April 12, 1932. W. H. TEETER 1,853,786

CHARGE FORMING DEVICE

Filed Sept. 27, 1928

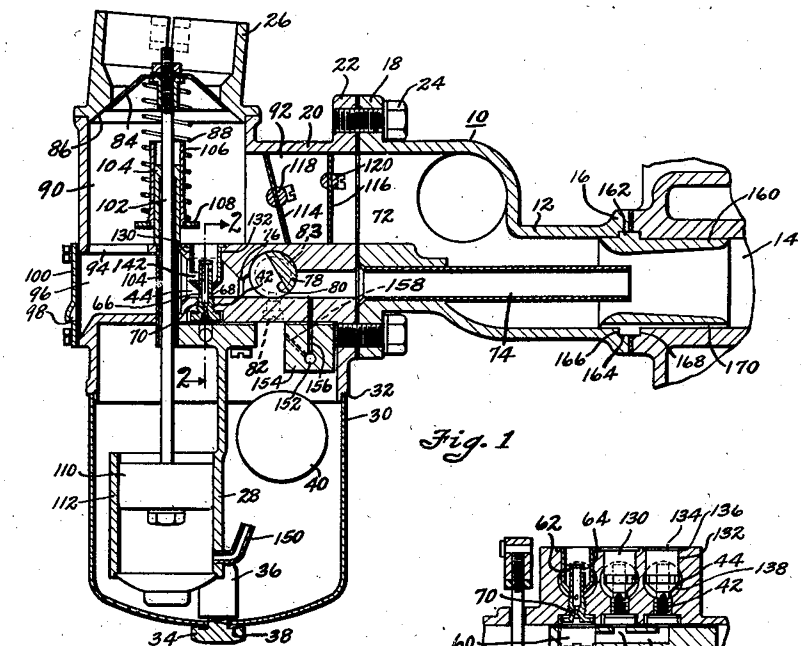

Fig. 1

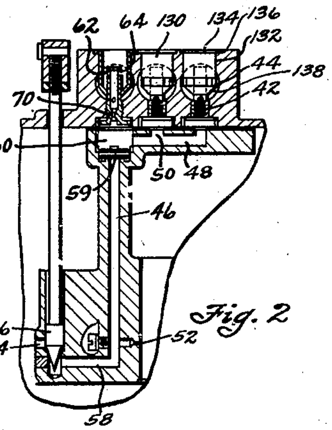

Fig. 2

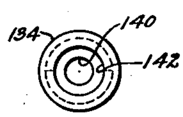

Fig. 3

Fig. 5

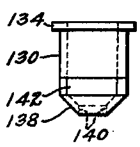

Fig. 4

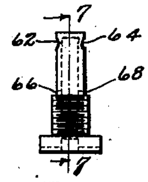

Fig. 6

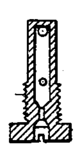

Fig. 7

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Patented Apr. 12, 1932 1,853,786

UNITED STATES PATENT OFFICE

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CHARGE FORMING DEVICE

Application filed September 27, 1928. Serial No. 308,845.

This invention relates to charge forming devices for internal combustion engines and more particularly to the type of charge forming device comprising a plurality of primary fuel mixing chambers or primary carburetors, one for each intake port of the engine and cooperating respectively with a plurality of secondary fuel mixing chambers or secondary carburetors each located adjacent an engine intake port and receiving fuel air mixture from a pipe connected with one of the primary carburetors while receiving air when required through one branch of an air manifold which supplies air to all the secondary carburetors. The primary carburetors receive liquid fuel from a common fuel bowl in which the level is controlled by a float valve.

Examples of charge forming devices of this character are disclosed in the copending applications of W. H. Teeter Serial No. 221,372, filed September 22, 1927, W. H. Teeter, Fred E. Aseltine and Carl H. Kindl, Serial No. 288,683, filed June 27, 1928; and for convenience of illustration the improvement constituting the present invention is shown herein as embodied in a carburetor of the form disclosed in the last mentioned copending application.

The general objects of the charge forming device disclosed in the above mentioned applications are, first, to provide a mixture of fuel and air, having the desired fuel and air ratio under all operating conditions, and, second, to deliver equal quantities of this mixture to each cylinder of the engine under various conditions of load and speed, without requiring the heating of the fuel or fuel mixture before it is delivered to the engine.

Various means are provided in the device shown in the application referred to to control the flow of fuel and air under various operating conditions so as to secure at all times a mixture having the desired fuel and air ratio. Certain of these flow proportioning devices are made necessary because the air flowing through the primary carburetors moves past the fuel jets at such high velocity that it creates at said jets a velocity head which is the force effective to cause the fuel flow. This velocity head builds up rapidly on increase of engine speed and causes so rapid an increase in fuel flow as to form too rich a fuel mixture to be properly combustible unless some means is provided to compensate therefor. Since the velocity head is a variable thing, depending on several different factors, it follows that the excess of fuel in the mixture, which depends on the velocity head is also variable and it has been found almost impossible to correct the effect of the velocity head on the fuel flow by any one compensating device, in fact difficult to secure a mixture having the desired fuel and air ratio under all operating conditions by use of any compensating, or mixture proportioning devices heretofore known.

As above stated, the charge forming device forming the subject of the present invention is of the same type as that disclosed in the above mentioned application, and the principal object of this invention is to provide a charge forming device in which the fuel is caused to flow from the jets by the effect of the static suction within the carburetor and in which the effect of velocity head on the fuel flow is substantially eliminated under all operating conditions.

Briefly the above objects are accomplished according to the present invention by the provision of tubes seated in the floor of the main air chamber and extending downwardly into the mixture passages, one of said tubes surrounding each fuel nozzle, the lower ends of said tubes being closed, except for an orifice in each large enough to fit closely around a nozzle. Each tube is provided with an outlet orifice facing the inlet end of the primary mixture passage, and of considerably less area than the inlet end of the tube which communicates with the main air chamber.

The velocity of the air passing through the tubes adjacent the nozzles is maintained low under all conditions of engine operation for two reasons, first because of the difference in size of inlet and outlet orifices of said tubes, and second, because of the effect of impact of the air entering the primary mixture passage on the outlet orifice. By maintaining a low velocity of air through the tubes surrounding the nozzles the formation of a velocity head at the nozzles is prevented.

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 one form of the present invention is clearly shown.

In the drawings:

Fig. 1 is a vertical section through a charge forming device embodying the present invention.

Fig. 2 is a section on line 2—2 of Fig. 1.

Figs. 3 and 4 are a detail plan and elevation respectively of the air inlet tubes surrounding the nozzle.

Figs. 5 and 6 are a detail plan and elevation respectively of the nozzle.

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

The charge forming device disclosed herein and in which the present invention is incorporated, comprises a main air manifold indicated in its entirety by the reference character 10, and having three outlet branches 12, the middle one of which is shown herein and each of which is adapted to communicate with an intake port 14 of a multicylinder engine, one of which ports is shown in Fig. 1. Each port serves two adjacent cylinders in the usual manner and each branch of the manifold is provided with an attaching flange 16, for attaching the manifold to the engine block in the usual way. Adjacent the inlet of the manifold a flange 18 is provided to which is secured the main carburetor unit, as shown in Fig. 1.

The main carburetor unit comprises a main housing in the form of a single casting 20, having an attaching flange 22 secured by screws 24 to the flange 18. An air inlet horn 26, is secured in position over an opening in the upper wall of housing 20, by means disclosed in the copending applications above referred to and forming no part of this invention. A casting 28, having certain dash pot chambers and fuel passages formed therein is secured to the lower wall of the main housing 20 by means not shown herein, and a sheet metal fuel bowl 30 is held tight against a shoulder 32 on the housing 20 by a screw 34, screwed into a post 36 depending from frame 28, a gasket 38 being provided to prevent leakage around the screw.

Fuel is conducted from a main source of supply to the bowl 30 and the level of fuel in said bowl is maintained substantially constant by a float 40 operating in the usual manner. Fuel is conducted from the fuel bowl to a plurality of primary fuel nozzles 42 located in the primary mixing chambers 44 formed in a central part of the main housing 20 which may be termed the distributor block. To carry the fuel from the fuel bowl to the primary nozzles 42 the casting 28 is provided with a vertical fuel channel 46 which connects, at its upper end, with a horizontal fuel canal 48, communicating with each of the nozzles 42 through holes 50. Fuel flows from the bowl 30 to the channel 46 at low speeds through a metering orifice 52. All the fuel supplied to the fuel nozzles up to a predetermined engine speed, for example that corresponding to a vehicular speed of 20-25 miles per hour on a level flows through the orifice 52. At higher engine speeds fuel is also admitted to the fuel channel 46, through an orifice 54, controlled by a fuel valve 56, operated in a manner described hereinafter, and thence through a horizontal channel 58, connecting with the lower end of the channel 46.

Fuel is lifted from the fuel bowl through the fuel conduit described and nozzles 42 by the suction maintained in the primary mixing chambers. When the throttle is moved toward closed position to reduce the engine speed, there is a sudden reduction in the suction effective on the fuel column between the bowl and the nozzles which might permit this column of fuel to drop sufficiently to cause a temporary fuel starving of the engine unless means were provided to prevent the dropping of such column of fuel. To prevent this action a check valve 59 is provided in an enlarged chamber 60 at the junction of the channel 46 and fuel canal 48, and on reduction of suction in the primary mixture passages said valve seats on the bottom of such chamber, preventing downward flow through channel 46.

According to the present invention, each fuel nozzle is closed at the top and provided with two main fuel outlets 62 and 64 on opposite sides of the nozzle near the top thereof, while the small holes 66 and 68 positioned below the outlets 62 and 64 respectively, and close to the floor of the primary mixture passage form secondary fuel outlets. At higher engine speeds the suction maintained at the nozzles is sufficient to draw fuel from the main fuel outlets as well as the secondary outlets. At idling or other very low speed operation, however, there is insufficient suction to cause such a flow of fuel, the fuel at such times standing in the nozzle at a point somewhere between the primary and secondary fuel outlets and flowing from the latter by action of gravity. Each fuel nozzle is provided with a restricted fuel metering orifice 70.

The primary nozzles are formed as above described according to this invention because, as set forth more specifically hereinafter, the air passing immediately adjacent the nozzles flows downwardly past the upper ends of said nozzles and axially with relation to said nozzles, so that the upper end of said nozzles must be closed to prevent retardation of fuel flow from the nozzle because of the impact of the air on the fuel at the top of the nozzle.

In the charge forming device in which the present invention is embodied, the central portion of the main casting constitutes the distributor block and is indicated at 72 in Fig. 1. The distributor block has three primary mixture passages 44 formed therein, these passages being parallel to each other and close together as indicated in Fig. 2. These mixture passages connect with primary mixture conduits which carry the primary mixture to the various branches of the manifold where it is mixed with additional air. One of these conduits which connects with the middle primary mixture passage and is associated with the middle outlet branch of the manifold is indicated at 74 in Fig. 1.

The inlet ends of the primary mixture passages into which the nozzles project are of larger cross sectional area than the outlet ends thereof and between the inlet and outlet end of each passage its cross sectional area is reduced, as indicated at 76, for the purpose of reducing the velocity of flow in the primary mixture passages at points anterior to restriction 76.

The flow of primary mixture through the passages 44 is controlled by a single primary throttle valve 78 having grooves 80 therein which register with the passages 44. This throttle valve is journalled for rotation in the walls of housing 20 and is held against longitudinal movement by means of a screw 82 screwed into the housing, the end of which projects into a groove 83 formed in the external surface of the throttle as shown in dotted lines in Fig. 1. While the mechanism for operating this throttle is not shown and forms no part of the present invention, the operation of the throttle in connection with the operation of certain other parts will be briefly discussed hereinafter and the operating mechanism is fully disclosed in the above mentioned copending applications.

Substantially all the air entering the carburetor flows through air horn 26, the flow being controlled by a main air valve 84, normally held against its seat 86 by a spring 88. Air flows past the valve 84 into a main air chamber 90 formed in housing 20, and a secondary air conduit 92 controlled by a valve mechanism hereinafter briefly described connects said main air chamber with the air manifold while a hole 94 of considerable area in the floor of the main air chamber permits a flow of air to a secondary air chamber 96 which communicates directly with the inlet ends of the primary mixture passages.

When the carburetor is choked the valve 84 is held closed, and to provide sufficient air to carry the starting fuel from the primary nozzles to the engine cylinders an air inlet 98 in the form of an elongated slot cut through a plate 100 detachably secured to the housing 20, is provided.

The air valve 84 is adjustably secured on a stem 102, slidably mounted in a guide sleeve 104 fixed in housing 20. Slidable on the guide sleeve is a sleeve 106 provided with a projecting flange 108 at its lower end, which serves as a seat for the air valve spring and is adapted to be lifted by the choke device (not shown) to bring the upper end of sleeve 106 into engagement with valve 84 to close the valve when it is desired to start the engine. Moreover, if the choke device is partially operated the flange 108 will be partially lifted to increase the force of spring 88 holding the valve closed, and thus regulate the suction maintained within the carburetor.

On any increase of engine speed the suction in chamber 90 is increased and the air valve is opened against the tension of spring 88, permitting an inrush of air to the secondary mixing chambers which will be sufficient to lean the mixture unless means are provided to retard the opening movement of said valve. By retarding the opening of the valve fluttering of said valve as well as leaning of the mixture will be prevented. To retard the opening of said valve the lower end of stem 102 has a piston 110 secured thereto which slides in a cylinder 112 supplied with fuel from the fuel bowl. The piston and cylinder constitute a liquid dash pot retarding the opening movement of the air valve but allowing the valve to close freely. The specific details of construction of this dash pot are not shown herein and are in no way material to the present invention, but are fully illustrated in the last copending application previously mentioned.

The flow of air from the air chamber 90 through the passage 92 to the secondary carburetors is controlled by two valves, a manually operated butterfly throttle 114, and a suction operated valve 116. The throttle is fixed on a shaft 118, journalled in the walls of housing 20 and is operated concurrently with the throttle in a manner hereinafter described. The valve 116 is fixed to a shaft 120, which is positioned off center with respect to the valve; a greater portion of the valve being below the shaft than above. The shaft 120 is journalled in the walls of housing 20 and the valve is operated primarily by engine suction, the opening movement of said valve being retarded for a purpose later set forth.

The mode of operation and the functions of the two throttle valves will now be briefly set forth. At engine speeds up to approximately that speed which corresponds to a vehicular speed of 20–25 miles per hour on a level, only the primary throttle 78 is opened and the primary mixture is of proper combustible proportions and sufficient in quantity to meet the requirements of the engine. At speeds above the specific speed mentioned the capacity of the primary mixture passages is such that the velocity of flow therethrough would increase very rapidly. For reasons which will be apparent from the description appearing hereinafter the throttle operating mechanism is so constructed that the air throttle 114 begins to open at approximately the vehicular speed above mentioned, admitting air to the secondary mixing chambers and preventing such increase in velocity of flow through the primary tubes. The throttle operating mechanism is fully shown in the above applications.

According to the present invention means are provided to prevent the formation of a velocity head at the fuel nozzles, and to communicate the static suction of the air chamber 90 to said nozzles so that said static suction becomes the dominant factor in controlling the fuel flow from said nozzles. The advantageous results produced by this means will be best understood by a consideration of the difficulties caused by the presence of a velocity head in prior devices of this type, for instance those disclosed in the copending applications above referred to.

Owing to the presence of a velocity head at the fuel jets in such devices the metering jets which determine the fuel flow are calibrated somewhat smaller than they should be to give a fuel mixture ratio of 15½ to 1 proper for medium speed. Up to an engine speed of approximately 1000 R. P. M., which is equivalent to a vehicular speed of 20–25 miles per hour, the velocity head increases slowly and produces a flow which is approximately correct to give the desired mixture ratio.

At higher engine speeds the velocity head builds up so rapidly that the fuel mixture becomes entirely too rich unless means are provided to reduce the velocity effect on the jets. To do this the secondary throttle corresponding to throttle 114 of this device is timed to begin opening at an engine speed of about 1000 R. P. M. Owing to the large diameter of this throttle and consequent rapid increase in volume of air flowing past the throttle per degree of rotation, the velocity of air flowing past the jets is very rapidly lowered after the air throttle begins to open, the velocity head being practically eliminated at a little more than 1500 R. P. M. Since the fuel flow is determined by velocity head the jets are calibrated to give a proper feed of fuel as the velocity head increases up to 1000 R. P. M., the reduction in velocity head at higher speeds causes so great a reduction in fuel flow that the mixture becomes too lean to be properly combustible. This necessitates an additional flow of fuel which is provided by opening a needle valve similar to the valve 56 and permitting fuel to flow through an auxiliary fuel passage. This valve is opened by means of a cam, the contour of which is designed, in the above mentioned earlier applications, to begin opening the fuel valve at approximately 1000 R. P. M. and to continue opening said valve to admit just enough additional fuel to compensate for the loss in suction on the fuel jets due to reduction in the velocity head effective thereon.

In order to secure a fuel mixture of the desired proportions, the two throttles must be accurately synchronized, not only with relation to each other, but also to the needle valve. The cam which lifts the needle must be correct in contour, must be accurately located with reference to its follower and the latter must be also of exactly the right size and located in the right position. Since it is attempted to correct the velocity head which is a variable and unstable force by a mechanically operated means, it is difficult to attain the synchronization of operation referred to, and if such synchronization is secured it will be disturbed by wear or by dimensional variations, or by any of the parts becoming loose.

By eliminating the velocity head at the jets and employing metering jets calibrated to permit flow of fuel necessary to give a fuel mixture of 15½ to 1 when the fuel flow is governed by engine suction as determined by the spring held main air valve, the variation in fuel flow on opening of the air throttle will disappear and there will be no need to open the needle valve to admit additional fuel except for full throttle operation. Therefore the need of accurate timing of operation of the two throttles relative to each other or to the needle valve will disappear.

This invention provides means for making the static suction, as determined by the air valve, the factor controlling the fuel flow. The main air throttle is opened merely for the purpose of increasing the quantity of mixture after the capacity of the primary tubes becomes inadequate to meet the engine demand, and the needle valve 56 is designed to open at an engine speed corresponding to a vehicular speed of approximately 45–50 miles per hour on a level, merely for the purpose of enriching the mixture at high speeds to provide the power necessary for such operation.

To provide means for eliminating the velocity head and making the static suction effective to draw fuel from nozzles 42, each of said nozzles is surrounded by a tube 130, which projects through a bore 132 in the floor of housing 20. Each tube is provided at its upper end with a flange 134, which is received in an annular recess 136 surrounding the upper end of bore 132. The lower end of each tube 130 is tapered inwardly as at 138, and is provided with an orifice 140 in the tapered end of just sufficient size to fit around the nozzle 142. The upper end of the tube

130 is entirely unrestricted and forms an inlet communicating with the air chamber 90. An outlet orifice 142, of much less area than the inlet end of said tube 130 is provided in the wall of the tube facing the inlet end of the primary mixture passage. The suction maintained in the primary mixture passages adjacent the outlet orifices 142 is somewhat greater than that of the air chamber 90 causing a flow of air from the chamber 90 through tubes 130 and outlets 142 to the primary mixture passages. Owing to the great difference in size between the inlet end of the tube 130 and outlet orifice 142 there can never be any great velocity of flow through the tube, irrespective of the difference in pressure which may be maintained in the primary mixture passages and in the chamber 90, and any tendency toward an increase of velocity within which might be brought about by opening of the throttle is eliminated by the effect of impact at the outlet orifices 142. Obviously as the throttle opens, the velocity of flow through the primary mixture passages increases with corresponding increase in the impact of the ingoing air against the outlet orifice 142. By means of the tubes 130 and the impact of the entering air on the outlets 142, the velocity through said tubes 130 is maintained substantially constant at all speeds under all conditions of operation, entirely providing the formation of any velocity head at the nozzles 40.

The opening of the valve 116 is retarded to secure proper enrichment of the fuel mixture for acceleration. In the device disclosed herein a fuel pump is provided which forces additional fuel into the primary mixture passages on opening movement of the throttle. The previously described air valve dash pot comprising piston 110 and cylinder 112 forms the pump. Any opening of the throttle for acceleration causes a downward movement of the air valve and corresponding downward movement of piston 110, which is effective to force fuel through a conduit 150 connecting the lower end of the dash pot cylinder with a fuel channel 152 in a block 154 secured to the bottom of the distributor block. The block 154 extends across all of the primary mixture passages and a plurality of passages 156, one of which is shown in Fig. 1, connect the channel 152 with said mixture passages. Air is admitted to channel 152 through two passages 158, one of which is shown in dotted lines in Fig. 1. Air is admitted to the channel 152 as described to prevent the high suction maintained in the primary mixture passages acting to draw fuel from the dash pot independently of the action of piston 110. The pump is fully described in the last copending application above referred to, its details of construction and operation are immaterial to this invention.

It requires an appreciable interval of time to transfer the dense primary mixture from the primary mixing chambers to the secondary mixing chambers at the ends of the primary mixture conduits 74, and, clearly, less time is needed for air entering the passage 92, as the air throttle is opened, to reach said secondary mixing chambers. The opening of the valve 116 is retarded on opening of the air throttle 114 to retard the flow of air sufficiently to enable the rich primary mixture to reach the secondary mixing chambers at the same time that the air flowing through passage 92 reaches such chambers. Neither the construction of the pump nor the valve 116 and its controlling means form any part of the present invention. These devices are therefore described only briefly herein, reference being had to the last copending case above referred to for a full disclosure.

The secondary mixing chambers comprise Venturi tubes 160, there being three of these tubes of identical construction associated with the three outlet branches of the manifold and positioned so that the point of greatest suction in each venturi is immediately adjacent the outlet end of the particular primary mixing tube which is associated therewith. Each venturi is provided with an annular rib 162 which fits, when the manifold is attached to the block, in a recess 164 in the end of the associated branch of the manifold and a corresponding recess in the block, being clamped between shoulders 166 and 168 on the manifold and engine block respectively. A channel 170 is formed in the outer wall of the venturi, at the bottom of the element when the device is assembled, to permit any fuel which precipitates out of the mixture and collects on the wall of the manifold branch to flow into the intake port. The Venturi tubes increase the velocity of air passing the ends of the primary mixture conduits to insure at all times a high suction in said conduits.

While the form of embodiment of the present invention as herein disclosed, constitutes a preferred form, it is to be understood that other forms might be adopted, all coming within the scope of the claims which follow.

What is claimed is as follows:

1. A charge forming device for internal combustion engines comprising, a mixing chamber, a fuel nozzle therefor, an air chamber for supplying air thereto, a throttle, and means for effecting flow of fuel by the static suction of the air chamber, said means comprising a tube surrounding said fuel nozzle and discharging into the mixing chamber, and means for maintaining within the tube a suction substantially equal to that of the air chamber.

2. A charge forming device for internal combustion engines comprising, a mixing chamber, a fuel nozzle therefor, an air cham-

ber for supplying air thereto, a throttle, and means for effecting flow of fuel by the static suction of the air chamber, said means comprising a tube surrounding the fuel nozzle discharging into the mixing chamber and means for maintaining a substantially constant velocity of flow through the tube under all operating conditions.

3. A charge forming device for internal combustion engines comprising, a mixing chamber, a fuel nozzle therefor, an air chamber for supplying air thereto, a throttle, and means for effecting flow of fuel by the static suction of the air chamber, said means comprising a tube surrounding the fuel nozzle and forming a supplemental air passage immediately adjacent thereto, said tube having an outlet of considerably less area than its inlet discharging into the mixing chamber, whereby the velocity of flow through said tube is maintained substantially constant under all operating speeds and conditions.

4. A charge forming device for internal combustion engines comprising, a mixing chamber, a fuel nozzle therefor, an air chamber for supplying air thereto, a throttle, and means for effecting flow of fuel by the static suction of the air chamber, said means comprising a tube surrounding the fuel nozzle and forming a supplemental air passage immediately adjacent thereto, said tube having an entirely unrestricted inlet end and an outlet end having a relatively small orifice therein discharging into the mixing chamber, whereby the velocity of flow through the tube is maintained substantially constant.

5. A charge forming device for internal combustion engines comprising, a mixing chamber, a fuel inlet therefor, an air chamber for supplying air thereto, a throttle, and means for effecting flow of fuel by the static suction of the air chamber, said means comprising a tube surrounding the fuel inlet and forming a supplemental air passage immediately adjacent thereto, said tube having an entirely unrestricted inlet end and an outlet end having a relatively small orifice therein positioned in the path of the air entering the mixing chamber, whereby the velocity of flow through the tube is maintained substantially constant.

6. A charge forming device for internal combustion engines comprising, a mixing chamber, a fuel nozzle therefor, an air chamber for supplying air thereto, a throttle, and means for effecting flow of fuel by the static suction of the air chamber, said means comprising a tube communicating directly with the air chamber and surrounding the fuel nozzle, said tube having an outlet discharging into the mixing chamber and means for maintaining within the tube a suction substantially equal to that of the air chamber.

7. A charge forming device for internal combustion engines comprising a mixing chamber, a fuel inlet therefor, an air chamber supplying air thereto, a throttle, and means effecting a flow of fuel by the air chamber suction comprising, a tube surrounding the fuel inlet and forming a supplemental air passage immediately adjacent thereto, said tube having an inlet end connecting directly with the air chamber and an outlet orifice positioned in the path of the air entering said mixing chamber, so that the impact of the air entering the mixing chamber tends to prevent any increase in flow through the tube on increased engine speed.

8. A charge forming device for internal combustion engines comprising, a mixing chamber, a fuel nozzle therefor, an air chamber supplying air thereto, a throttle, and means effecting a flow of fuel by the air chamber suction comprising a tube surrounding the fuel nozzle and forming a supplemental air passage immediately adjacent thereto, said tube having an unrestricted inlet end communicating directly with the air chamber and a relatively small outlet orifice discharging into the mixing chamber.

9. A charge forming device for internal combustion engines comprising, a mixing chamber, a fuel inlet therefor, an air chamber supplying air thereto, a throttle, and means effecting a flow of fuel by the air chamber suction comprising a tube surrounding the fuel inlet and forming a supplemental air passage immediately adjacent thereto, said tube having an unrestricted inlet end communicating directly with the air chamber and a relatively small outlet orifice positioned in the path of the air entering the mixing chamber.

10. A charge forming device for internal combustion engines, comprising a mixing chamber, an air chamber for supplying air thereto, a throttle, and means for effecting a flow of fuel to the mixing chamber by the static suction of the air chamber, said means comprising a tube communicating with the air chamber and discharging into the mixing chamber, a fuel nozzle having a closed end projecting axially into said tube, and fuel feeding orifices in the side wall of said nozzle, whereby the flow of fuel is not retarded by the impact of the air entering said tube.

11. A charge forming device for internal combustion engines, comprising a mixing chamber, an air chamber for supplying air thereto, a throttle, and means for effecting a flow of fuel to the mixing chamber by the static suction of the air chamber, said means comprising a tube having its inlet connected to the air chamber, a fuel nozzle having a closed end projecting axially into said tube, fuel feeding orifices in the side walls of the nozzle whereby retardation of fuel flow by the impact of the air flowing through said tube is prevented, and an outlet orifice in said tube positioned in the path of air entering the

mixing chamber whereby the velocity of flow through said tube is reduced.

12. A charge forming device for internal combustion engines comprising a plurality of primary mixture passages adapted to deliver a mixture of fuel and air to a plurality of secondary mixing chambers, a plurality of fuel nozzles for supplying fuel to said primary mixture passages, a single main air chamber for supplying air to all of said primary mixture passages, and means for effecting flow of fuel from all said fuel nozzles by the static suction of said air chamber comprising a plurality of tubes, one of which surrounds each of said nozzles and all of which communicate directly with said main air chamber, and each of which discharge into one of the mixing chambers.

13. A charge forming device for internal combustion engines comprising a plurality of primary mixture passages adapted to deliver a mixture of fuel and air to a plurality of secondary mixing chambers, a plurality of fuel nozzles for supplying fuel to said primary mixture passages, a single main air chamber for supplying air to all of said primary mixture passages, and means for effecting flow of fuel from all said fuel nozzles by the static suction of said air chamber comprising a plurality of tubes, surrounding said nozzles and having direct unrestricted communication with said main air chamber, each of said tubes having a restricted outlet communicating with one of said primary mixture passages.

In testimony whereof I hereto affix my signature.

WILFORD H. TEETER.