturi plates **30**), to increase the clearance and therefore to permit increased fuel flow.

There is also shown in FIGS. **13** and **17,** a modified spray bar **160** fixedly mounted in mixing passage **24** as in the previous embodiment, but having a different external configuration. To improve the atomization of fuel discharged through orifices **162** (which communicate through ports **78** with the interior of tubular shaft **76**), the outer surface of the spray bar has a symmetrical, elongated, diamond-shaped cross section as seen best in FIG. **17.** Smoother aerodynamic effect is also accomplished by the provision of vane elements **164** at the upper end of the spray bar.

Further shown in FIGS. **13** and **17** is relief means for exhausting high pressure gases produced by engine backfire through the carburetor. In the exemplary embodiment, such means comprises a plurality of openings **170** in the venturi plates **172** and resilient cover elements **174, 176** secured by screws or the like **178** to each of the plates. During normal operation, the atmospheric pressure is greater than the mixing passage pressure so that the elements **174, 176** conform closely to the upper surfaces of plates **172.** However, should the engine backfire, the mixing passage pressure will exceed atmospheric pressure, forcing the elements **174, 176** to pivot upwardly, allowing the high pressure gas to escape.

Although exemplary embodiments of the invention have been disclosed for illustrative purposes, it will be understood that various changes, modifications, and substitutions may be incorporated in such embodiments.

I claim:

1. In a carburetor for an internal combustion engine, the combination of:

a. a housing providing a mixing passage adapted to have air drawn therethrough by the engine;

b. movable venturi plates pivotally mounted on parallel axes spaced apart and adjacent the walls upstream of said mixing passage;

c. throttle means in said housing movably mounted downstream of said mixing passage;

d. a fuel chamber;

e. a fuel discharge spray bar extending laterally across said mixing passage having an axis parallel to the pivot axes of said venturi plates and fixedly mounted immediately below the venturi plates when in a closed position, said bar having a plurality of spaced apart fuel discharge openings;

f. a fuel pickup arm pivotally mounted in said fuel chamber and having an opening therein in fluid communication with said fuel discharge spray bar, said opening moving in an arcuate path within said fuel chamber;

g. means interconnecting said movable venturi plates and said pickup arm for concurrent pivotal movement thereof; and

h. ramp means in said fuel chamber variably spaced from said pickup arm opening so as to cooperate therewith to provide a non-linear variable fuel metering clearance at different arcuate positions of said pickup arm, said clearance increasing with arcuate movement of said pickup arm to a position corresponding to an increased opening of said venturi to maintain the air-fuel mixture ratio substantially constant.

2. The carburetor of claim **1** wherein said means interconnecting said movable means defining a variable venturi and said pickup arm comprises mechanical linkage for rotating said pickup arm in direct proportion to movement of said movable means.

3. The carburetor of claim **2** wherein said linkage comprises a gear train.

4. The carburetor of claim **1** including electrically operated valve means for admitting fuel under pressure into said fuel chamber and switch means operable by said movable means defining a variable venturi for preventing energization of said electrically operated valve means when said variable venturi is closed.

5. The carburetor of claim **4** including manually operable, normally closed switch means for preventing energization of said electrically operated valve means.

6. A carburetor for an internal combustion engine comprising:

a. a housing including a mixing passage through which air is drawn;

b. variable venturi plates pivotally mounted on parallel axes in the upstream end of said mixing passage for movement from a position at which the free ends of said plates are substantially in contact so as to entirely close said mixing passage to an open position at which said plates are substantially removed from the air flow passage;

c. pivotally mounted throttle means mounted at the downstream end of said mixing passage;

d. a fuel supply chamber;

e. a hollow fuel discharge spray bar extending entirely across said mixing passage having an axis parallel to the pivotal axes of said venturi plates and fixedly mounted immediately below said venturi plates so as to be in close proximity to the free edge of said plates when said plates are partially open,

and including a plurality of fuel discharge openings;

f. a tubular shaft rotatably mounted within said hollow spray bar and having openings in communication with the interior of said spray bar;

g. a fuel pickup arm pivotally mounted in said fuel supply chamber and having a passage therein in fluid communication at one end with said tubular shaft and having an inlet opening at its other end;

h. means interconnecting said variable venturi plates and said fuel pickup arm for concurrent pivotal movement; and

i. ramp means in said fuel chamber variably, nonlinearly spaced from said pickup arm opening so as to cooperate therewith to provide a varying fuel metering clearance upon movement of said arm, said clearance increasing in proportion to increased opening of said variable venturi plates.

7. A carburetor for an internal combustion engine comprising:

a. a housing adapted for mounting to an intake manifold having an elongated mixing passage through which air is drawn and fuel is discharged;

b. a pair of venturi plates each mounted on a shaft, said plates being pivotable toward each other, said shafts being spaced apart, parallel and positioned in the upstream end of said mixing passage;

c. throttle means movably mounted in the downstream end of said mixing passage;

d. a fuel discharge spray bar fixedly mounted in said mixing passage below said venturi plates and above said throttle means and having an axis parallel to said venturi plate shafts and having a plurality of lateral fuel discharge openings;

e. a fuel pickup arm pivotally mounted in a fuel supply chamber, said arm having a fuel passage in communication with said fuel discharge spray bar at one end and an inlet opening at the other end moving in an arcuate path within said fuel chamber adjacent a ramp in said chamber variably and nonlinearly spaced from the pickup arm inlet opening so as to cooperate therewith to provide a variable fuel metering clearance at different arcuate positions of said pickup arm; and

f. means interconnecting said venturi plates and said pickup arm for coordinated concurrent pivotal movement of said arm whereby the clearance between said arm inlet opening and said ramp increases with increasing opening of said venturi so as to control the air-fuel mixture ratio.

8. The carburetor of claim **7** additionally including temperature responsive resilient means biasing said venturi plates towards their closed position with variable force in opposition to the force due to the pressure differential across said plates tending to move said plates to the open position.

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