Dec. 28, 1948.

A. H. WINKLER

2,457,765

CARBURETOR

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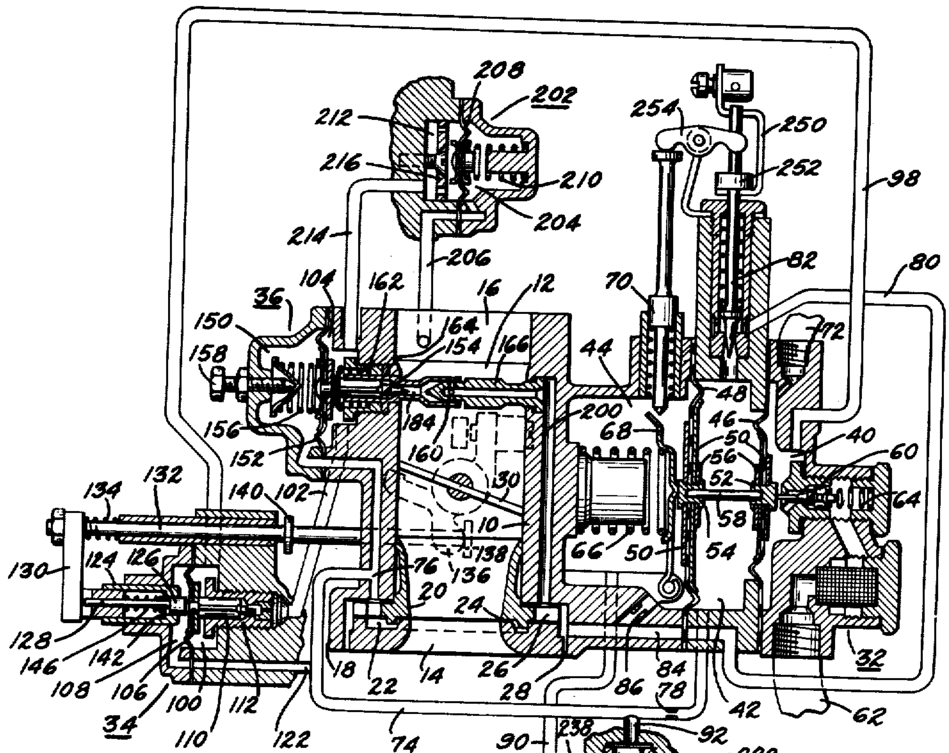

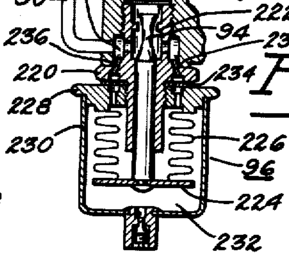

Fig. 1

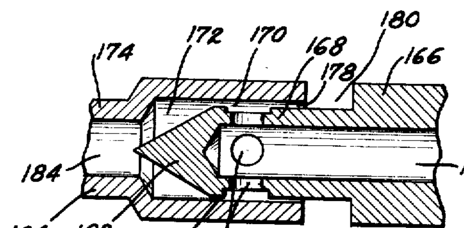

Fig. 2

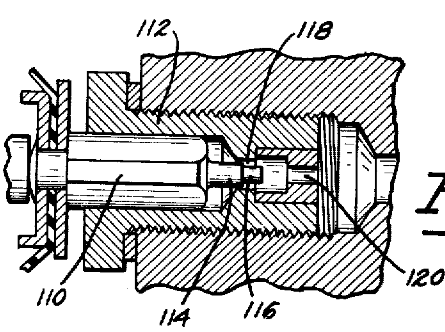

Fig. 3

INVENTOR
ALBERT H. WINKLER

BY

J. C. Baisch

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CARBURETOR

Albert H. Winkler, South Bend, Ind., assignor to Bendix Aviation Corporation, South Bend, Ind., a corporation of Delaware

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This invention relates to fuel feeding systems for internal combustion engines and more particularly to devices or systems in which liquid fuel is supplied thereto under superatmospheric pressure and is metered while being maintained under pressure. Certain subject matter of this application has been divided therefrom and is now embodied in applicant's copending applications Serial No. 600,469 filed June 20, 1945, and Ser. No. 603,783, filed July 9, 1945.

One of the principal objects of the invention is to provide a simplified device of this character which may be built at reasonable cost and which is capable of accurately regulating the fuel supply to maintain a proper fuel to air ratio through wide ranges of engine load, speed, and variations in altitude such as are experienced with an aircraft engine.

Another object of the invention is to eliminate boiling of the fuel under high temperature or altitude conditions to thereby insure accurate metering. This is accomplished by maintaining a fuel under positive pressure until it is discharged into the air supply to form a combustible mixture for the engine.

In fuel feeding systems of this character it is known to use a metered fuel control valve of the poppet or unbalanced type. Suction in the induction passage will therefore affect its position, a result that may have particularly disadvantageous results when the engine is operating in its idling range (the induction passage suction then being relatively high) and the quantity of fuel mixture supplied is relatively small. Under such conditions a very slight variation in the position of the fuel valve will cause a relatively great change in the ratio of fuel to air in the mixture.

It is therefore another object of the invention to provide a device of this character wherein fuel metering is substantially unaffected by variations in suction in the induction passage and the mixture is maintained at a substantially constant richness although manifold pressures may vary through rather a wide range. This is effected by providing a fuel nozzle including an emulsion chamber wherein substantially atmospheric pressure or the pressure at the entrance of the carburetor; which may be modified by impact or suction tubes, is maintained so that metering of fuel delivered thereto is substantially unaffected by variations in the suction in the induction passage, the emulsion being delivered to the induction passage through a passage of limited flow capacity, which particularly during idling is subjected to conditions of critical flow.

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Another object of the invention is to provide a device of this character wherein the nozzle is provided with means adapted to direct and evenly distribute fuel to the discharge groove thereof.

Still another object of the invention is to provide a device for delivering a mixture of a plurality of fluids wherein variations of suction on the delivery end of said device will not appreciably affect the operation of the device.

Other objects and advantages of the invention will be readily apparent to one skilled in the art from the following description taken in connection with the accompanying drawings, which represent preferred embodiments. After considering these embodiments skilled persons will understand that many variations may be made without departing from the principles disclosed; and I contemplate the employment of any structures, arrangements, or modes of operation that are properly within the scope of the appended claims.

In the drawings:

Figure 1 is a diagrammatic sectional view of a carburetor embodying the invention;

Figure 2 is an enlarged partial view in section of the discharge nozzle shown in Figure 1; and

Figure 3 is an enlarged partial view in section of the idle and economizer needle valve.

Throughout the drawings, similar reference characters represent similar parts although where such parts are modified in structure and operation they are given a further differing reference character.

With reference to Figure 1, there is shown a main body member 10 which contains an induction passage 12 therethrough having an air inlet 14 and an outlet 16, the air inlet being provided with an outer surface 18 to which an air scoop (not shown) opening in the direction of travel may be secured and the outlet being provided with flanges (not shown) for securing the body member 10 to the manifold of an internal combustion engine or to the inlet of a supercharger if one is used between the carburetor and the manifold. If desired, a supercharger may be used anterior to the body member 10 either in place of or in addition to a supercharger posterior to said body member. A venturi 20 having separable inlet and outlet sections is positioned in the induction passage adjacent the inlet 14 and is formed with an annular chamber 22 which communicates with the interior of the venturi through annular slot 24 to be thereby subjected to Venturi depression. An annular chamber 26 is in free communication with the air entering the venturi through an annular opening 28, the opening 28 being preferably subjected to the impact pressure of the air supplied to the venturi. A throttle 30 is pivotally mounted in the induction passage posterior to the venturi and is adapted to be manually actuated to control the air flow to the engine.

The fuel flow to the engine is regulated or controlled by an unmetered fuel pressure control unit or regulator, indicated generally at 32, which regulates or determines the fuel pressure on the upstream side of a fuel metering unit, indicated gnerally at 34, and by a discharge nozzle assembly indicated generally at 36 which regulates or determines the pressure on the downstream side of the metering unit 34. If desired, a metering orifice of fixed size may be used instead of the metering unit 34.

The interior of the regulator unit 32 is divided into three chambers 40, 42 and 44 by diaphragms 46 and 48. As shown the diaphragms 46 and 48 have an area ratio of ½ although, as will be apparent hereinafter any desired area ratio may be used. The center portions of the diaphragms are supported by thin plates 50 between which the diaphragms are clamped by centrally disposed cylindrically recessed rivets 52 and 54. Washers 56 are preferably provided under the deformed end of the rivets so that the thin plates will not tear loose from the riveted over portion of the rivets. The ends of a pin or rod 58, freely received in the recesses of the rivets, are preferably provided with rounded ends to form angularly adjustable one-way connections with the diaphragms whereby slight misalignment of the diaphragms may be accommodated without binding. This construction also greatly facilitates assembly and disassembly of the control unit 32.

Chamber 40 is provided with a fuel inlet port controlled by a valve 60 and receives fuel from a source of fuel under pressure, such as a fuel pump, through a pipe 62. The valve 60 has a pin-like extension projecting into the chamber 40 in position to be engaged by the head of rivet 52 whereby movement of the diaphragms to the right opens the valve. A spring 64 urges the valve to its closed position. A spring 66 is mounted at one end in the chamber 44 and has its free end received in a spring retainer portion of a lever 68 pivotally mounted at one end and having a crimped center portion normally engaging the head of rivet 54 and urging the diaphragms to the right in a direction to open the valve 60. The spring 66 may be rendered inoperative, when the engine is to be stopped, by a plunger 70 which upon downward movement thereof engages the free end of lever 68 and moves the lever to the left against the force of spring 66. The lever 68 will thus move out of engagement with the rivet 54 whereby the spring 64 may close the valve 60 and cut off the fuel supply to the engine. In order to eliminate vapor, a pipe 72 having a restricted communication with the top of chamber 40 is preferably provided which leads back to the fuel supply tank.

The chamber 42 of the regulator unit 32 is connected to the Venturi annulus 22 by means of a pipe 74 and passage 76 and is therefore subjected to a pressure primarily derived from the throat of the venturi 20. A restriction 78 may be provided in passage 74 if desired. The chamber 42 is also connected to the air scoop or Venturi entrance by means of a passage 80 controlled by a manual mixture control valve 82, a passage 84, and the annular chamber 26. The chamber 44 of the regulator unit 32 is connected to the annular Venturi entrance chamber 26 by a branch passage 85 of the passage 84 and is therefore subjected to a pressure primarily derived from the Venturi entrance. A restriction 86 may, if desired, be provided in the branch 85. The chamber 44 is also connected to the Venturi annulus 22 through passages 90, 92 and 74, the communication between passages 90 and 92 being controlled by a valve 94 of an automatic mixture control unit 96. Unmetered fuel entering the chamber 40 of the regulator from the fuel inlet 62 is transmitted through a pipe 98 to a chamber 100 of the fuel metering unit 34, and thence through the metering unit to a pipe 102 leading to a chamber 104 of the discharge nozzle 36.

The fuel metering unit 34, which determines the effective area of the fuel metering restriction under various conditions of operation, may be formed as a part of the main body 10, or of the regulator 32, or may be a separable unit secured to the body or regulator as desired. A diaphragm 106 separates the chamber 100 from a chamber 108 and is secured to a metering valve 110 (best shown in Figure 3) slidable in a plug 112 and having a double stepped end 114, 116 cooperating with a metering orifice 118 formed in the plug 112. If desired, a second orifice 120 may be provided to limit the flow of fuel when the valve 110 is entirely withdrawn from the orifice 118. As shown the orifice 120 is located in the plug 112; however, it may be placed at any desired point in either of the passages 102 or 98. The chamber 108 is connected to the Venturi annulus 22 by means of a pipe 122 and the passages 74 and 76.

A cup member 124 forms a stop, limiting movement of diaphragm 106 to the left, and may be adjustably mounted as by threading. A piston 126 is slidably mounted in the cup member 124 and projects therethrough into abutting relation with the diaphragm 106 of the valve 110 to thereby limit the permissible movement to the left of diaphragm 106 under the influence of the fuel pressure in chamber 100. The piston 126 is provided with a reduced diameter extension 128 adapted to be engaged at idle by a cross bar 130 adjustably secured to a slidably mounted rod 132 which is urged to the left by a spring 134 and is moved to the right at idle by a throttle lever finger 136 engaging a flange 138 on the rod 132. A stop 140 limits movement of rod 132 to the left at such times as the throttle is open beyond its idling or near idling positions. A washer 142, slidable within the cup member 124, is urged to the right against the bottom of the cup member by a pre-loaded spring 146. The washer is adapted to engage the shoulder of piston 126 to limit the movement to the left of said piston, diaphragm 106, and valve 110, whereby as the throttle is opened beyond the near idling position the fuel pressure in chamber 100 moves the valve 110 to the left only sufficiently far to withdraw the step 114 from the orifice 118. During high power operation, however, the high unmetered fuel pressure in chamber 100 and the low Venturi pressure in chamber 108 create a sufficient pressure differential across the diaphragm 106 so that the spring 146 is further compressed and step 116 at the end of valve 110 is completely withdrawn from the orifice 118.

Thus during idling, with the parts as shown in Figures 1 and 3, the step 114 cooperates with the orifice 118 to limit the area for fuel flow. As the throttle is opened through the near idling range the valve 110 moves to the left until the piston 126 engages the washer 142, at which time the step 116 cooperates with the orifice 118 to limit the area for fuel flow during normal cruising operation. At high power output the step 116 is completely withdrawn from the orifice 118, at which time said orifice 118, or the orifice 120, or both, determine the effective fuel metering area.

Fuel passing through the metering unit 34 is transmitted through a pipe 102 to a chamber 104, in the discharge nozzle assembly 36, which is separated from a chamber 150 by a preformed annularly grooved diaphragm 152 connected to a fuel outlet valve 154 and urged to the right in a direction to close the valve by a spring 156 arranged to be variably loaded by an adjustment screw 158, said chamber 150 being connected to the Venturi annulus 22 by the passage 76. The stem of valve 154 is of triangular cross section or otherwise relieved to permit fuel flow therepast and is slidable within the nozzle bar 160. In this arrangement the valve 154 is not fixed to the diaphragm 152 but is maintained in abutting relation therewith by means of a light spring 162 which constantly urges the valve 154 to the left. This arrangement eleminates any tendency for the valve to bind in its valve guide and seat member 164 as a result of misalignment between the diaphragm and the guide member.

The discharge nozzle, as best shown in Figure 2, comprises a member 166 mounted in the wall of the body 10 and extending transversely of the induction passage 12. The member 166 is provided with a reduced diameter end portion 168 having a groove 170 therein. The portion 168 projects into an enlarged portion 172 of a tubular extension 174 of the valve guide and seat member 164, the outer surface of the end 168 being substantially concentric with but spaced from the inner surface of the enlarged portion 172 to thereby form an annular fuel passageway 176 of limited flow capacity, an emulsion chamber formed by the groove 170, and a second annular passageway 178 of limited flow capacity which leads to an annular space 180 from which fuel emulsion is discharged into the induction passage 12. The tip 182 of the end 168 is preferably pointed or otherwise formed so that fuel received past the valve 154, through the passage 184, will be readily directed outwardly to the annular passageway 176. Ports 186 connect the groove 170 with a bore 188 in the member 166 which receives air through passage 200 from the annular venturi entrance 26.

An acceleration pump indicated at 202, which may be provided if desired, includes a suction chamber 204 connected through pipe 206 with the induction passage 12 posterior to the throttle. A diaphragm 208 urged to the left by a spring 210 separates the suction chamber 204 from a fuel chamber 212 connected through a pipe 214 with the fuel chamber 104 of the discharge nozzle 36. During periods of high engine suction operation the diaphragm 208 is moved to the right and the fuel "robbed" from the chamber 104 is drawn into the chamber 212. Upon a loss in engine suction as upon acceleration, the spring 210 forces the diaphragm to the left and pumps fuel from chamber 212 to the nozzle chamber 104 thereby temporarily richening the mixture. An adjustable stop 216 is provided whereby the stroke of the diaphragm 208 may be varied.

The automatic mixture control unit 96, which is responsive to variations in altitude, includes a plug 220 which carries a seat portion 222 and is screwed into any desired fixed member, which may be the body 10. The stem of valve 94 is slidably received within the plug 220 and is secured to an end closure member 224 of a corrugated bellows 226, the other end of which is secured to a base 228 to which a cap 230 is also secured. The bellows and cap form walls of a sealed chamber 232 which may be evacuated to any desired degree. By controlling the degree of evacuation, the pressure and temperature responsiveness of the bellows may be correlated as desired. If desired a quantity of fluid may be used in chamber 232 to aid in obtaining the desired temperature responsiveness. The base 228 is threadedly secured to the plug 220 and is separated therefrom by shims 234, the number of thickness of which may be readily varied to adjust the zero setting of the valve 94 relative to the seat portion 222.

Oppositely disposed ports 236 connect the interior of the bellows 226 with annular chamber 238 whereby the pipes 90 and 92 may communicate with the interior of the bellows, thereby making the control unit 96 responsive to changes in the temperature and pressure of the air entering the venturi. The unit 96 may, if desired, be placed closely adjacent to or in the air inlet so as to be in direct contact with the entering air. Also if desired the interior of the bellows 226 may be connected directly to the inlet.

The calibrated passage 80 interconnects the chambers 42 and 44 and is controlled by the spring closed manual mixture control valve 82 adapted to be opened any desired amount from the pilot's compartment by a cable actuated member 250. The stem of valve 82 is provided with a collar 252 which engages a pivoted lever 254 to force the plunger 70 downwardly when the mixture control valve is moved beyond its wide open or lean position to its idle cut-off position.

Operation

The operation of the device disclosed in Figure 1 is as follows:

Assuming the carburetor has not been filled with fuel and the idle cut-off plunger 70 is in its upward position as shown, the spring 66 will urge the diaphragms to the right and open the valve 60. Fuel under pressure supplied to pipe 62 enters and fills chamber 40 and flows through the unit 34 and pipe 102 to the chamber 104. As the pressure in chamber 40 increases it acts against the diaphragm 46 and tends to compress spring 66 whereby the valve 60 tends to close. Fuel under pressure supplied to chamber 104 acts on diaphragm 152 and tends to open valve 154. The screw 158 is normally adjusted to compress spring 156 to such a point that a slightly lower pressure is required in chamber 104 to open the valve 154 than is required in chamber 40 for sufficiently compressing the spring 66 to permit the valve 60 to close. Once the carburetor has been fully filled with fuel, fuel will therefore slowly spill from the discharge groove 180 unless the lever 250 is actuated and the plunger 70 forced downwardly to compress spring 66 and so allow valve 60 to close. Although the screw 158 has been described as being adjusted to permit valve 154 to open at a pressure somewhat less than the closing pressure for valve 60, it will be apparent that by screwing the adjustment screw 158 in or out of the pressure in chamber 104 required to open valve 154 may be made greater than, equal to or less than the pressure required in chamber 40 to permit the valve 60 to close. It will also be apparent that the actual value or degree of the fuel pressures will be determined by the strength of the springs 66 and 156, the pressure required being greater as the strength of the spring is increased.

It has generally been found desirable to adjust the discharge nozzle spring 156 sufficiently weaker, in proportion to the area of the diaphragm 152, than the spring 66, in proportion to the area of diaphragm 46, so that at idle an excessively rich mixture is obtained, and then to decrease the richness of the idling mixture by decreasing the effective area of the metering orifice 118 during idling operation. It is for this reason that the valve 110 and the rod 132 function to reduce the metering orifice area at idle. By controlling the rate at which the valve 110 is permitted to move to the left as the throttle is opened from its idle position, any desired near idling mixture richness can be obtained.

During operations, assuming the area ratio of the diaphragms 48 and 46 is equal to two, the regulator unit 32 functions to mtaintain a differential fuel pressure across the metering unit 34 which is equal to twice the venturi to entrance air differential pressure. For example, a given decrease in the pressure in the Venturi chamber 22 is transmitted to the chamber 42, where it results in an equal increment increase in the unmetered fuel pressure in chamber 40, and is transmitted to chamber 104, where it results in an equal increment decrease in the metered fuel pressure. Consequently the fuel metering differential pressure is increased in amount double the increase in the air differential. Similarly a given increase in the entering air pressure in the chamber 26 is transmitted to chamber 44 and since it is applied to the diaphragm 48 having twice the area of diaphragm 46, the unmetered fuel pressure in chamber 40 is increased an increment double the increase in entering air pressure.

Although the diaphragms 48 and 46 are shown as having a two-to-one area relationship, they may be of any other desired area ratio, in which case the fuel metering differential pressure will be maintained at some multiple, other than two, of the air differential pressure. For example, if the area of diaphragm 48 is three times the area of diaphragm 46, the fuel differential will be maintained equal to three times the air metering differential. Or, if diaphragms 46 and 48 are of equal size, the fuel metering differential pressure is maintained substantially equal to the air differential pressure. In any event, the fuel and air differential pressures are maintained in constant proportion and therefore constant fuel to air proportioning is obtained.

In order to minimize the disturbance of the ratio of fuel to air by induction passage suction on the valve 154, which is of the unbalanced type, a critical flow nozzle, one embodiment of which is shown in Figures 1 and 2, is provided and constitutes an important element of the present device. In this nozzle the emulsion chamber 170 is freely supplied with air through the ports 186 at substantially atmospheric or entering air pressure and said emulsion chamber is connected with the induction passage by a restricted calibrated passage 178. Therefore, as the passage 178 is one of limited flow and the chamber 170 is freely supplied with air at atmospheric or entering air pressure, the pressure in chamber 170 is maintained substantially constant at said atmospheric or entering air pressure regardless of variations in induction passage suction at or beyond the point of critical flow of passage 178. With this arrangement the fuel pressure in passage 184, and consequently the fuel metering, is substantially unaffected by variations in the suction at the annulus 180. In addition, the restricted annular passageway 178 functions as a critical flow nozzle, relative to the air bled to said nozzle, at low manifold pressures corresponding to idling, so that fluctuations in manifold pressure at or above said critical flow point, for a given fuel flow as determined by the regulator, are ineffective to vary the quantity of air being drawn through the ports 186. By this means a mixture of constant richness is provided even though the idling manifold pressure varies through rather wide limits.

It is generally desirable to provide the pilot with a manual mixture control so that he can vary the richness of the mixture between predetermined limits. For this purpose the calibrated passage 80, controlled by the tapered valve 82 is provided, which with the valve closed corresponds to a rich setting. As the valve 82 is opened, air is bled from the air scoop chamber 44 into the Venturi chamber 42 whereby the differential pressure between these chambers is reduced an amount depending upon the extent the valve 82 is opened. This in turn reduces the unmetered fuel pressure in chamber 40 required to maintain the diaphragm assembly in an equilibrium position, thus reducing the fuel metering differential and consequently reducing the richness of the mixture for a given air flow. With the valve 82 completely withdrawn the carburetor is in its full lean position, the effective area of passage 80, as limited by the seat of valve 82, determining the maximum permissible bleeding action.

The automatic mixture control unit 96, or altitude control unit, as it is sometimes referred to, is provided to maintain a constant mixture richness with variations in altitude, and functions on substantially the same air bleed principle as the manual mixture control. Upon a decrease in the density of the air entering the venturi, as by increase in altitude, the differential between the entering air and the Venturi pressures will increase for a constant weight of air flow per unit time and will tend to increase the fuel flow and enrich the mixture. As the density decreases, however, the bellows 226 collapses, because of the decreased pressure within the bellows, and moves valve 94 upwardly to increase the area of communication between the pipes 90 and 92. Air is thus bled into the Venturi chamber 42 to thereby reduce the differential pressure which would otherwise exist between the chambers 42 and 44, whereby the unmetered fuel pressure in chamber 40 is correspondingly decreased. By properly contouring the valve 94, the differential in the air pressures in chambers 42 and 44 are so controlled that the fuel supplied to the engine remains constant for a given weight of air flow per unit time even though the entering air density changes. Automatic altitude compensation is thus obtained.

With the orifice 86 positioned as shown and properly proportioned relative to the orifice 78, the manual mixture control will function primarily to vary the pressure in chamber 42 to thereby vary the differential between the pressures in chambers 42 and 44; whereas, the automatic mixture control 96 will function primarily to vary the pressure in chamber 44 to thereby vary said differential. If desired, however, restriction 86 may be eliminated and restriction 78 placed in the passage 74 to the left of passage 92, in which case both controls would tend to have their major effect upon pressure in chamber 42. Other arrangements of the restrictions may be used if desired.

When the engine is to be stopped it is desirable to cut off all fuel flow thereto so that it will not continue to run, as a result of pre-ignition, after the ignition is turned off. To accomplish this end, the valve 82 is moved upwardly beyond its full lean position to an idle cut-off position at which the plunger 70 is forced downwardly by the lever 254 whereby the spring 68 is compressed and the light spring 64 is able to fully close valve 60.

It will also be understood that many changes might be made in the form and arrangement of the parts without departing from the spirit and scope of the invention or sacrificing all of its material advantages and it is not intended that the scope of the invention shall be limited to the form shown and described nor otherwise than by the terms of the appended claims.

I claim:

1. In a charge forming device having a throttle controlled induction passage: a discharge nozzle comprising a pair of members projecting into the induction passage from opposite sides thereof and having their ends in spaced telescopic relation forming an annular space between the telescoped portions; a passageway in the outer of the two telescoping members in communication with the annular space; a groove in the outer surface of the inner member enlarging the intermediate portion of the annular space to form an emulsion chamber; an air supply duct in the inner of the two telescoping members communicating with said groove; a shoulder on the inner member in spaced relation to the adjacent free end of the outer member thereby providing an annular discharge groove in communication with said annular space; and means for supplying fuel to the passageway of the outer member.

2. In a charge forming device having a throttle controlled induction passage: a discharge nozzle comprising a pair of members projecting into the induction passage from opposite sides thereof and having end portions in spaced telescopic relation forming an annular space therebetween; a shoulder on the inner member in spaced relation to the adjacent free end of the outer member thereby providing an annular discharge groove in communication with the annular space; a passageway in the outer of the two telescoping members in communication with the annular space; a groove in the outer surface of the inner member enlarging an intermediate portion of the annular space to form an emulsion chamber; a passageway in the inner of the two telescoping members communicating with said groove; means for supplying fuel to one of the passageways; and means for freely supplying air to the other passageway, the annular space between being so calibrated that suction transmitted from the induction passage to the emulsion chamber will reach the maximum value at a predetermined induction passage suction and will not vary appreciably from said maximum value upon a rise in induction passage suction above said predetermined suction.

3. In a discharge nozzle for a fuel supply system: a pair of oppositely extending members having their ends in spaced telescopic relation forming a calibrated annular space therebetween thereby providing a fuel emulsion discharge passage of limited flow capacity; a fuel passageway in the outer of the two telescoping members in communication with the annular space; a shoulder on the inner member in spaced relation to the adjacent free end of the outer member thereby forming an emulsion discharge groove in communication with the annular space; a groove in the outer surface of the inner member enlarging an intermediate portion of the annular space to form an emulsion chamber; an air passageway in the inner of the two telescoping members communicating with said groove; means for supplying fuel to one of the passageways; means for supplying air to the other passage, said annular space being adapted to limit fluid flow therethrough to a critical maximum; and a conical tip on the free end of the inner member which tapers to a point facing the fuel flow.

4. In a charge forming device: a throttle-controlled air-intake passage having a venturi therein anterior the throttle, a fuel conduit leading from a source of fuel under pressure and terminating in a fuel-discharge nozzle located in said passage, a fuel-metering restriction in said conduit, means for regulating the pressure of fuel upstream of said restriction, means for regulating the pressure of fuel downstream of said restriction independently of upstream pressure thereof including a valve controlling flow of fuel to said nozzle and spring-pressed toward closed position and subjected in a valve-opening direction to the pressure of fuel downstream of said restriction and to Venturi suction; said discharge nozzle having an emulsion chamber receiving liquid fuel from the fuel conduit at pressures determined by said valve, a discharge passage communicating the emulsion chamber with the air-intake passage posterior the throttle, and means for supplying air to said emulsion chamber, said discharge passage being calibrated in a manner such as to limit the suction effect on the emulsion chamber to a critical maximum so that under certain conditions of operation, for example, at partly or fully closed throttle when Venturi suction is at a low value and posterior throttle suction is high, the disturbing effect of intake passage suction on the said valve and hence on the fuel-air ratio will be minimized.

5. In a charge forming device: a throttle-controlled air-intake passage having a venturi therein anterior the throttle, a fuel conduit leading from a source of fuel under pressure and terminating in a fuel-discharge nozzle located in said passage, a fuel-metering restriction in said conduit, means for regulating the pressure of fuel upstream of said restriction including a fuel valve to which fuel is supplied at substantially constant pressure and pressure-sensitive means controlling said valve and arranged to be responsive to variations in the flow of air through said air-intake passage and unmetered fuel pressure upstream of said restriction, means for regulating the pressure of fuel downstream of said restriction independently of the pressure upstream thereof including a discharge-nozzle valve controlling flow of fuel to said nozzle and a pressure-responsive element connected to said latter valve and subjected to the perssure of fuel downstream of said restriction and Venturi suction; said discharge nozzle having an emulsion chamber receiving liquid fuel from the fuel conduit at pressures determined by said discharge-nozzle valve, an emulsion-discharge passage communicating the emulsion chamber with the air-intake passage posterior the throttle, and means for freely supplying air to the emulsion chamber, said emulsion discharge passage being

calibrated in a manner such as to limit the suction effect on the emulsion chamber to a critical maximum so that under certain conditions of operation, for example, at partly or fully closed throttle when Venturi suction is at a low value and posterior throttle suction is high, the disturbing effect of intake passage suction on the said valve and hence on the fuel-air ratio will be minimized.

ALBERT H. WINKLER.

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