April 5, 1932. C. H. KINDL ET AL 1,852,752

CHARGE FORMING DEVICE

Filed Sept. 27, 1928

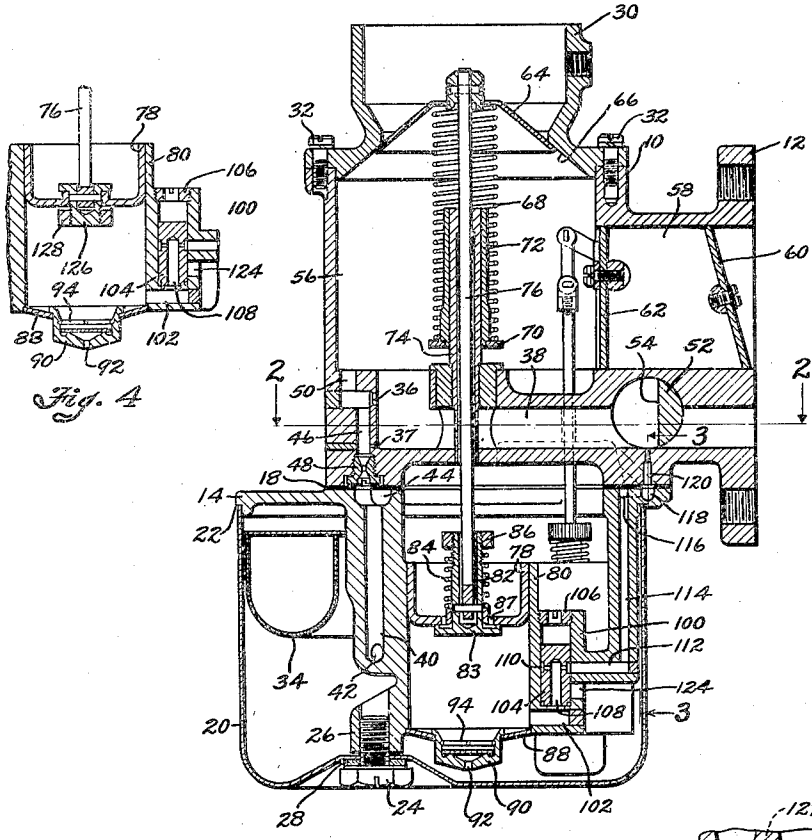

Fig. 1

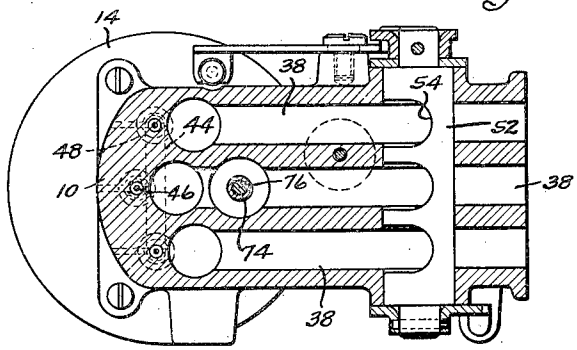

Fig. 2

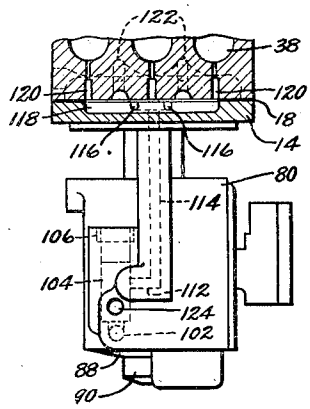

Fig. 3

Inventor

Wilford N. Teeter

Carl H. Kindl

By Spencer, Hardman & Fehr

Attorney

Fig. 4

Patented Apr. 5, 1932 1,852,752

UNITED STATES PATENT OFFICE

CARL H. KINDL AND WILFORD H. TEETER, OF DAYTON, OHIO, ASSIGNORS, BY MESNE ASSIGNMENTS, TO DELCO PRODUCTS CORPORATION, OF DAYTON, OHIO, A CORPORATION OF DELAWARE

CHARGE FORMING DEVICE

Application filed September 27, 1928. Serial No. 308,848.

This invention relates to charge forming devices for multi-cylinder internal combustion engines and more particularly to the type of charge forming device or carburetor 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 primay carburetors and receiving air when required through one branch of an air manifold, which supplies air to all of the secondary carburetors, the quantity of fluid flowing through the secondary carburetors being controlled primarily by a single main air throttle, which controls all said secondary carburetors. The primary carburetors receive their liquid fuel through a single fuel duct leading to a common float bowl. Examples of charge forming devices of this type are disclosed in the applications of Fred E. Aseltine, Wilford H. Teeter and Carl H. Kindl, Serial No. 288,683, filed June 27, 1928, and Wilford H. Teeter, Serial No. 288,685, filed June 27, 1928.

Various means are provided in the device disclosed in the joint application above referred to for controlling the flow of fuel and air under various different operating conditions, so as to secure at all times a mixture having the desired fuel and air ratio. One of these proportioning means is a fuel pump adapted to force fuel into the mixing chambers on opening movement of one or both throttle valves to enrich the mixture for acceleration. The pump employed is variable in its action, in fact when the trottle is opened from some positions it occupies when the engine is running at relatively high speeds, the pump is entirely ineffective to pump additional fuel into the mixing chambers. It has been found desirable to force some additional fuel into the mixture passages on any opening movement of the throttle, to force substantially the same amount of additional fuel into the mixture passages on any relatively rapid opening movement and to force a small amount of additional fuel into the mixture passages throughout any very slow opening of the throttle.

For these reasons this pump has not always proven a satisfactory means for enriching the mixture for acceleration and the present invention is in the nature of an improvement on the device disclosed in the above mentioned joint application, the principal object of which is to provide an improved means for enriching the mixture for acceleration, which is simple in construction, positive in action, and effective to enrich the mixture throughout any very slow opening movement of the throttle, and is effective to the same degree on rapid opening movements of the throttle irrespective of its position at the beginning of its opening movement or the amount of such movement.

A more specific object of the invention is to provide a fuel pump which is operative on very slow opening movements of the throttle to force additional fuel into the mixture passage or passages throughout the throttle movement, the amount of fuel varying in accordance with such movement, but which, on relatively rapid opening of the throttle is effective to supply substantially the same amount of additional fuel, irrespective of the amount of throttle movement or its position at the beginning of such movement.

These objects are accomplished according to the present invention by the provision of a fuel pump in the form of a dash pot, the piston of which is connected to the main air valve which opens on opening movement of the throttle. The dash pot piston makes its pumping stroke on opening movements of the valve and the amount of fuel forced into the mixing chambers is determined by a pressure operated piston slidably received in an auxiliary cylinder positioned adjacent the dash pot cylinder and communicating therewith. In the normal position of the piston the fuel delivery conduit, extending to the mixing chambers, is open. During the pumping stroke of the pump piston, the auxiliary piston is lifted by pressure of the fuel, except on very slow movement of the pump piston, closing the fuel delivery conduit and opening

a by pass leading to the main fuel bowl and through which fuel is forced during the remainder of the pumping stroke of the dash pot piston.

The subject matter of this invention is shown but not claimed in the application of W. H. Teeter, above referred to and since the present disclosure is identical with a part of the disclosure of said application, reference is made to the latter for a complete disclosure of the whole device in which the present invention is embodied.

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 carburetor unit in which the present invention is embodied.

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

Fig. 3 is a detail section of line 3—3 of Fig. 1.

Fig. 4 is a detail view of a modified form of pump piston.

The drawings of this application disclose only a carburetor unit in which the present invention is embodied. This carburetor unit, however, is designed primarily to be associated with a manifold of the type disclosed in the above mentioned application of W. H. Teeter. The manifold, however, constitutes no part of the present invention and, therefore, is not disclosed herein.

The carburetor unit comprises a main housing 10 having a flange 12 adapted to be attached in the usual way to a corresponding flange on the manifold. A casting 14, having formed therein the dash pot cylinders and fuel passages through which fuel is conducted to the mixing chambers, in a manner later described, is secured in any suitable manner to a boss 16 projecting from the bottom wall of housing 10, a gasket 18 being provided to prevent leakage. A sheet metal fuel bowl 20 is held tight against an annular shoulder 22 formed on the casting 14 by means of a screw 24, which is screwed into a projecting portion 26 of the casting 14, a gasket 28 preventing leakage around the screw. An air inlet horn 30 is secured by screws 32 in position to register with an opening in the upper wall of housing 10 to admit air thereto.

Fuel flows into the fuel bowl from a main source of supply (not shown), the flow being regulated in the usual manner by a float 34 which maintains a substantially constant level of fuel in the fuel bowl under all operating conditions. Fuel is conducted from the fuel bowl to a plurality of pairs of fuel outlet ports 36 and 37, communicating with a plurality of primary mixture passages 38, the construction of which will be briefly described hereinafter. The fuel passage through which fuel flows from the fuel bowl to the above mentioned ports 36 and 37 comprises a vertical fuel channel 40 communicating at its lower end with the fuel bowl through the orifice 42 and connecting at its upper end with a horizontal fuel canal 44, which connects with three vertical fuel passages 46, each of which leads to a pair of ports 36 and 37. A metering plug 48 is provided in the bottom of each passage 46 to regulate the flow of fuel and passages 50 are provided to permit a flow of air from the main air chamber, later described, to the ports 36 for the purpose of making the static suction of said air chamber the effective suction which determines the flow of fuel through the plugs 48, as fully described in the above mentioned application of W. H. Teeter.

Each pair of fuel ports 36 and 37 communicate with one of the mixture passages 38, there being three of these passages which are parallel to each other and relatively close together, as shown in Fig. 2. Each of said passages is adapted to connect with a conduit for conveying the mixture to secondary mixing chambers, as shown and described in the application of W. H. Teeter, No. 288,685, and the flow through all these passages is controlled by a single throttle valve 52 having grooves 54 therein which register with the mixture passages. The throttle is journalled in the housing 10 and operated by mechanism not shown herein, which forms no part of the present invention.

Air is admitted through the horn 30 to a main air chamber 56 and flows to the manifold through the primary mixture passages 38 and also through a secondary air passage 58, controlled by a manually operable throttle 60 and a suction operated valve 62, the mechanism for operating these valves being immaterial to the present invention and being fully described in the above mentioned application of W. H. Teeter. Admission of air through horn 30 is controlled by a suction operated valve 64, normally held against its seat 66 by a spring 68 received between the valve and a flange 70 projecting from a sleeve 72 slidably mounted on a sleeve 74 fixedly mounted in the main housing 10 and constituting a guide sleeve for the stem 76 on which the valve 64 is mounted. The sleeve 72 is adapted to be moved by means not shown herein, until its upper end engages the valve to hold said valve closed for the purpose of choking the carburetor to facilitate starting of the engine, as shown in application Serial No. 288,685.

Opening movements of the air valve are retarded to prevent admission of sufficient air to lean the mixture and to prevent fluttering of the valve. To this end the stem 76 is pro-

vided with a piston 78 slidable in a cylinder 80, the cylinder and piston comprising a dash pot. The piston normally moves with the valve stem, in the form shown in Fig. 1, but may move relatively thereto. A coupling member 82 provided with a flange 83 is pinned to the lower end of the valve stem and the piston is slidably mounted on the coupling member, being normally held against the flange 83 by a spring 84 received between the piston and a nut 86 threaded on the member 82 and by means of which the tension of the spring 84 may be adjusted. This construction permits the piston to be lifted from the flange 83 under certain operating conditions to permit liquid to pass through holes 87 in the piston for the purpose of relieving the dash pot and permitting relatively free opening movement of the valve. The bottom of the dash pot is closed by a closure member 88 having a valve cage 90 secured in the center thereof which is provided with a fuel inlet 92 and a check valve 94 which permits liquid fuel to enter from the fuel bowl on closing movement of the air valve, but prevents flow of fuel from the cylinder on opening of the valve.

The mechanism above described is all old and is fully described in the above mentioned application of W. H. Teeter.

The dash pot constitutes the fuel pump and according to the present invention the action of such pump is controlled by means now to be described. An auxiliary cylinder 100 is cast integral with and closely adjacent the dash pot 80 and a passage 102 connects cylinders 80 and 100 at the bottom. A weighted piston 104 is slidably mounted in the cylinder 100 and its upward movement is limited by a plug screwed into the top of the cylinder. A vertical passage 108 is bored in the piston 104 and connects with a plurality of radial passages 110, each of which connects with a peripheral channel 112 registering with an angular fuel channel 114, when the piston 104 is in the position shown in Fig. 1. At its upper end the passage 114 connects with two passages 116 which in turn connect with a horizontal channel 118, connecting with three vertical passages 120, each communicating with one of the mixture passages 38. Two passages 122 admit air to the channel 118 and this air forms an emulsion with the fuel in the channel 118, which passes through the passages 120 to passages 38, augmenting the primary mixture and providing a richer mixture for purposes of acceleration. When the piston 104 is lifted by the pressure of the liquid to move passage 112 out of registration with passage 114, a by pass port 124 through which fuel may flow from the cylinder 80 back to the fuel bowl, is opened.

Air is admitted to the horizontal fuel channel 118 to prevent the high suction at the outlets of passages 120 acting to draw fuel from the cylinder 80 independently of the pumping action of piston 78. A high suction is maintained in the primary mixture passages under all conditions of operation and unless the fuel delivery passage from the pump be vented to atmosphere at some point therein, fuel would be lifted from the pump cylinder to the mixture passages at all times instead of only during the pumping stroke of the piston 78. The air entering channel 118 reduces the suction effective on passage 114 so that it is insufficient to lift fuel to the channel 118. This suction is enough, however, to lift fuel to a point intermediate the pump cylinder and channel 118, preferably to a point immediately below said channel.

During very slow opening movements of the throttle to gradually increase the speed, it is desirable to supply a small amount of additional fuel to the mixture passages throughout the entire opening movement of the throttle and air valve, while during relatively rapid opening of the throttle the suction on the fuel jets is increased so rapidly that the injection of additional fuel is necessary only momentarily to supply additional fuel during the brief interval of time necessary to carry the increased amount of fuel from the jets 36 to the engine intake ports. The above described pump operates to supply additional fuel in the manner indicated. On very slow opening movements of the throttle it and the air valve move substantially simultaneously and the valve moves the piston 78 downwardly so slowly that the pressure on the fuel is insufficient to raise the piston 104, but is sufficient to lift fuel in passage 114 to the channel 118 throughout the entire opening movement of the air valve and throttle. When the throttle is opened relatively rapidly, however, the throttle completes its movement before the valve, owing to the action of the dash pot on the latter, resulting in a great increase in suction on the jets. The downward movement of piston 78 builds up sufficient pressure to lift piston 104 and cut off the flow of fuel after a small quantity of fuel has been forced through passage 114, any further movement of the piston 78 merely forcing fuel through by pass 124 to the fuel bowl. After the piston 78 comes to rest, the piston 104 will fall by gravity and a second opening of the throttle will effect the same pumping action as above described.

Any opening of the throttle which will result in a rapid enough opening of the valve to lift the auxiliary piston 104 will force substantially the same amount of fuel into the mixture passages. Moreover, since the piston 104 assumes its normal position after each opening movement of the throttle, it is obvious that any opening of the throttle

throughout its entire range of movement will be effective to force additional fuel into the mixture passages irrespective of the position of the throttle at the beginning of such movement, therefore, rapid opening movements of the throttle will force substantially the same amount of fuel into the mixture no matter what the position of the throttle is at the beginning of its movement or what the amount of such movement may be.

In Fig. 4 is shown a modified form of piston pump in which the piston 78 is secured to the valve stem so as to move therewith under all conditions of operation. A flanged coupling member 126 is pinned to the valve stem and the piston 78 is clamped between the flange thereof and a nut 128 screwed on said coupling member.

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, means for supplying fuel and air thereto, a throttle, and means operative on any relatively rapid opening movement of the throttle of more than a predetermined amount to supply substantially the same amount of additional fuel to said mixture passage, irrespective of the amount of movement of said throttle.

2. A charge forming device for internal combustion engines comprising a mixture passage, means for supplying fuel and air thereto, a throttle, and means operative on any relatively rapid opening movement of the throttle of more than a predetermined amount to supply substantially the same amount of additional fuel to the mixture passage irrespective of the position of the throttle at the beginning of said opening movement.

3. A charge forming device for internal combustion engines comprising a mixture passage, means for supplying fuel and air thereto, a throttle, and means operative on any slow opening movement of the throttle to supply an additional amount of fuel to the mixture passage which is dependent on the movement of the throttle, said means being effective on rapid opening of the throttle of more than a predetermined amount to supply a predetermined amount of fuel irrespective of the amount of movement of said throttle.

4. A charge forming device for internal combustion engines comprising a mixture passage, means for supplying fuel and air thereto, a throttle, and means operative on slow opening movements of the throttle to supply additional fuel to the mixture passage throughout the movement of the throttle, said means being effective on rapid opening of the throttle to supply additional fuel during a part of the opening movement of the throttle.

5. A charge forming device for internal combustion engines comprising a mixture passage, means for supplying fuel and air thereto, a throttle, a pump operative on opening movements of the throttle to supply additional fuel to said mixture passage, and controlling means for said pump which renders the pump effective on rapid opening of the throttle to supply substantially the same amount of fuel on different movements of the throttle.

6. A charge forming device for internal combustion engines comprising a mixture passage, means for supplying fuel and air thereto, a throttle, a pump operative on opening movements of the throttle to supply additional fuel to said mixture passage, and controlling means for said pump which renders the pump effective on rapid opening of the throttle of more than a predetermined amount to supply substantially the same amount of fuel irrespective of the amount of movement of said throttle, or the position of said throttle at the beginning of its movement.

7. A charge forming device for internal combustion engines comprising a mixture passage, means for supplying fuel and air thereto, a throttle, a pump operative on opening movements of the throttle to supply additional fuel to said mixture passage, and controlling means for said pump which renders the pump effective on rapid opening of the throttle of more than a predetermined amount to supply an amount of fuel which is independent of the amount of throttle movement and on slow opening of the throttle to supply an amount of fuel which varies in accordance with the throttle movement.

8. A charge forming device for internal combustion engines comprising a mixture passage, means for supplying fuel and air thereto, a throttle, a pump operative on opening movements of the throttle to supply additional fuel to said mixture passage, and controlling means for said pump which renders the pump effective on slow opening of the throttle throughout its opening movement and on rapid opening of the throttle renders the pump ineffective after the throttle has completed a part of its movement.

9. A charge forming device for internal combustion engines comprising a mixture passage, fuel and air inlets therefor, a throttle, a spring held air valve in said air inlet adapted to open on opening movements of the throttle and means operated by said air valve for forcing substantially the same amount of fuel in the mixing chamber to enrich the mixture for acceleration whenever the throttle is opened rapidly, more than a predetermined amount.

10. A charge forming device for internal

combustion engines comprising a mixture passage, fuel and air inlets therefor, a throttle, a spring held air valve in said air inlet adapted to open on opening movements of the throttle and means operated by said air valve for forcing a predetermined amount of fuel into the mixing chamber to enrich the mixture for acceleration whenever the throttle is opened rapidly more than a predetermined amount, irrespective of the position of the throttle at the beginning of its opening movement or of the duration of such movement.

11. A charge forming device for internal combustion engines comprising a mixture passage, fuel and air inlets therefor, a throttle controlling the flow therefrom, a pump for injecting additional fuel into the mixing chamber to enrich the mixture for purposes of acceleration and suction operated means for operating said pump to force substantially the same amount of fuel into said mixing chamber whenever said throttle is opened rapidly, more than a predetermined amount.

12. A charge forming device for internal combustion engines comprising a mixture passage, fuel and air inlets therefor, a throttle controlling the flow therefrom, a fuel pump for injecting additional fuel into the mixing chamber to enrich the mixture for acceleration and suction operated means for operating said pump to force the same amount of fuel into the mixing chamber whenever the throttle is opened rapidly more than a predetermined amount, irrespective of the position of the throttle at the beginning of its opening movement or of the duration of such movement.

13. A charge forming device for internal combustion engines comprising a mixing chamber, fuel and air inlets therefor, a throttle controlling the flow therefrom, a fuel pump for injecting additional fuel into the mixing chamber to enrich the mixture for acceleration, said pump comprising a cylinder and piston operating therein, an auxiliary cylinder connected with the first cylinder provided with a port connecting with a conduit leading to the mixing chamber and a by-pass port, and a piston in said auxiliary cylinder controlling the flow of fuel from the pump cylinder through said ports.

14. A charge forming device for internal combustion engines comprising a mixing chamber, fuel and air inlets therefor, a throttle controlling the flow therefrom, a fuel pump for injecting additional fuel into the mixing chamber to enrich the mixture for acceleration, said pump comprising a cylinder and piston operating therein, an auxiliary cylinder connected with the first cylinder provided with a port connecting with a conduit leading to the mixing chamber and a by-pass port, and a weighted piston in said auxiliary cylinder normally positioned to permit flow through said conduit, said piston being moved by the pressure of the pump piston to prevent flow through said conduit and open the by-pass after a predetermined amount of fuel has been forced through said conduit by the pump.

15. A charge forming device for multi-cylinder internal combustion engines comprising a plurality of mixture passages, each of which is adapted to deliver mixture to a separate intake port of the engine, means for supplying fuel and air to said passages, a throttle controlling flow through said passages, a pump for supplying additional fuel to all said mixture passages on opening of the throttle and means for rendering said pump effective on rapid opening of the throttle, more than a predetermined amount to supply a predetermined amount of fuel to said mixture passages irrespective of the amount of movement of the throttle or its position at the beginning of such movement.

In testimony whereof we hereto affix our signatures.

CARL H. KINDL.
WILFORD H. TEETER.