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CHARGE FORMING DEVICE

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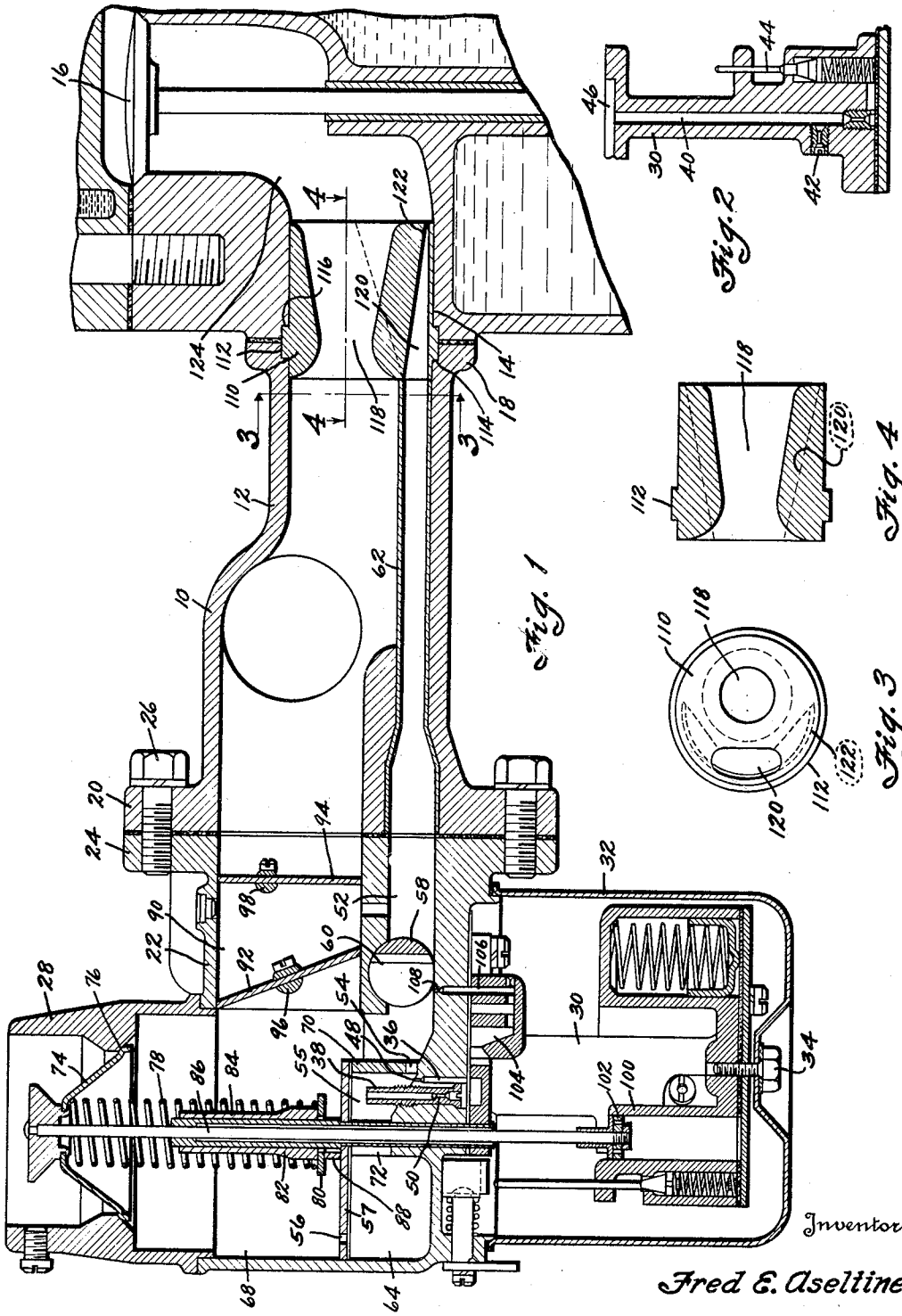


Fig. 1

Fig. 2

Fig. 4

Fig. 3

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CHARGE FORMING DEVICE

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14 Claims. (Cl. 123—119)

This invention relates to charge forming devices for internal combustion engines, and more particularly to devices of this character which comprise a plurality of primary carburetors, each of which delivers a primary mixture of air and fuel to one of a plurality of secondary mixing chambers located adjacent the engine intake ports and in which the primary mixture is mixed with additional air under certain operating conditions.

A device of this character is shown in the copending application of Fred E. Aseltine, Wilford H. Teeter, Carl H. Kindl and Frederick D. Funston, Serial No. 370,179, filed June 12, 1929.

It is the object of this invention to provide means for accelerating the flow of the primary mixture as it is discharged into the secondary mixing chambers as well as passing therethrough the air in order to prevent accumulation of liquid fuel on the walls of said secondary mixing chambers. It is a further object to provide means for accomplishing this result which is so constructed that the flow may be accelerated as described without restricting the area of the intake passage sufficiently to reduce the engine power.

While this invention is most particularly adapted to the L-head type of engine, it will be obvious that its use is not limited to an L-head engine, but it will, to a lesser degree, improve the operation of the engine of the overhead valve type.

This invention is accomplished by the provision of a Venturi tube in each outlet branch of the air manifold through which the air flows into the engine intake port and which is provided with a passage extending longitudinally through the wall thereof, which communicates with the primary mixture conduit and which is tapered at its posterior end so that the outlet thereof is in the form of a very narrow semi-circular slot positioned in the end of the Venturi tube and through which the fuel is discharged at very high velocity.

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

In the drawing:

Fig. 1 is a longitudinal, vertical section through a charge forming device constructed in accordance with the present invention.

Fig. 2 is a fragmentary section showing the passages supplying fuel from the reservoir to the nozzles.

Figs. 3 and 4 are detailed sections on the lines 3—3 and 4—4 of Fig. 1.

The device disclosed comprises a main air manifold 10, having three outlet branches, the middle branch 12 being shown herein. Each outlet branch communicates with one of the ports 14 of a multicylinder engine, that disclosed in the drawing, being of the L-head type and provided with valves 16, which open upwardly. The outlet branches of the manifold are provided with attaching flanges 18 for securing the manifold to the engine block in the usual manner and a flange 20 is provided at the manifold inlet for securing the carburetor unit thereto.

The carburetor unit comprises a main housing 22, having an attaching flange 24, adapted to be secured to the flange 20 by screws 26, and an air inlet coupling 28 is secured in an opening in the upper wall of the housing to admit air thereto. A casting 30 in which the passages for supplying fuel to the nozzles are formed, is secured to the lower wall of the main housing and a sheet metal fuel bowl 32 is held tightly against the main housing by screw 34. Fuel is conducted from a main source of supply to this fuel bowl and is maintained at a substantially constant level by a float (not shown) operating in the usual manner.

Fuel feeding orifices in the form of speed fuel inlets 36 and a plurality of high speed fuel nozzles 38 supply fuel to the primary mixture passages in a manner hereinafter described. Fuel is supplied to these orifices by a vertical passage 40, in the casting 30 having a fixed fuel feeding inlet 42 and another inlet normally closed, but opened at relatively high speed by means of a valve 44, this valve and its operating means being fully shown and described in application Serial No. 370,179. The passage 40 delivers fuel to horizontal fuel canal 46 which communicates with the above mentioned fuel feeding orifices. The low speed fuel inlet is restricted as indicated at 48, while a fixed restriction 50 is provided in each of the high speed nozzles to limit the flow therefrom.

The fuel is supplied to angular primary mixture passages indicated in their entirety by the reference character 52, which will hereinafter be more fully described and are provided in the lower part of the main housing. Communicating with the vertical portion of these mixture passages through orifices 54 are three chambers 55, which for convenience may be designated fuel supply chambers. Fuel is admitted directly to these chambers by the fuel supply elements 36 and 38 and is mixed therein with a small quantity of air which is admitted through a slot 56 formed in a partition 57 separating the fuel supply chambers from a main air chamber, which

is more fully described later. This mixture of fuel and air flows from the fuel supply chambers to the primary mixture passages.

The primary mixture passages are controlled by a single throttle valve 58, which extends across all of said passages, is provided with grooves 60, which register with said passages, and is operated in a manner briefly described later. The primary mixture passages register with conduits for conveying primary mixture to the secondary mixing chambers when the device is assembled, and these conduits comprise tubes cast in position in the manifold during the casting of the latter, as fully shown and described in the above copending application. Only the tube 62 which conveys the primary mixture to the secondary mixing chamber, formed in the middle branch of the manifold, is shown herein, this being sufficient for the purposes of the present disclosure.

All of the fuel supply chambers 55 receive air from what may be termed a primary air chamber 64, this chamber and all of the chambers 55 being separated by the partition plate 57 from a main air chamber 68 and the chambers 55 are separated from the vertical portions of the primary mixture passages by a wall 70, which is an integral part of the main housing and on which the partition 57 is supported. The fuel supply chambers 56 are separated from each other by vertical partitions 72.

Air is admitted through the air inlet coupling 28 and is controlled by a valve 74, normally held against a seat 76 by a spring 78, received between the valve and the flange 80, projecting from a sleeve 82, slidable on a sleeve 84 fixed in position in the main housing and guiding the valve stem 86 during opening and closing of the valve. In order to choke the carburetor to facilitate starting, the flange 80 is adapted to be lifted by an arm 88, as fully described in application Serial No. 370,179. The valve 74 admits air directly to the chamber 68 which supplies air through the slot 56 to the primary air chamber 64 and to the secondary mixing chambers in the manifold by a secondary air passage 90, controlled by a manually operable valve 92 and a suction operated valve 94 secured to shafts 96 and 98 respectively, both of which are journalled in the main housing. The operating mechanism for these valves is not disclosed herein and forms no part of the present invention, but their manner of operation will be briefly described later in order to facilitate an understanding of the entire device.

The area of slot 56 which admits air to the chamber 64, is greater than the total area of the orifices 54 and because of this difference in size the inlet and outlet passages to and from the fuel supply chambers, it is obvious that the velocity of air passing therethrough will never be sufficient to create a velocity head at the fuel feeding orifices therein. Therefore, a substantially static suction, as controlled by the spring held air valve 74, is maintained at the fuel feeding orifices under all operating conditions.

During operation at all engine speeds below a predetermined speed, for example, that corresponding to a vehicular speed of approximately 20–25 miles per hour on the level, the mixture conveyed through the primary mixture conduits is sufficient to provide the proper quantity of fuel charge and is conveyed to the engine without mixture with addition air in the secondary mixing chambers. At higher engine speeds than this, however, the valves controlling the secondary air passage are opened to increase the quantity of mixture supplied to the engine. The valve 92 is operated from the primary throttle through a connection which permits an independent movement of the throttle up to the position corresponding to the vehicular speed above referred to, after which the valve 92 and the throttle are operated simultaneously. The valve 94 is suction operated and remains closed until the valve 92 begins to open. All opening movements of the valve 94 are retarded by a dashpot for a purpose and by means fully disclosed in the earlier application Serial No. 370,179. As these operating connections form no part of the present invention, they are not described in detail herein.

On any increase of suction in the main air chamber 68 the valve 74 is opened and its opening movement is retarded to prevent fluttering of said valve by a dashpot comprising a cylinder 100 and a piston 102 secured to the lower end of the valve stem 86. The specific construction of this dashpot is entirely immaterial to the present invention.

In order to enrich the mixture during the acceleration period for a purpose well known to those skilled in the art, a pump is provided which is operated by the throttle to pump fuel into a well 104, from which it is delivered to each of the primary mixture passages through delivery passages 106 having restrictions 108 at their outlet ends. This pump is not shown herein and forms no part of the present invention, but is fully disclosed in application Serial No. 370,179.

It is unnecessary to describe further the details of construction of the carburetor unit in order to understand the present invention. It will be obvious that fuel is delivered to the primary mixture passages 52 from which it flows through primary mixture conduits 62 to secondary mixing chambers, in which it is mixed with additional air subsequent to the opening of the valve 92, but prior to the opening of this valve the primary mixture is delivered directly to the engine intake ports without dilution in the secondary mixing chamber.

It is desirable to provide means for accelerating the flow of primary mixture through the primary mixture passages so that the enriched mixture following an opening of the throttle will be delivered to the secondary mixing chambers almost immediately after the throttle opens in order to secure smooth and rapid engine acceleration and it is also desirable to produce a high velocity of flow through the secondary mixing chambers and discharge the primary mixture at high velocity from the primary mixture conduits in order to prevent precipitation of the fuel from the mixture and puddling of this fuel on the walls of the secondary mixing chamber and the passage from the intake port to the valve, particularly in an L-head engine where the valve is above the secondary mixing chamber. Obviously precipitation and puddling of the fuel as described will cause unequal distribution of the fuel to the various cylinders and irregular operation of the engine. In certain earlier forms of this device, Venturi tubes have been positioned in the outlet branches of the manifold surrounding the outlet ends of the primary mixture conduits. These tubes have, however, been open to the objection that when the Venturi tube is made sufficiently small at the throat to produce the desired acceleration of flow when the throttle is only partially opened and a small quantity of air passing through the tube, such tube will restrict the flow

to such a degree, when the throttle is relatively wide open that sufficient partial vacuum is created within the intake passage to effect a reduction in volumetric efficiency of the engine.

According to the present invention, means are provided to secure the desirable results above referred to without reducing the power output of the engine and for this purpose the primary mixtures are designed to include tubes cast in position in the manifold outlet branches so that they lie along the lower wall thereof instead of being coaxial with the branches, as in earlier forms of this device. Instead of discharging into the center of the Venturi tubes as formerly, such conduits 62 communicate with passages formed in the wall of Venturi tubes with which they are associated. Venturi tubes 110 are positioned in each outlet branch of the manifold and are provided with an exterior rib 112, which, when the device is assembled, is clamped between shoulders 114 and 116, formed in the outlet branch of the manifold and the engine block respectively. The tubes are provided with a passage 118, of Venturi form through the interior of the tube and through which secondary air passes after the opening of the valve 92, while a tapered passage 120 is provided in the wall of each Venturi tube and extends longitudinally thereof. At the anterior end, the passage 120 is somewhat oval in shape, as shown in Fig. 4 and is adapted to register with the end of the primary mixture conduit 62, which is of the same shape. The passage 120 tapers toward its posterior end so that this end of the passage is in the form of a very narrow semi-circular slot 122, which opens through the posterior end of the venturi and extends substantially half around the tube as indicated by dotted lines in the drawing.

The operation of this device is substantially as follows: At all speeds below that at which the valve 92 is opened, a primary mixture only is supplied to the engine and the suction at all points between the valve 92 and the engine is very high. This high suction causes a high velocity of flow through the primary mixture conduits and because of the shape of the discharge outlet 122, the fuel mixture is discharged at a very high velocity therethrough, being in the form of a very fine mist which is carried into the engine substantially without precipitation on the walls of the passages 124 leading from the intake ports 14 to the cylinders. Subsequent to the opening of the valve 92, the suction in the passage 124 and throughout the manifold falls, but the air passing through the Venturi tube 118 at this time flows at high velocity and the aspirating effect of the air passing through the Venturi tube on the fuel feeding slot 122 is sufficient to prevent a reduction in the velocity of discharge of the rich fuel mixture therefrom so that there is no tendency for precipitation of fuel on the walls of the intake passage subsequent to the opening of the valve 92. Moreover, the velocity of flow through the passage 124 is necessarily greater after the opening of the valve 92 than before, so that any possible reduction in the velocity of discharge from the slot 122 is offset by the action of the high velocity air current passing through the passage 124 so that there is substantially no trapping of fuel in the passage between the intake port and the engine valve. It will also be understood that the shape of the passage 124 is such that any small quantity of fuel which does collect on the walls of the passage will drain down to a position immediately in advance of the discharge slot 122 and will be picked up by the primary mixture which issues from such slot at high velocity.

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 mixture passage, a throttle, means for supplying fuel and air to the mixture passage, a secondary mixing chamber receiving fuel mixture from said mixture passage, and means for forming a homogeneous mixture of fuel and air in the secondary mixing chamber, said means comprising a passage restricting member for increasing the velocity of air flow through said chamber, and a long thin mixture delivery orifice connecting the mixture passage with the secondary mixing chamber.

2. A charge forming device for internal combustion engines comprising a mixture passage, a throttle, means for supplying fuel and air to the mixture passage, a secondary mixing chamber receiving fuel mixture from said mixture passage, and means for forming a homogeneous mixture of fuel and air in said passage, said means comprising a Venturi tube in the secondary mixing chamber and through which ingoing air flows and a long, thin mixture delivery orifice for discharging the mixture into the air passing through said tube.

3. A charge forming device for internal combustion engines comprising a mixture passage, a throttle, means for supplying fuel and air to the mixture passage, and means for forming a homogeneous mixture of fuel and air in said passage, said means comprising a Venturi tube through which ingoing air flows, a mixture passage in the wall of the Venturi tube and a long thin delivery slot at the end of said passage.

4. A charge forming device for internal combustion engines comprising a mixture passage, a throttle, means for supplying fuel and air to the mixture passage, and means for forming a homogeneous mixture of fuel and air in said passage, said means comprising a Venturi tube through which ingoing air flows, a mixture passage in the wall of the Venturi tube and a long, thin delivery slot at the posterior end of said mixture delivery passage.

5. A charge forming device for internal combustion engines comprising a mixture passage, a throttle, means for supplying fuel and air to the mixture passage, and means for forming a homogeneous mixture of fuel and air in said passage, said means comprising a Venturi tube through which ingoing air flows, and a tapered fuel delivery passage extending longitudinally through the wall of the Venturi tube and delivering fuel through its posterior end.

6. A charge forming device for internal combustion engines comprising a mixture passage, a throttle, means for supplying fuel and air to the mixture passage, and means for forming a homogeneous mixture of fuel and air in said passage, said means comprising a Venturi tube through which ingoing air flows, and a tapered fuel delivery passage extending longitudinally through the wall of the Venturi tube, and a narrow fuel delivery slot formed in the posterior end of said Venturi tube and constituting the outlet of said tapered passage.

7. An intake manifold for a multi-cylinder engine having a plurality of intake ports, compris-

ing a plurality of outlet branches communicating with said ports, fuel delivery conduits associated with each outlet branch of said manifold, and means for effecting a discharge of fuel at high velocity from said conduits comprising a discharge orifice in the form of a narrow slot, whereby collection of fuel on the walls of the outlet branches is prevented.

8. An intake manifold for a multi-cylinder engine having a plurality of intake ports, comprising a plurality of outlet branches communicating with said ports, fuel delivery conduits associated with each outlet branch of said manifold, and means for effecting a discharge of fuel at high velocity from said conduits comprising a discharge orifice in the form of a narrow slot, an air inlet admitting air to said manifold, and means for increasing the velocity of air flow adjacent the discharge ends of said fuel delivery conduits.

9. An intake manifold for a multi-cylinder engine having a plurality of intake ports comprising a plurality of outlet branches communicating with said ports, a fuel delivery conduit formed in the wall of each outlet branch and having a restricted outlet whereby fuel is discharged at high velocity, an air inlet admitting air to said manifold, and means for increasing the velocity of air flow adjacent the restricted outlet of each fuel delivery conduit.

10. An intake manifold for a multi-cylinder engine having a plurality of intake ports, comprising a plurality of outlet branches communicating with said ports, a fuel delivery conduit formed in the wall of each outlet branch, an air inlet admitting air to the manifold, a Venturi tube in each outlet branch of the manifold for increasing the velocity of air flow therethrough and a fuel discharge pasage formed in the wall of said Venturi tube and registering with said fuel delivery conduit.

11. An intake manifold for a multi-cylinder engine having a plurality of intake ports, comprising a plurality of outlet branches communicating with said ports, a fuel delivery conduit formed in the wall of each outlet branch, an air inlet admitting air to the manifold, a Venturi tube in each outlet branch of the manifold for increasing the velocity of air flow therethrough and a fuel discharge passage formed in the wall of said Venturi tube and registering with said fuel delivery conduit, said fuel discharge passage having a restricted outlet, whereby the fuel is discharged at high velocity into the air passing through the outlet branches of the manifold.

12. A charge forming device for an internal combustion engine comprising a mixture supply passage adapted to communicate with an engine intake port, means for supplying fuel directly to said passage adjacent the engine intake port and having a restricted fuel feeding orifice through which fuel is discharged at high velocity, and means in said mixture passage for accelerating the flow of air past the fuel discharge orifice.

13. A charge forming device for internal combustion engines comprising a secondary mixing chamber communicating with the engine intake port, a primary mixture conduit adapted to deliver a primary mixture of fuel and air to said secondary mixing chamber, and means for discharging the primary mixture into the secondary mixing chamber, means for effecting the discharge of the primary mixture into the secondary mixing chamber at high velocity, whereby the accumulation of fuel on the walls of the secondary mixing chamber is prevented, said last mentioned means comprising a restricted discharge orifice through which the primary mixture is discharged, and a restricting means in the secondary mixing chamber adapted to create a high pressure differential on opposite sides of said discharge orifice.

14. A charge forming device for internal combustion engines comprising a secondary mixing chamber, a primary mixture conduit adapted to deliver a primary mixture of fuel and air to said secondary mixing chamber, means for supplying fuel and air to said primary mixture conduits, means for supplying air to said secondary mixing chamber, said primary mixture conduit having a restricted orifice through which the primary mixture is discharged at high velocity into the secondary mixing chamber, and means for accelerating the flow of air through the secondary mixing chamber adjacent the point of discharge of the primary mixture.

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