May 26, 1953 E. OLSON 2,639,907

CARBURETOR

Original Filed Oct. 25, 1950 3 Sheets-Sheet 1

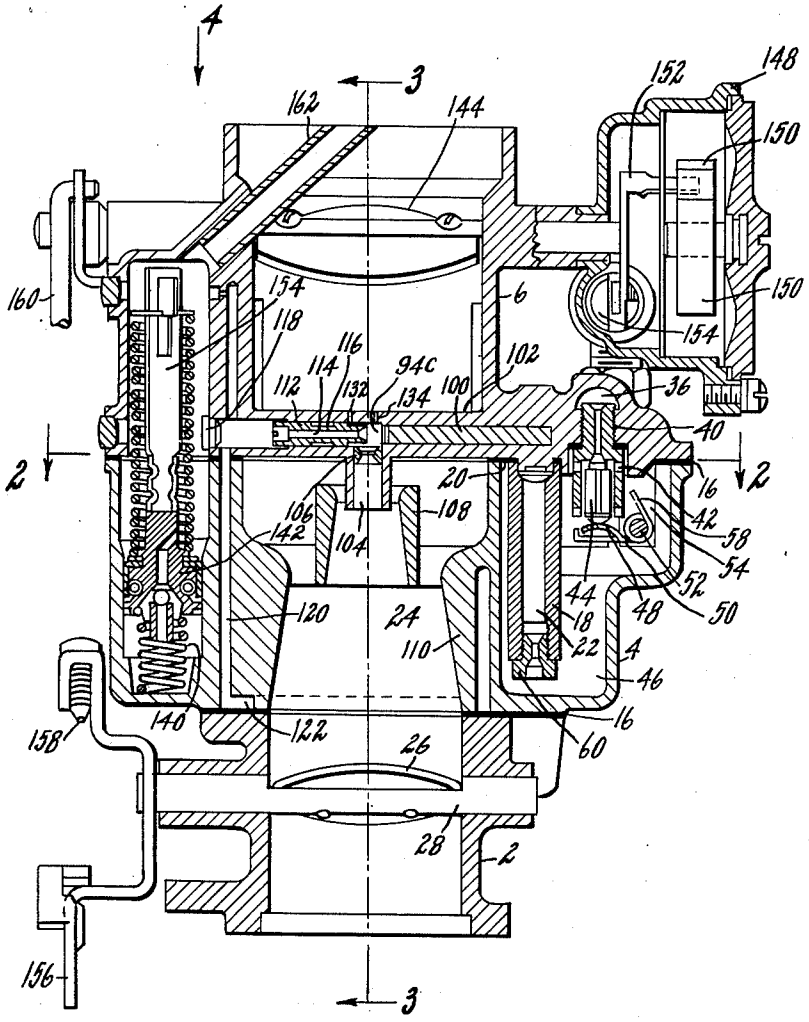


Fig. 1

INVENTOR.
ELMER OLSON

BY

Willits, Hardman & Zeks

HIS ATTORNEYS

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CARBURETOR

Original Filed Oct. 25, 1950 3 Sheets-Sheet 2

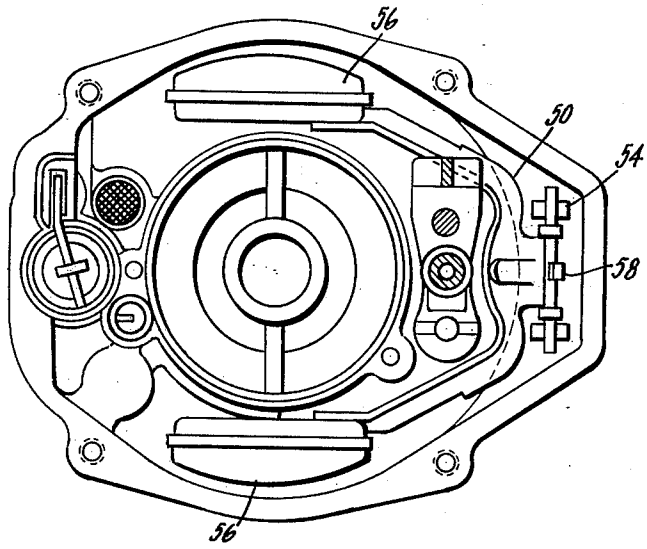


Fig. 2

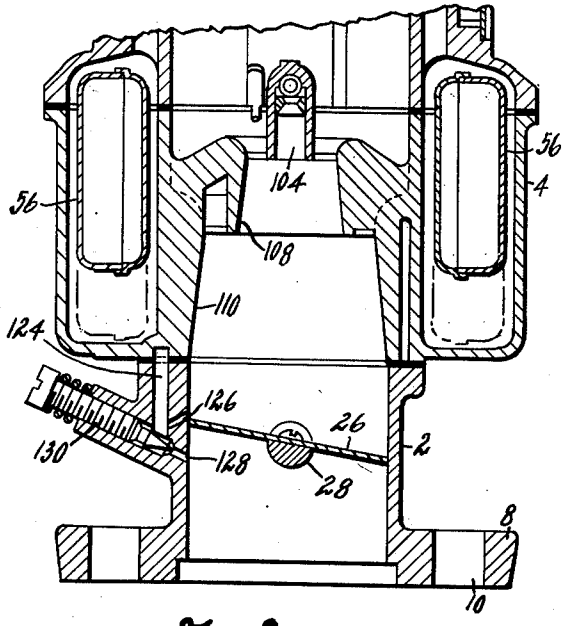


Fig. 3

INVENTOR.
ELMER OLSON

BY
Willitt, Hardman & Fehr
HIS ATTORNEYS

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CARBURETOR

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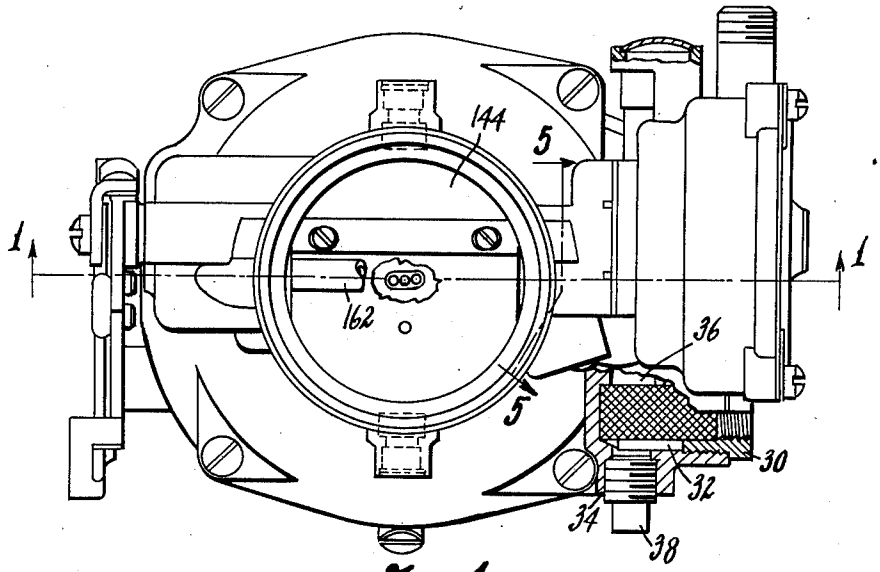


Fig. 4

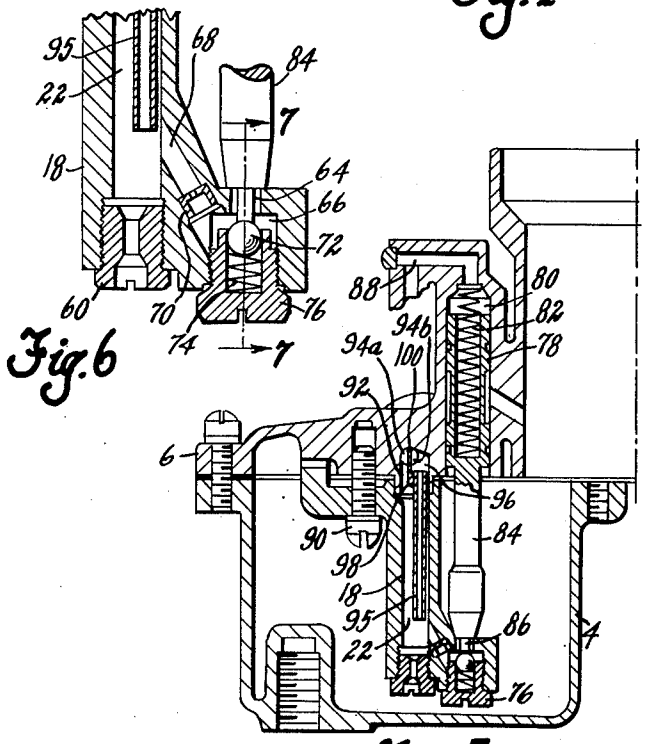


Fig. 6

Fig. 5

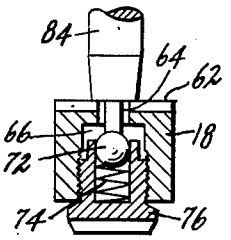


Fig. 7

INVENTOR.
ELMER OLSON

BY

Willitts, Hartman & Zeh

HIS ATTORNEYS

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UNITED STATES PATENT OFFICE

2,639,907

CARBURETOR

Elmer Olson, Rochester, N. Y., assignor to General Motors Corporation, Detroit, Mich., a corporation of Delaware

Original application October 25, 1950, Serial No. 192,035. Divided and this application January 12, 1952, Serial No. 266,152

5 Claims. (Cl. 261—41)

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This invention relates to carburetors for internal combustion engines, particularly for automotive use, and is an improvement on and quite similar to the carburetor disclosed and claimed in applicant's copending application, Serial No. 109,347, filed August 9, 1949.

At the present time certain difficulties are encountered, in the functioning of carburetors, which are occasioned by the highly volatile fuels now in use in the operation of automotive vehicles. Because of the highly volatile character of the fuels in use, difficulty is caused by fuel vaporization during operation under certain conditions, particularly during idling at high temperatures. There is sufficient vaporization of fuel in the fuel supply passage which conveys fuel from the float chamber to the fuel inlets of the carburetor, in a carburetor of conventional design, to form vapor bubbles and these tend to adhere to the wall and build up in size until the flow of fuel is largely blocked, when the bubble will be detached and passed on to the fuel inlets. This produces an irregularity in fuel flow and consequent irregularity in engine operation which may be sufficient even to cause stalling and in any event, is objectionable. The principal object of the present invention is to provide means to minimize the formation of bubbles in the fuel supply passages as far as possible and to prevent the formation of bubbles large enough to interfere materially with the regularity of fuel flow under any operating conditions.

Further objects and advantages of the present invention will be apparent from the following description, reference being had to the accompanying drawings wherein a preferred embodiment of the present invention is clearly shown.

In the drawings:

Fig. 1 is a vertical section through the carburetor on the line 1—1 of Fig. 4;

Fig. 2 is a plan view of the float chamber casting 4 with the cover casting 6 removed;

Fig. 3 is a fragmentary section on line 3—3 of Fig. 1;

Fig. 4 is a plan view of the carburetor which is shown in section in Fig. 1;

Fig. 5 is a section on the line 5—5 of Fig. 4;

Fig. 6 is an enlarged fragmentary detail of Fig. 5;

Fig. 7 is a detail section on the line 7—7 of Fig. 6.

Referring to Fig. 1, the carburetor includes three main castings 2, 4 and 6 which are, respectively, the outlet member which is attachable to the intake, the constant level fuel chamber which is positioned immediately above the outlet

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member and the air intake member which has formed integrally therewith a cover for the fuel chamber. The outlet member has a projecting flange 8 having holes 10 for receiving the attaching bolts which secure the caburetor to the manifold in the usual way. The outlet member and the fuel chamber, the fuel chamber and the air inlet, respectively, are secured together in any suitable way, gaskets 16 being provided between the several parts to prevent leakage, as shown in Fig. 1.

Depending from the casting 6 is a small casting 18, separated from the casting 6 by a gasket 20 and in which is provided the main fuel supply passage 22, through which fuel passes from the fuel chamber to the mixture passage 24. The latter extends centrally through all of the castings 2, 4 and 6 and supplies combustible mixture to the manifold, the flow of such mixture being controlled by a throttle valve 26 of conventional form, secured to a shaft 28, journaled for rotation in the wall of the outlet member 2, and manually operated by mechanism which will be later described.

As shown best in Fig. 1, fuel is supplied from a main source of supply to the fuel chamber through a bore 36 in casting 6 to which the fuel is delivered by any suitable conduit. The bore 36, at its inner end, communicates with a bushing 40, screwed into casting 6 and having a passage 42 formed therein. This passage extends from the bore 36 to a space within the bushing in which a conventional float valve 44 is positioned and which seats against the lower end of passage 42, so as to cut off the flow of fuel into such chamber when fuel within the fuel chamber 46 reaches a predetermined level.

The float valve is operated by a finger 48 integral with and projecting from a lever 50 pivoted on rod 52 supported by lugs 54 depending from the cover casting 6. As shown in Fig. 2, the lever 50 is attached to floats 56 which actuate the valve 44 by the mechanism described for the purpose of maintaining a substantially constant fuel level in the chamber 46. A finger 58 integral with lever 50 will engage the bushing 40, if for any reason there is any extreme drop in fuel level and will prevent the floats from striking the bottom of chamber 46 and will also prevent the valve 44 from falling out of the bushing under such conditions.

As already stated, the passage 22 in the small casting 18 constitutes the main fuel supply passage through which fuel flows from chamber 46 to the mixture passage. Admission of fuel to the passage 22 is primarily controlled by the

metering plug 60. Under certain operating conditions, fuel is also admitted to the passage 22 through two notches 62 formed in a horizontally projecting portion of the casting 18, as shown in Fig. 7. These notches communicate with a passage 64 which connects with a space 66. A passage 68 extends from this space to the passage 22 and the flow of fuel therethrough is controlled by the metering plug 70 which is positioned in such passage. Flow through the passage 64 is controlled by a ball check valve 72 which is held closed under some operating conditions by a spring 74 received within the removable plug 76 screwed into casting 18.

Under certain operating conditions when the manifold vacuum is low, as when operating with open throttle and at low speed, the valve 72 is opened to admit additional fuel thus forming a somewhat richer than normal mixture so as to give greater power. To open valve 72 under such conditions there is provided a piston 78 slidable in a cylinder 80 formed in the wall of the casting 6, as shown in Fig. 5. When the engine is not in operation, the piston is held in its lower position by a spring 82 which exerts a greater force than the spring 76. The piston has a rod 84 extending downwardly therefrom and provided with a reduced portion 86 which holds the valve 72 open when the piston is in the Fig. 5 position. A suction passage 88 connects with the cylinder 80 above the piston and such passage communicates with the intake passage posterior to the throttle. The entire passage is not shown, as its construction forms no part of this invention and is the same as that disclosed in Ser. No. 109,347. Obviously, during idling and when operating with partly open throttle and light load, the manifold vacuum is high and the piston 78 is lifted against the pressure of spring 82 so as to close the fuel passage 64. This will result in the formation of a relatively lean mixture under these conditions, but when operating with open throttle at heavy load, the vacuum is insufficient to overcome spring 82, the piston drops, opening passage 64 to admit additional fuel to provide the richer mixture necessary to give high power.

The casting 18 in which the vertical fuel passage 22 is formed is secured to the casting 6 by the screw 90 and the two castings are separated by a gasket to limit as far as possible the transfer of heat by conductivity to the fuel passage casting 18, and the latter is also so positioned that it is completely surrounded by the fuel in chamber 46 to keep the temperature of such casting as low as possible.

The fuel passage 22 communicates at its upper end with a smaller substantially vertical passage 92 formed in the casting 6. Extending downwardly into the fuel passage 22 is a fuel supply tube 95 which, at its upper end, connects with a short vertical passage 96 also formed in casting 6. The two passages 92 and 96 are separated by a part of the casting 6 indicated at 98 and both communicate with a horizontal passage which is divided into two parts 94*a* and 94*b* by the vertical partition plate 100 which is fitted in the horizontal passage and lies immediately above the element 96 which separates the passages 92 and 96. The tube 95 extends downwardly into the passage 22, terminating not far above the metering plug and conveys fuel from such passage to the passage 96 and thence to the horizontal passage 94*b* on the right side of the partition 100, as seen in Fig. 5. The main part of the fuel passage 22 conveys fuel to the passage 92 and thence to the horizontal passage 94*a* which lies to the left of the partition plate 100, as seen in Fig. 5.

The purpose of the specific form of fuel supply passage above described is to minimize as far as possible the formation of vapor bubbles and to prevent the formation of bubbles large enough to materially interfere with the continuous flow of fuel, particularly during idling at high temperatures. This function is assisted by providing the fuel passage 22 in a member which is substantially insulated from any metallic contact with the main housing of the carburetor and which is entirely surrounded by the fuel in chamber 46 so that the temperature of the fuel in passage 22 is kept as low as possible. This, of course, aids in reducing the vaporization of fuel in the passage.

Moreover the structure of the fuel supply passage is such as to prevent the formation of large enough vapor bubbles therein to materially interfere with fuel flow even when the engine is idling at relatively high temperatures, which is the operating condition under which difficulty arising from fuel vaporization is most likely to be encountered. The tube 95 is quite small and terminates at a point near the bottom of the passage 22 at which point there is but little formation of vapor bubbles. Therefore, few bubbles will enter the tube 95 and such as do are necessarily very small and are carried through the tube at relatively high velocity. Therefore, what flows through the tube is a column of substantially solid fuel with only a small number of very small bubbles therein under any operating conditions.

Although the area of the remainder of the fuel passage 22 is larger than the cross sectional area of the passage within the tube 95, the area of the passage is considerably reduced by positioning the tube therein. Therefore although there will be a larger number of bubbles formed in the fuel which flows through that part of the passage 22 outside the tube 95 than in such tube itself, such bubbles will be carried on toward the fuel inlets and will not, except under most extreme conditions, tend to collect and build up into a bubble of sufficient size to block the passage or interfere materially with the flow of fuel therethrough. Also, if under any very extreme conditions, as when idling at a very high temperature, there is any building up of a bubble to sufficient size to materially obstruct the flow either through the tube or the other part of the fuel passage, such blocking of fuel flow would probably never occur in both the tube and the other part of the passage at the same time so that there will substantially never be an instant when the interference will be more than partial and stalling even during idling at high temperatures, will be prevented. In other words, the fuel supply conduit comprises two substantially parallel fuel passages in which fuel vaporization is minimized and blocking of both passages by vapor bubbles, even under most extreme operating conditions, is substantially impossible.

The passage 94 is formed in a horizontal tubular portion 102 of the casting 6 which extends entirely across the mixture passage as indicated in Fig. 1 and the divided parts of the passage 94 terminate adjacent a slightly enlarged portion of said passage which is designated 94*c* in Fig. 1. Communicating with the right end of the passage 94*c* is the main fuel inlet 104, which is integral with and extends downwardly from the cross piece 102, as shown in Fig. 1. The main fuel inlet is provided with a flow controlling member

106 which is shaped somewhat like a Venturi tube, having a restricted opening and walls flared outwardly from said opening in both directions. The main fuel inlet terminates at the throat of a primary Venturi tube 108 which, in turn, terminates at the throat of a larger or secondary Venturi tube 110 formed by the inner wall of the fuel chamber casting 4. The primary Venturi tube is also integral with this casting and supported by ribs extending from the wall of the mixture passage.

Positioned in the passage 94c is a tubular member 112 having a passage 114 therethrough for the passage of idling fuel mixture. This member is reduced in size at its right end providing a small annular space 116 between it and the wall of passage 94c. The latter is closed at its left end, as seen in Fig. 1, by a plug 118 and communicates with a vertical passage 120 formed in the wall of casting 4, the lower end of which connects with a horizontal passage 122 which leads to a vertical passage 124 formed in the wall of casting 2. This passage connects with two orifices on opposite sides of the throttle valve, the orifice 128 being controlled by a manually adjustable, spring-held screw 130 to control the supply of idling fuel mixture. Two orifices 132 and 134 admit air to the passage 94c above the main fuel inlet 104.

During idling of the engine when the throttle is substantially or nearly closed, the high suction of the intake passage posterior to the throttle is communicated to the fuel in the passage 22 through the arrangement of passages described above. This will cause fuel to flow from the passage 22 through the several passages above described and finally through the orifice 128 into the mixture passage to supply combustible mixture for idling purposes. A stream of solid fuel flows through the passages 22 and 94 but is mixed with air which enters the orifices 132 and 134 and from that point to the orifice 128 a rich mixture of fuel and air is conveyed through the idling fuel passage and is discharged into the intake passage, the quantity of this idling mixture being manually regulated by adjustment of the valve 130. Some additional air will flow through the orifice 126 into the idling mixture as it is drawn through the passage 124, if the throttle is closed to such an extent that such orifice is anterior to the throttle.

During idling there is practically no flow of air through the primary Venturi tube and no introduction of fuel into such tube from the main fuel inlet. However, as the throttle is moved toward its open position from the idling position, the flow of air through the primary venturi will be progressively increased and the suction will ultimately become great enough in the main fuel inlet to effect a flow of fuel therefrom. The flow of fuel from the main inlet begins before the flow of idling mixture ceases, but as the throttle is progressively opened, the suction in the primary venturi will become so great by comparison with the suction at the orifice 128 that flow from such orifice will cease and instead there will be a flow from the intake passage back into the idling passage 124 through this orifice and a reverse flow from that point back through the idling mixture passages which have been described already, to the main fuel inlet. Thus, after the throttle has been opened sufficiently for the suction to the main fuel inlet to become high enough there will be a flow of mixture from the mixture passage along the path above described back to the main fuel inlet and this mixture will pass out into the mixing chamber through the main fuel inlet along with the fuel which is supplied to such inlet from the passage 94.

In carburetors of the prior art there have been some difficulties encountered at the time of transfer of operation from the idle system to the main fuel inlet due to a momentary leaning of the mixture at such time. This was largely due to the fact that while the idling system functioned, the fuel for the main fuel inlet was maintained at an appreciable distance from such inlet so that before the main fuel inlet began to function the fuel had to move through this distance. Due to the inertia of the fuel, this movement of fuel to the main inlet required an appreciable interval of time so that there was a slight lag in the flow of fuel from the main inlet with respect to the flow of air through the intake passage. In the device disclosed herein the above described difficulty is largely eliminated because a solid column of fuel which has not been mixed with air is maintained in the passages 22 and 94 and extends to a point immediately adjacent the main fuel inlet before it begins functioning. Therefore, when the latter does begin to operate, the fuel does not have to be moved through any appreciable distance. It is maintained at a point immediately adjacent the main inlet, the distance through which it has to be moved when flow from the main inlet starts being negligible.

The bleed holes 132 and 134 which admit air to the fuel passage 94a immediately above the main fuel inlet not only supply air to mix with the fuel in formation of the idle mixture, but also to reduce the surface tension of the solid fuel at this point and to cause the transfer of fuel from the idle range to the main range to be made smoother. The admission of air at relatively high velocity through the orifices 132 and 134 aids in effecting thorough atomization of the fuel which is discharged from the passage 94 to form a homogeneous mixture which is supplied to both the idling fuel passage and the main fuel discharge inlet 104.

As the throttle moves toward open position, it will reach a position soon after the beginning of its opening movement where the orifice 126 will lie on the posterior or high suction side of the throttle. After the throttle reaches this position, the suction effective on the idling fuel supply passages will be progressively increased and will slightly increase the supply of idling mixture.

Shown in Fig. 1, is a cylinder 140 in which slides a pump piston 142 which is operated in response to rapid opening movements of the throttle to provide additional fuel during acceleration to enrich the mixture to some extent as is required for best operation under such operating conditions. Since the pump and its operating mechanism forms no part of the present invention, it is not completely shown and will not be further described for the sake of simplifying the disclosure.

An unbalanced choke valve 144 is positioned in the air inlet end of the mixture passage and is secured to a shaft 146 suitably journalled in the casting section 6. The choke valve is positioned in accordance with variations in temperature and engine suction by mechanism positioned in the housing 148 and which includes a thermostat 150, engaging an arm 152 secured to the shaft 146, and a suction operated piston 154 engaging

the opposite end of arm 152 and exerting a force to move the choke valve open upon an increase in engine suction. Since the details of the choke valve controlling mechanism form no part of this invention such mechanism will not be further described.

The throttle valve shaft is operated by an arm 156 which carries an adjustable stop screw 158 adapted to engage a fast idle cam (not shown) movable to different positions by a rod 160 operated by the choke valve shaft. This mechanism causes the engine idling to be faster than normal at low temperatures to prevent stalling, but forms no part of the present invention.

The pump mechanism, the choke valve operating mechanism and the fast idle mechanism are all fully shown and described in application S. N. 192,035 of which this application is a division.

The subject matter claimed in this application is an improvement on and somewhat similar to devices disclosed and claimed in co-pending applications to Olson, Serial No. 132,821, filed December 14, 1949, and Stoltman, Serial No. 186,419, filed September 23, 1950, both of common ownership with the present application.

A vent tube 162 connects the air intake with the pump cylinder to vent the float chamber as fully described in the parent application.

While the embodiment of the present invention as herein disclosed, constitutes a preferred form, it is to be understood that other forms might be adopted.

What is claimed is as follows:

1. A charge forming device for an internal combustion engine having, in combination, a constant level fuel supply chamber, an intake passage having an air intake and a mixture outlet, a throttle valve in said mixture passage for controlling the flow of combustible mixture therefrom, main and idling fuel inlets for supplying fuel to the mixture passage, a fuel conduit for conveying fuel from the fuel supply chamber to said fuel inlets which includes a fuel conveying member extending downwardly into the fuel supply chamber, said member being so positioned that it is completely surrounded by fuel in the chamber and having two fuel passages formed therein, fuel inlet means admitting fuel from the fuel supply chamber to both said fuel passages, a substantially horizontal member connected with said downwardly extending member and having a fuel conduit formed therein, and a substantially vertical partition in said conduit which divides the conduit into two passages each of which is connected with one of the fuel passages in said downwardly extending member.

2. A charge forming device for an internal combustion engine having, in combination, a constant level fuel supply chamber, an intake passage having an air intake and a mixture outlet, a throttle valve in said mixture passage for controlling the flow of combustible mixture therefrom, main and idling fuel inlets for supplying fuel to the mixture passage, a fuel conduit for conveying fuel from the fuel supply chamber to said fuel inlets which includes a member extending downwardly into the fuel supply chamber and having a passage therein, a substantially horizontal passage connecting with the upper end of said first-mentioned passage, and a substantially vertical partition in said horizontal passage and means whereby the fuel supplied by the downwardly extending passage is caused to flow through the horizontal passage on both sides of said partition.

3. A charge forming device for an internal combustion engine having, in combination, a constant level fuel supply chamber, an intake passage having an air intake and a mixture outlet, a throttle valve in said mixture passage for controlling the flow of combustible mixture therefrom, main and idling fuel inlets for supplying fuel to the mixture passages, a fuel conduit for conveying fuel from the fuel supply chamber to said fuel inlets which includes a substantially horizontal passage having a substantially vertical partition therein, a member extending downwardly into the fuel supply chamber and having a passage therein which communicates at its upper end with said horizontal passage at one side of said vertical partition, and a tube extending downwardly into the second mentioned fuel passage and communicating at its upper end with the horizontal fuel passage at the opposite side of said partition.

4. A charge forming device for an internal combustion engine having, in combination, a constant level fuel supply chamber, an intake passage having an air intake and a mixture outlet, a throttle valve in said mixture passage for controlling the flow of combustible mixture therefrom, main and idling fuel inlets for supplying fuel to the mixture passage, a fuel conduit for conveying fuel from the fuel supply chamber to said fuel inlets which includes a substantially horizontal passage having a substantially vertical partition therein, a member extending downwardly into the fuel supply chamber and having a passage therein which communicates at its upper end with said horizontal passage at one side of said vertical partition, and a tube extending downwardly into the second-mentioned fuel passage and communicating at its upper end with the horizontal fuel passage at the opposite side of said partition, the passage through said tube being of smaller size than the passage in said downwardly extending member at its point of connection with the horizontal member.

5. A charge forming device for internal combustion engines having, in combination, a constant level fuel supply chamber, an intake passage provided with an air inlet and a throttle valve for controlling the flow of combustible mixture therethrough, a main and idling fuel inlets for supplying fuel to said intake passage, an inverted U-shaped fuel passage for supplying fuel to said inlets, said passage having a leg extending downwardly into the fuel chamber and through which only fuel flows, another leg extending downwardly to supply fuel to the idling fuel inlet, a connecting passage located above the level of fuel in the fuel supply chamber for connecting the two downwardly extending legs and supplying fuel direct to the main fuel inlet, a substantially vertical partition in said connecting passage dividing it into two parts, and means for causing fuel to be delivered from the first-mentioned leg to the connecting passage on both sides of said partition.

ELMER OLSON.

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