March 29, 1932. W. H. TEETER 1,851,548

CHARGE FORMING DEVICE

Filed Sept. 22, 1928

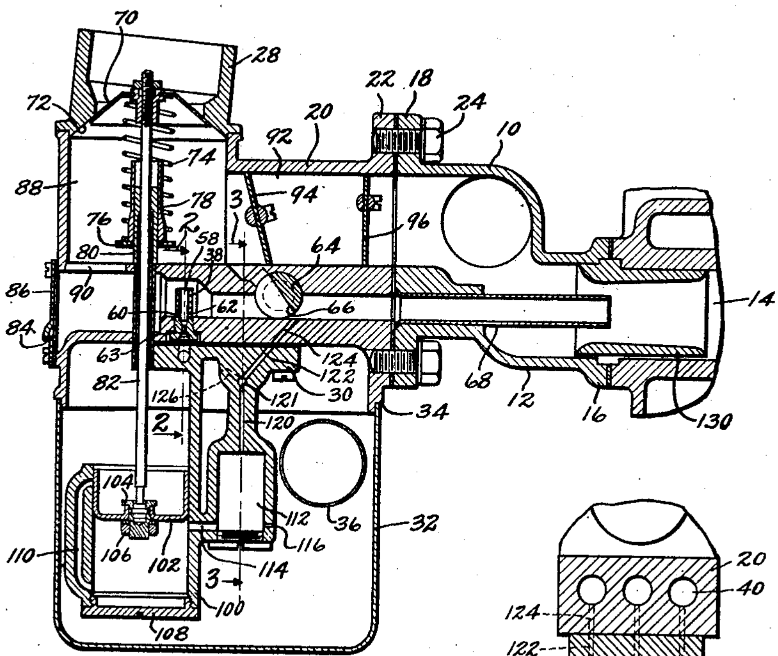

Fig. 1

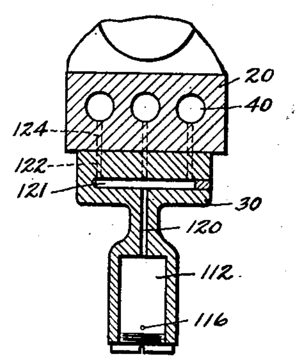

Fig. 3

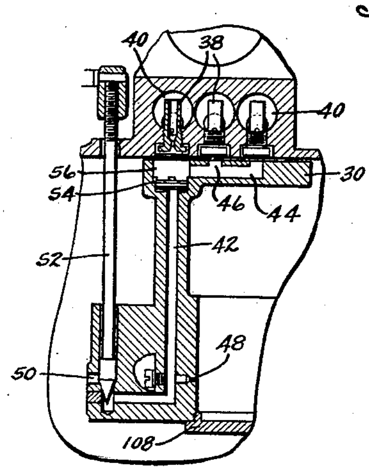

Fig. 2

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UNITED STATES PATENT OFFICE

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CHARGE FORMING DEVICE

Application filed September 22, 1928. Serial No. 307,746.

This invention relates to charge forming devices for internal combustion engines and more particularly to the type of charge forming device which comprises a plurality of primary fuel mixing chambers, one for each intake port of the engine and cooperating respectively with a plurality of secondary fuel mixing chambers located adjacent the engine intake ports, and receiving fuel air mixture from pipes connected with the primary carburetors, and receiving air when required through branches of an air manifold having a single air inlet for supplying air to all the secondary mixing chambers, the quantity of mixture flowing through the secondary carburetors being controlled primarily by a single main air throttle. A common fuel reservoir supplies liquid fuel to all of said primary carburetors.

An example of a charge forming device of this type is disclosed in the copending application of Fred E. Aseltine, Carl H. Kindl, and Wilford H. Teeter, Serial No. 288,683, filed June 10, 1928.

In the device disclosed in the above application various means are provided for regulating the proportions of fuel and air in the mixture under different operating conditions, so as to provide a mixture of the desired proportions to secure proper operation of the engine under all conditions of speed and load. Among these mixture proportioning devices is a dash pot which damps the opening movement of the main air valve on opening of the throttle and comprises a cylinder having a check valve in the bottom designed to open as the valve closes to permit unretarded closing movement of said valve; and which has a fuel delivery conduit connected thereto through which fuel is forced to the mixture passages on opening of the throttle to enrich the mixture for acceleration.

The present invention is in the nature of an improvement to the device disclosed in the above application and the primary object of the invention is to provide improved means for controlling the mixture proportions on opening of the throttle, which is simple in construction, positive in its action and relatively cheap to manufacture. More specifically, an object of the invention is to provide improved means for controlling the movements of the air valve and an improved form of pump for supplying additional fuel to the mixture passages to enrich the mixture for acceleration.

According to this invention these objects are accomplished by the provision of a dash pot controlling the motion of the air valve which comprises a cylinder having a solid bottom which is not provided with a check valve, but which instead communicates with a well supplied with fuel from the main fuel bowl, and having a capacity equal to the amount of fuel displaced by the dash pot piston during its movement from normal position to a position where the upper end of a bypass in the wall of said cylinder is uncovered. This fuel is available to run back into the dash pot cylinder on any movement of the air valve toward closed position, rendering the check valve in the bottom of the cylinder unnecessary to permit unretarded closing movement of the valve. The well also constitutes a part of the fuel delivery conduit through which fuel is forced from the dash pot cylinder and said well is provided with a restricted fuel conduit leading to the mixture passages and a small orifice connecting with the fuel bowl for filling the well so that the well is normally filled at the beginning of any opening of the valve.

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 form of embodiment of the present invention is clearly shown.

In the drawings:

Fig. 1 is a vertical longitudinal section through a charge forming device in which the present invention is embodied.

Figs. 2 and 3 are sections on the lines 2—2 and 3—3 respectively of Fig. 1.

The device disclosed comprises a main air manifold 10 having three outlet branches, the middle branch 12 being shown herein. Each of these branches communicates with one of the intake ports 14 of a multi-cylinder engine. These outlet branches are each provided with an attaching flange 16 for securing the manifold to the engine block in the usual manner. Adjacent the inlet of the manifold is provided a flange 18 to which the main carburetor unit is adapted to be attached as shown in Fig. 1.

The carburetor unit comprises a main housing 20 having an attaching flange 22 adapted to be secured to flange 18 by screws 24. An air inlet horn 28 is secured in position to register with an opening in the upper wall of housing 20, in any suitable way. A casting 30, having certain dash pot chambers and fuel passages formed therein, is secured by screws to the lower wall of housing 20, and a sheet metal fuel bowl 32 is held tight against an annular shoulder 34 on the housing 20 by any suitable means. Fuel is conducted from a main source of supply to the fuel bowl through a conduit not shown herein and the flow of fuel to the bowl is controlled by a float 36, operating in the usual manner to maintain a substantially constant level of fuel therein.

Fuel flows from bowl 32 to a plurality of primary fuel nozzles 38, one of which is located in each of the primary mixing chambers 40, the construction of which is briefly described hereinafter. The fuel conduit between the fuel bowl and the nozzles comprises a vertical fuel passage 42 communicating at its upper end with a horizontal fuel canal 44 which connects with each of the nozzles 38 through orifices 46. Fuel is admitted from the fuel bowl to passage 42 at all speeds through a fixed metering orifice 48 and at high speeds additional fuel is admitted through an orifice 50 controlled by a valve 52 in the manner set forth in the above mentioned application.

Fuel is lifted from the fuel bowl through the above described fuel passages and nozzles 38 to the mixing chambers by the suction therein. Closing movements of the throttle cause a reduction in mixing chamber suction, which might permit the fuel column to drop sufficiently to cause a temporary fuel starving of the engine unless means were provided to prevent it. For this purpose a check valve 54 is provided in an enlarged chamber 56 at the junction of channels 42 and 44, and on reduction of mixing chamber suction seats on the bottom of its chamber, preventing downward flow of the fuel.

Each primary fuel nozzle is provided with a main fuel outlet 58 in the top of the nozzle and a secondary fuel outlet comprising two orifices 60 and 62 near the bottom of the vertical wall of the nozzle. At relatively high speeds the mixing chamber suction is enough to lift fuel from the main outlet as well as from holes 60 and 62. At idle or low speeds, however, the suction is sufficient to lift fuel only to some point between the top of the nozzle and orifices 60 and 62, fuel flowing from these orifices by action of gravity. Each nozzle is provided with a restricted fuel metering orifice 63. The primary mixture passages 40 are parallel to each other and close together as indicated in Fig. 2, and when the carburetor is attached to the manifold, these passages register with conduits which convey the primary mixture to the secondary mixing chambers, as fully disclosed in the copending application referred to.

A single throttle valve 64, which extends across all the primary mixture passages, controls the flow therethrough and is provided with grooves 66 which register with said mixture passages. This throttle is operated by means fully disclosed in the above copending application and which forms no part of the present invention. The middle primary mixture passage connects with a tube 68, fixed in the manifold branch 12, which conveys the primary mixture to the secondary mixing chamber in that branch of the manifold.

Substantially all the air entering the carburetor flows through the air horn 28, controlled by a main air valve 70, normally held against a seat 72 by a spring 74 received between the valve and a flange 76 projecting from a sleeve 78 slidably mounted on a stationary guide sleeve 80, fixed in the housing 20 and serving as a guide sleeve for the stem 82 to which the air valve is secured.

When it is desired to choke the carburetor to start the engine, the flange is adapted to be lifted, by means not shown herein, until the upper end of sleeve 78 engages the valve to hold it against its seat. Sufficient air to carry the starting fuel from the nozzles to the intake ports is admitted through an elongated slot 84 formed in a plate 86 secured to the housing 20, as shown in Fig. 1.

The valve 70 admits air to a main air chamber 88 from which air flows to the primary mixture passages through an orifice 90 in the floor of the air chamber and to the secondary mixing chambers through a passage 92, which connects with the inlet of the manifold 10. A manually operable throttle 94 and a suction operated valve 96 control the flow of air through passage 92 and the operating connections for said valves are fully disclosed in the above mentioned application.

On opening of either throttle 64 or 94 the suction in the air chamber 88 is increased and the air valve is opened against the tension of its spring to admit additional air and increase the quantity of mixture supplied to the engine. The opening of the valve must be retarded to some extent, however, to prevent admission of sufficient air to lean the mixture. A dash pot is provided to accomplish this result and to prevent fluttering of the valve comprising a cylinder 100 forming part of the casting 30 and a piston 102 secured to the valve stem 82 by means of a flanged coupling member 104 pinned to said stem, the piston being clamped between the flange on said coupling member and a nut 106 threaded thereon. The lower end of the dash pot cylinder is closed by a solid plug 108 screwed into the cylinder, and a by-pass 110, both ends of which communicate with the interior of the dash pot cylinder, is formed in the wall thereof. The piston 102 closes the upper end of the by-pass when the air valve is closed. As the valve opens the piston uncovers the end of the passage 110, permitting passage of fuel from below the piston through the by-pass in order to partially relieve the dash pot at high speed and permit less retarded opening of the air valve.

On the closing of the valve, fuel must be admitted to the cylinder below the piston 102, or the upward movement of the piston would create a vacuum below said piston at the beginning of such movement which would prevent further upward movement and the air valve would not close. To admit fuel to cylinder 100 below piston 102, a well 112 is formed in casting 30 and is connected by a relatively large passage 114 with the cylinder 100. This well has a capacity at least equal to the amount of fuel displaced by the piston 102 before said piston uncovers the upper end of by-pass 110. A small hole 116 permits fuel from the float bowl to flow into the well 112.

The above described dash pot operates substantially as follows: Downward movement of the piston forces fuel from the cylinder 100, first through the passage 114 and then through by-pass 110, the speed of the piston being determined by the rate of flow from the cylinder. In dash pots heretofore employed, a check valve has been provided either in the piston or cylinder to prevent the formation of a vacuum below the piston when the latter starts its return movement. In the dash pot disclosed, the check valve has been eliminated, but the air valve is permitted to close substantially without retardation. Let it be assumed that the valve is open and the piston is below the upper end of by-pass 110. On a closing movement of the throttle suction in the chamber 88 is reduced and spring 74 moves the valve 70 toward closed position, the piston 102 moving upwardly and creating a vacuum below the piston. This vacuum will draw fuel from above the piston through by-pass 110 until the upper end of the by-pass is covered by the piston, at which point the closing of the valve would cease if the well 112 were not provided. However, as the by-pass is covered the passage 114 is uncovered and fuel flows from the well 112 into cylinder 100, satisfying the vacuum formed therein as the air valve continues its closing movement. The orifice 116 permits the filling of the well with fuel after the fuel therein has been drawn out as described.

The above described dash pot also constitutes a fuel pump to supply additional fuel to the mixture passages on opening movements of the throttle to enrich the mixture for acceleration. The well 112 is a part of the fuel delivery conduit between the dash pot cylinder and mixture passages. A passage 120 of smaller size than passage 114 connects the top of the well with a horizontal fuel channel 121 bored in casting 30 and connecting with three passages 122 which communicate with three passages 124 in the main housing 20, each of which communicates with one of the mixture passages 40, as shown in Fig. 1. One or more passages 126 admit air to the channel 121, which forms an emulsion with the fuel in said channel, this emulsion being forced through passages 122 and 124 on downward movements of the piston 102.

Air is admitted to channel 121 to prevent the high mixing chamber suction acting to draw fuel from cylinder 100 independently of the pumping action of the piston 102. A high suction is maintained in the mixing chambers under all conditions of operation and unless the fuel delivery passage were vented, this suction would operate to lift fuel from the cylinder 102 at all times, while it is desirable to supply this additional fuel only on opening of the throttle. It is desirable to admit sufficient air to the channel 121 to reduce the suction effective on the passage 120 so it can lift fuel to a point slightly below the channel 121, but no higher.

The reservoir 112 is normally full of fuel whenever the piston 102 starts downwardly. Downward movement of the piston therefore forces fuel through the restricted conduit 120, which retards such movement. The passage 114, however, is large enough to permit relatively free return movement of the piston, the fuel in the auxiliary reservoir running into the dash pot cylinder to satisfy the vacuum created by return of the piston and the passage 120 serving as a vent.

A secondary mixing chamber is associated with each outlet branch of the manifold, one of such mixing chambers being shown herein. Each of these mixing chambers comprises a Venturi tube 130 clamped between the manifold and the engine block, and positioned so the outlet of the primary mixture conduit associated therewith terminates at the point of greatest suction therein. These Venturi tubes constitute no part of the present invention, but function in a manner fully set forth in the above mentioned application.

It will be clear that by the provision of the well 112 in the delivery conduit from the dash pot cylinder to the mixture passages, the applicant has accomplished the elimination of the check valve formerly used in the dash pot to permit return movement of the dash pot piston without reducing the efficiency of the pump, which would not have been possible if the outlet passage 114 communicated directly with the fuel bowl. The passage 116, by means of which the well fills after an upward movement of the piston, is so small by comparison to the delivery passage 120 that it has no appreciable effect on the pumping action of the dash pot.

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 comprising a mixture passage, means supplying fuel and air thereto, a suction operated air valve controlling the admission of air, a dash pot retarding the opening of the air valve, a by-pass connected at two vertically spaced points with the dash pot cylinder for varying the retarding effect of the dash pot, and an auxiliary reservoir communicating with the dash pot cylinder below the normal position of the dash pot piston into which liquid is forced by the dashpot piston on opening of the air valve.

2. A charge forming device comprising a mixture passage, means supplying fuel and air thereto, a suction operated air valve controlling the admission of air, a dash pot retarding the opening of the air valve, a by-pass connected at two vertically spaced points with the dash pot cylinder adapted to be rendered effective during opening of the air valve, and an auxiliary reservoir communicating with the dash pot cylinder into which fuel is forced by the dash pot piston before the by-pass becomes effective.

3. A charge forming device comprising a mixture passage, means supplying fuel and air thereto, a suction operated air valve controlling the admission of air, a dash pot retarding the opening of the air valve, a by-pass connected at two vertically spaced points with the dash pot cylinder adapted to be rendered effective during opening of the air valve, an auxiliary reservoir, means connecting the auxiliary reservoir with the dash pot cylinder, said means being rendered ineffective as the by-pass is rendered effective.

4. A charge forming device comprising a mixture passage, means supplying fuel and air thereto, a suction operated air valve controlling the admission of air, a dash pot retarding the opening of the air valve, a by-pass connected at two vertically spaced points with the dash pot cylinder, one end of which is covered by the piston in closed position of the valve and is adapted to be uncovered as the valve opens, an auxiliary reservoir and means connecting the auxiliary reservoir with the dash pot cylinder when the valve is closed, said connecting means being adapted to be covered by said piston during opening of the valve as the by-pass is uncovered.

5. A charge forming device for internal combustion engines comprising a fuel reservoir, a mixture passage, means supplying fuel and air thereto, a suction operated air valve controlling admission of air, a dash pot retarding the opening of the air valve and supplying additional fuel to the mixing chamber for acceleration on opening of the throttle, and an auxiliary reservoir forming a part of the fuel delivery conduit having a relatively large passage communicating with the dash pot cylinder and a relatively small outlet passage leading to the mixture passage, whereby closing movement of the air valve is relatively unretarded.

6. A charge forming device for internal combustion engines comprising a fuel reservoir, a mixture passage, means supplying fuel and air thereto, a suction operated air valve controlling admission of air, a dash pot retarding the opening of the air valve and supplying additional fuel to the mixing chamber for acceleration on opening of the throttle, an auxiliary reservoir forming a part of the fuel delivery conduit having a relatively large passage communicating with the dash pot cylinder and a relatively small passage communicating with the fuel reservoir.

7. A charge forming device comprising a mixture passage, means supplying fuel and air thereto, a suction operated air valve controlling the admission of air, a dash pot retarding the opening of the air valve, a by-pass connected at two vertically spaced points with the dash pot cylinder adapted to be rendered effective during opening of the air valve, and an auxiliary reservoir communicating with the dash pot cylinder into which fuel is forced by the dash pot piston before the by pass becomes effective, said auxiliary reservoir having a capacity as great as the volume of fuel displaced by the piston before the by-pass is rendered effective.

8. A charge forming device for multi-cylinder engines comprising a fuel reservoir, a plurality of mixture passages each of which is adapted to supply fuel air mixture to a separate intake port, means for supplying fuel and air to said mixture passages, a suction operated valve controlling admission of air to all said passages, a dash pot for retarding the opening of the air valve and supplying additional fuel to all of said mixture passages on opening movement of the throttle, an auxiliary reservoir having relatively free communication with the dash pot, and a restricted delivery conduit extending from the reservoir to all said mixture passages.

In testimony whereof I hereto affix my signature.

WILFORD H. TEETER.