Feb. 14, 1933. F. E. ASELTINE 1,897,101

CHARGE FORMING DEVICE

Filed April 30, 1929

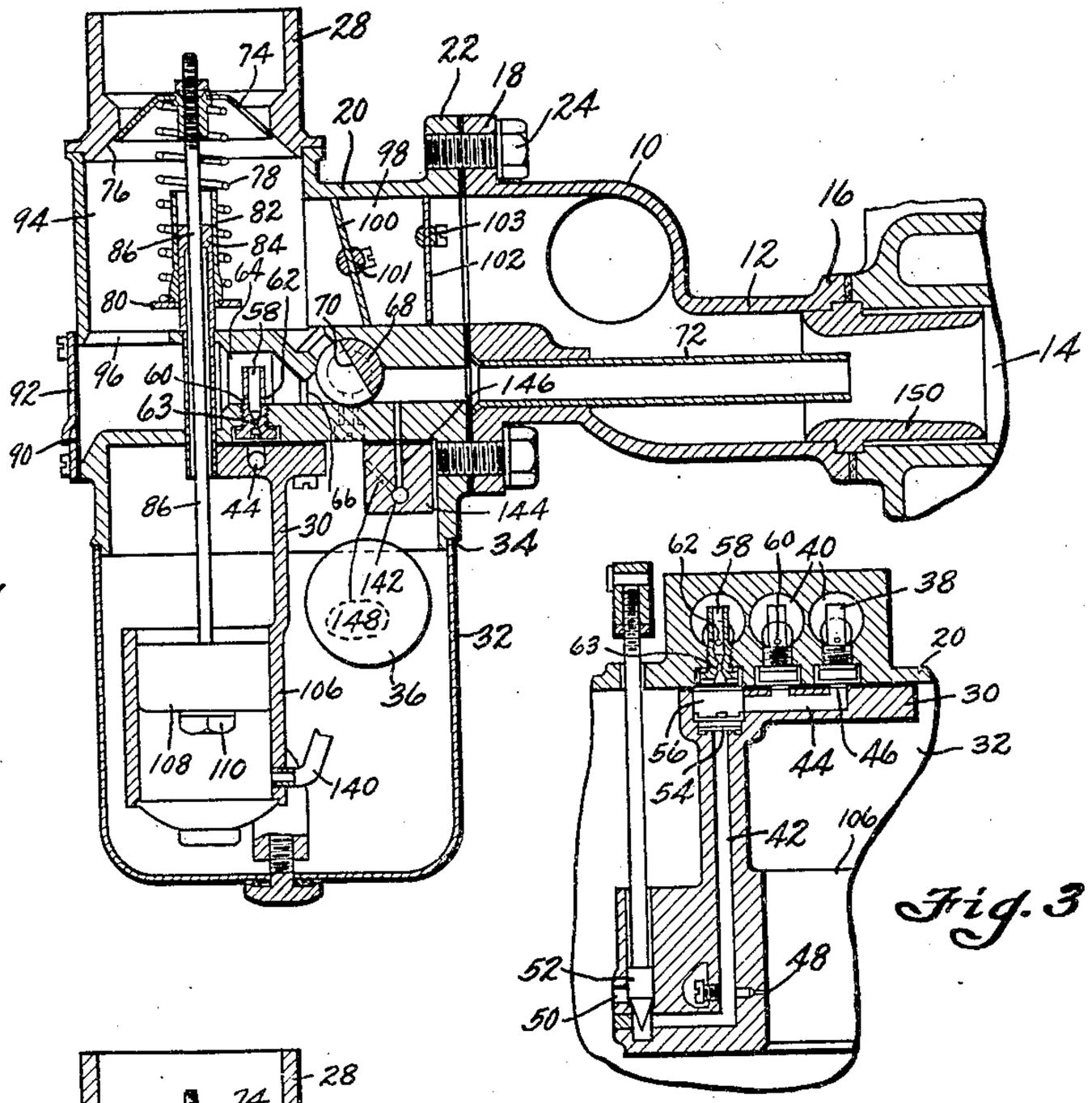

Fig. 1

Fig. 3

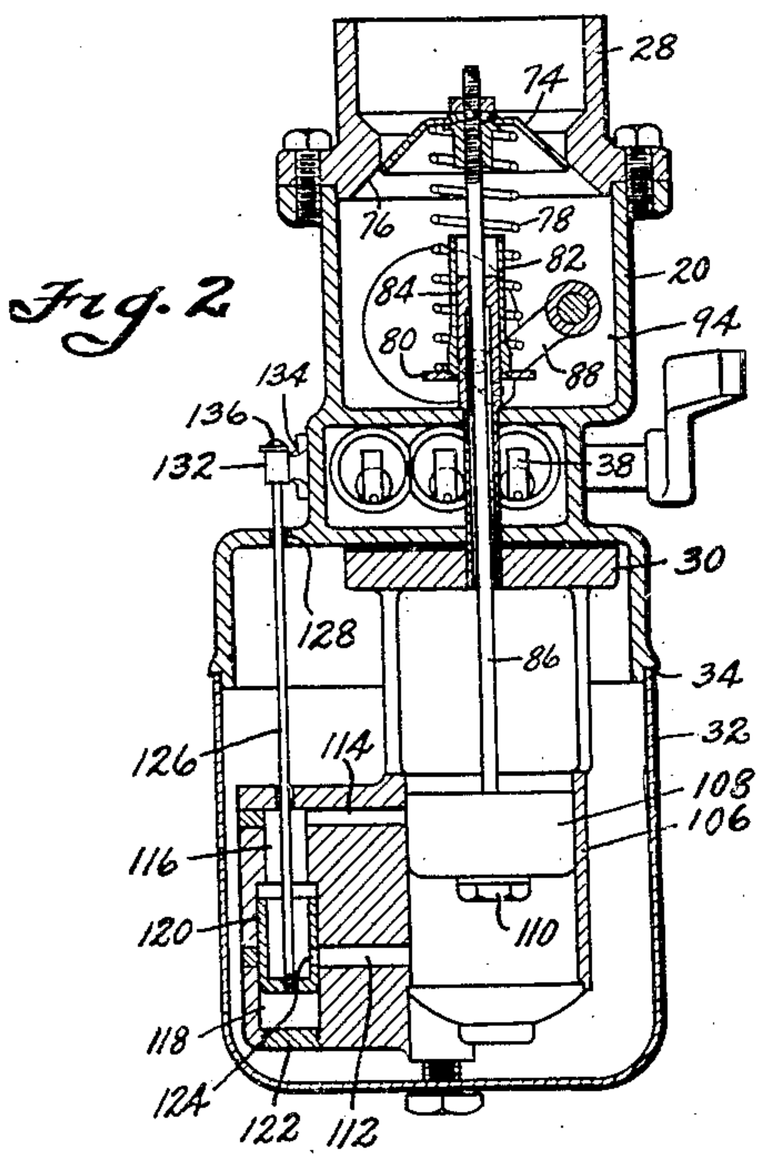

Fig. 2

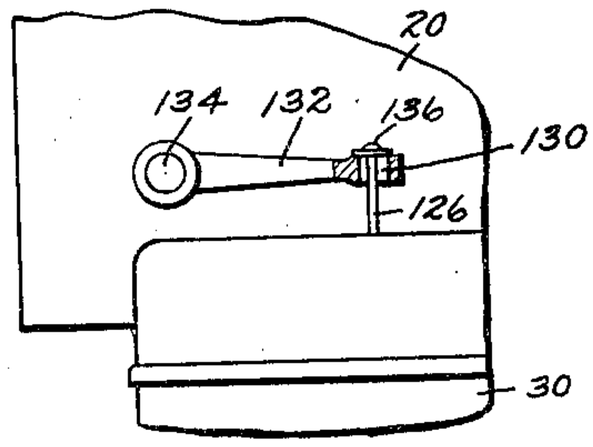

Fig. 4

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UNITED STATES PATENT OFFICE

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CHARGE FORMING DEVICE

Application filed April 30, 1929. Serial No. 359,318.

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 mixing chambers, one for each engine intake port, which cooperate respectively with a plurality of secondary mixing chambers located adjacent the said intake ports and receiving primary fuel air mixture from pipes connected with the primary carburetors, while receiving air when required through an air manifold having a single air inlet for supplying air to all the secondary mixing chambers.

An example of charge forming device of this character is disclosed in the copending application of Fred E. Aseltine, Carl H. Kindl and Wilford H. Teeter, Serial No. 228,683, filed June 27, 1928.

In earlier charge forming devices of this character as exemplified by the above application various mixture proportioning devices have been provided to control the admission of fuel and air to the mixing chamber and it is the principal object of the present invention to provide simplified and improved means for controlling the mixture proportions under certain predetermined operating conditions which is effective to secure a more desirable proportioning of the mixture under those specific conditions than has been possible with devices heretofore known.

More specifically it is an object of the present invention to provide means which will maintain a mixture of substantially uniform proportions on opening movements of the throttle under certain operating conditions.

In earlier forms of charge forming devices of this character a dash pot is provided to temporarily retard the opening of the air valve on opening movements of the throttle to aid in enriching the mixture on acceleration. On certain opening movements of the throttle, as for instance, when the throttle is opened from closed position when the engine is running at relatively high speed, the enriching of the mixture above referred to is not desired. Therefore certain passages for the escape of fuel from below the dash pot piston have been provided which are opened to permit the piston to move relatively freely when the throttle is opened as described. It has been found that with such construction the air valve sometimes opens too much, which results in leaning the mixture near the end of its movement to such an extent as to cause the engine to miss firing. According to the present invention a passage is provided to permit escape of fuel from below the dash pot piston which results in free opening of the valve, but means are also provided, controlled by the primary throttle and operating after the throttle is opened, which close or partially close the escape passage to prevent leaning of the mixture as described.

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 vertical longitudinal section through a charge forming device according to the present invention and an intake port with which it is associated.

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

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

Fig. 4 is fragmentary elevation of certain operating connections viewed from the left in Fig. 4.

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 the

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 the 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 in the vertical wall of the nozzle near the bottom of the mixing chamber. At relatively high speeds the mixing chamber suction is enough to lift fuel from the main outlet as well as from orifices 60 and 62. At idling, or low speed operation under load, 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 mixing chambers comprise the enlarged anterior ends of primary mixture passages 64, which are parallel to each other and close together as indicated in the drawing. 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. Restrictions 66 separate the primary mixing chambers from the remainder of the mixture passages.

A single throttle valve 68, which extends across all the primary mixture passages, controls the flow therethrough and is provided with grooves 70, 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 communicates with a tube 72, 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 74, normally held against a seat 76 by a spring 78 received between the valve and a flange 80 projecting from a sleeve 82 slidably mounted on a stationary guide sleeve 84, fixed in the housing 20, and serving as a guide sleeve for the stem 86 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 an arm 88, as described in the copending application, until the upper end of sleeve 82 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 90 formed in a plate 92 secured to the housing 20, as shown in Fig. 1.

The valve 74 admits air to a main air chamber 94 from which air flows to the primary mixture passages through an orifice 96 in the floor of the air chamber and to the secondary mixing chambers through a passage 98, which connects with the inlet of the manifold 10. A manually operable throttle 100 and a suction operated valve 102, secured to shafts 101 and 103 respectively, control the flow of air through passage 98 and the operating connections for said valves are fully disclosed in the above mentioned application.

On opening of either throttle 68 or 100, the suction in the air chamber 94 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. To accomplish this result and to prevent fluttering of the valve, a dash pot is provided comprising a cylinder 106 forming part of the casting 30 and a piston 108 secured to the valve stem 86 by any conventional means such as a nut 110 threaded thereon.

In order to facilitate understanding of this invention the operation of the device on open-

ing movements of the throttles will now be very briefly described. On opening of the throttle valves the suction effective to open the air valves 74 and 102 is increased resulting in wider opening of the valves and an increased supply of air, and a pump, briefly described later and fully disclosed in the copending application above referred to, may be provided to supply additional fuel to the mixture passage for a brief period to effect enrichment of the mixture during the acceleration period. It is desirable also under normal conditions for reasons fully set forth in the above mentioned application to temporarily retard the opening of the suction operated air valves 74 and 102 when the throttles are opened, to aid in the enrichment of the mixture. To this end the dash pot previously described and another dash pot (not shown) controlling valve 102 have been provided.

Under certain operating conditions it is not desirable to accompany an opening movement of the throttle with a delayed opening of the air valves. For example when the throttles are opened after the automobile on which the carburetor is used has been coasting with throttles closed and clutch engaged, it is not desirable to enrich the mixture because the engine is already running at speed. And mixture enrichment is, therefore, not necessary to increase engine speed. Under such operating conditions it is desirable that the air valves open relatively freely when the throttles are opened and in earlier devices of the character disclosed various means have been provided to relieve the resistance of the dash pots controlling the motion of said air valves when any opening movement of the throttles is accompanied by a relatively great increase in suction effective on said valves.

One of the means for relieving the resistance of the dash pot in the manner described consists of a by-pass associated with the cylinder 106 and permitting fuel to pass from below the dash pot piston to a point above the piston under certain conditions. Means controlled by the primary throttle are provided to regulate the flow through this by-pass, in order to determine the degree to which the resistance of the dash pot is relieved. The by-pass comprises the passages 112 and 114 which connect with a larger vertical passage formed in the casting 30, and indicated in its entirety by the reference numeral 116. The passages 112, 114 and 116 are rendered effective under normal operating conditions to permit a flow of fuel from below the piston 108 back to the dash pot cylinder above said piston almost immediately after the downward movement of the piston begins, to partially relieve the dash pot of its resistance to opening movement of the air valve. Other means such as the "blowoff" valve, fully shown and described in the above mentioned copending application, may also be provided in addition to by-pass, above referred to, to relieve the dash pot of substantially all of its retarding effect under the specific operating conditions previously described if desired.

It has been found, however, that when the resistance of the dash pot is relieved, either by a by-pass alone or by the combined action of a by-pass and the above described "blow-off" valve the mixture sometimes becomes too lean, when the throttle is opened from a substantially closed position or the position it occupies during relatively low speed operation, causing the engine to miss firing at times, and also a reduction in power. It is the purpose of this invention to provide means for preventing this faulty operation of the engine by controlling the action of the previously described by-pass so as to restrict the flow therethrough to a greater degree after the throttle begins to move, and then increasing the resistance again as the throttle is opened further, thus maintaining the proportions of the mixture substantially constant during the operation described. To accomplish this result the lower portion of the passage 116 is enlarged as indicated at 118 and is adapted to receive a piston 120 which is slidable therein, a movable plug 122 being provided in the lower end of the bore to permit insertion of the piston. The piston is hollow and is provided with an orifice 124 in the wall thereof, and the orifice may be so positioned that it registers fully with the passage 112 when the piston is moved by the primary throttle to the position it occupies, when the said throttle is in closed position. It is probably preferable however, for the orifice 124 to so position that it registers only partially with the passage 112 when the throttle is in substantially closed position and does not fully register therewith, during normal operation of the vehicle on the level until the dash pot piston moves enough to uncover the passage 114. In order to operate the piston 120 by the throttle, a rod 126 which is screwed into the bottom of the piston and extends through an orifice 128 in the top of the float chamber is provided. The upper end of this rod extends through a slot 130 formed in the outer end of an arm 132 secured to a spindle 134 projecting from one end of the primary throttle. The rod is provided with a head 136 which is adapted to be engaged by the arm 132 on closing movements of the throttle to lift the piston to the position shown in Fig. 2, but the rod 126 fits loosely in the slot 130, so that on opening movements of the throttle the arm 134 has no effect on the rod, the piston moving downwardly only by action of gravity.

The piston 120 has a sliding fit in the bore 118 and fits tightly enough therein to delay its downward movement relative to the opening movement of the throttle so that said piston will move to a position to close the passage 112 after the throttle completes its opening

movement and substantially at the end of the opening movement of the air valve.

This mechanism operates substantially as follows: During the first part of the opening movement of the throttle, if the orifice 124 is so positioned as to register partially with passage 112 when the throttle is closed, the piston 120 moves to bring said orifice into full registry with the passage so that by the time the dash pot piston 108 is moved to position to open the passage 114, the orifice 124 is in the position shown in Fig. 2, of the drawing. With the parts in this position there is an unobstructed passage for fuel through the by-pass which would reduce the resistance of the dash pot too much and permit the air valve to open sufficiently to lean the mixture during the latter part of its opening, if the parts remained in this position. To prevent this action further opening movement of the throttle permits the piston 120 to restrict and finally to close the passage 112 preventing further escape of fuel from below the piston 108 through the above described by-pass. This will increase the resistance to movement of the air valve during the latter part of its opening movement substantially to the degree of resistance at the beginning of the opening of said valve and tend to prevent any leaning of the mixture.

A fuel pump such as that disclosed in the above mentioned copending application may be provided if desired, but this pump forms no part of the present invention and may be omitted so far as this invention is concerned. Briefly, this pump comprises a fuel delivery conduit 140 at its lower end to the dash pot cylinder 106 and at its upper end communicating with a fuel distributing canal 142 formed in a block 144 secured to the lower side of the main housing. The canal 142 communicates with each primary mixing chamber through one of a plurality of passages 146. Two passages 148, one of which is indicated in dotted lines in Fig. 1, admit air to the canal 142 to form an over rich mixture of fuel and air which is forced into the primary mixing chambers through the passages 146.

While a manually operated throttle 100 and suction operated valve 102 are shown in this device, the structure forming the subject matter of this invention may be incorporated in a device constructed in accordance with earlier designs than that shown herein, having only the manually operated valve in the passage 98. The presence of the suction operated valve is not essential so far as this invention be concerned.

A secondary mixing chamber is associated with each outlet branch of the manifold, one of such mixing chambers being shown herein. Each mixing chamber comprises a Venturi tube 150 clamped between the manifold and the engine block and positioned so that 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.

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, means for supplying fuel and air thereto, a throttle controlling the flow of mixture from said chamber, means for regulating the mixture ratio, said means tending to lean the mixture during a part of the opening movement of the throttle, and means effective during another part of the opening of the throttle for so controlling the action of the means for regulating the mixture ratio as to compensate for the tendency to produce a lean mixture, whereby a substantially uniform mixture is provided throughout the operating range.

2. A charge forming device for internal combustion engines comprising a mixing chamber, means for supplying fuel and air thereto, a throttle controlling the flow of mixture from said chamber, means for regulating the mixture ratio, said means tending to lean the mixture during a part of the opening movement of the throttle and means operated by the throttle during another part of its opening movement, for so controlling the action of the means for regulating the mixture ratio as to compensate for the tendency to produce a lean mixture whereby a substantially uniform mixture is provided throughout the operating range.

3. A charge forming device for internal combustion engines comprising a mixing chamber, means for supplying fuel and air thereto, a throttle controlling the flow of mixture from said chamber, an air valve controlling admission of air to said mixing chamber and adapted to open as the throttle is opened, means for retarding the opening movement of said air valve, means controlled by the air valve for reducing the resistance of said retarding means during part of the opening movement of said valve, and means controlled by the throttle for regulating the effectiveness of said last mentioned means.

4. A charge forming device for internal combustion engines comprising a mixing chamber, means for supplying fuel and air thereto, a throttle controlling the flow of mixture from said chamber, an air valve controlling admission of air to said mixing chamber and adapted to open as the throttle is opened, means for retarding the first part of the opening movement of said air valve and throttle

controlled means effective only after the valve has moved a predetermined distance for rendering said retarding means less effective.

5. A charge forming device for internal combustion engines comprising a mixing chamber, means for supplying fuel and air thereto, a throttle controlling the flow of mixture from said chamber, an air valve controlling admission of air to said mixing chamber and adapted to open as the throttle is opened, and means for controlling the opening movement of the air valve, said retarding means being so constructed that the retarding effect of said means is relatively great during the first part of the movement of said valve, but is reduced during intermediate movement of the valve and is increased during the last part of said movement.

6. A charge forming device for internal combustion engines comprising a mixing chamber, means for supplying fuel and air thereto, a throttle controlling the flow of mixture from said chamber, an air valve controlling admission of air to said mixing chamber and adapted to open as the throttle is opened, means for retarding the initial opening movement of the air valve, throttle controlled means for rendering said retarding means less effective during the intermediate movement of the throttle and for increasing the retarding effect of said means during final movement of the throttle.

7. A charge forming device for internal combustion engines comprising a mixing chamber, means for supplying fuel and air thereto, a throttle controlling the flow of mixture from said chamber, an air valve controlling admission of air to said mixing chamber and adapted to open as the throttle is opened, a dash pot for retarding the opening movements of the air valve, and means controlled by the air valve for automatically reducing the retarding effect of said dash pot during operation of the air valve under certain operating conditions and means controlled by the throttle for regulating the effectiveness of said last mentioned means.

8. A charge forming device for internal combustion engines comprising a mixing chamber, means for supplying fuel and air thereto, a throttle controlling the flow of mixture from said chamber, an air valve controlling admission of air to said mixing chamber and adapted to open as the throttle is opened, a dash pot for retarding the opening movements of the air valve, a by-pass from one side of the dash pot piston to the other side thereof for controlling the retarding effect of said dash pot, and means for variably regulating the effectiveness of the by-pass during the movement of the throttle.

9. A charge forming device for internal combustion engines comprising a mixing chamber, means for supplying fuel and air thereto, a throttle controlling the flow of mixture from said chamber, an air valve controlling admission of air to said mixing chamber and adapted to open as the throttle is opened, a dash pot for retarding the opening movements of the air valve, a by-pass from one side of the dash pot piston to the other side thereof for controlling the retarding effect of said dash pot and means controlled by the throttle for variably regulating the effectiveness of the by-pass during the movement of the throttle.

10. A charge forming device for internal combustion engines comprising a mixing chamber, means for supplying fuel and air thereto, a throttle controlling the flow of mixture from said chamber, an air valve controlling admission of air to said mixing chamber and adapted to open as the throttle is opened, a dash pot for retarding the opening movements of the air valve, a by-pass adapted to be opened after a predetermined movement of said air valve to reduce the effectiveness of the dash pot and means independent of the dash pot for subsequently closing the by-pass to increase the effect of the retarding means after a further opening movement of said air valve.

11. A charge forming device for internal combustion engines comprising a mixing chamber, means for supplying fuel and air thereto, a throttle controlling the flow of mixture from said chamber, an air valve controlling admission of air to said mixing chamber and adapted to open as the throttle is opened, a dash pot for retarding the opening movements of the air valve, a by-pass adapted to be opened after a predetermined movement of said air valve to reduce the effectiveness of the dash pot and means controlled by the throttle for subsequently closing the by-pass to again increase the effect of the retarding means after a further opening movement of the air valve.

12. A charge forming device for internal combustion engines comprising a mixing chamber, means for supplying fuel and air thereto, a throttle controlling the flow of mixture from said chamber, an air valve controlling admission of air to said mixing chamber and adapted to open as the throttle is opened, a dash pot for retarding the opening movements of the air valve, a by-pass for reducing the retarding effect of said dash pot comprising passages communicating with the dash pot cylinder and an auxiliary cylinder, and a piston slidable in said auxiliary cylinder to vary the area of the by-pass during movement of the throttle between its fully closed and its fully open position.

13. A charge forming device for internal combustion engines comprising a mixing chamber, means for supplying fuel and air thereto, a throttle controlling the flow of mixture from said chamber, an air valve con-

trolling admission of air to said mixing chamber and adapted to open as the throttle is opened, a dash pot for retarding the opening movements of the air valve, a by-pass for reducing the retarding effect of said dash pot comprising passages communicating with the dash pot cylinder and an auxiliary cylinder, a piston slidable in said auxiliary cylinder to vary the area of the by-pass and means for operating said piston from the throttle during movement of the throttle between its fully closed and open position.

14. A charge forming device for internal combination engines comprising a secondary mixing chamber, a primary carburetor for supplying a primary mixture to said secondary mixing chamber, means for supplying fuel and air thereto, a primary throttle associated with said primary carburetor, a secondary throttle controlling the flow through the secondary mixing chambers, an air valve controlling admission of air, means for retarding the opening movement of the air valve, means for varying the retarding effect of said retarding means and means controlled by the primary throttle for controlling said last mentioned means.

15. A charge forming device for internal combustion engines comprising a plurality of secondary mixing chambers, a plurality of primary carburetors for supplying primary mixture thereto, means for supplying fuel and air thereto, a primary throttle associated with all of said primary carburetors, a secondary throttle controlling the flow through all of said secondary mixing chambers, an air valve controlling admission of air to all of said secondary mixing chambers, means for retarding the opening movement of said valve and means controlled by the primary throttle for regulating the effectiveness of said retarding means.

16. A charge forming device for internal combustion engines comprising a mixing chamber, means for supplying fuel and air thereto, a throttle controlling the flow of mixture from said chamber, an air valve controlling admission of air to said mixing chamber and adapted to open as the throttle is opened, means for controlling the operation of the air valve, means controlled by the throttle for regulating the effectiveness of said controlling means and means whereby the operation of said throttle controlled means is delayed with respect to operation of the throttle.

17. A charge forming device for internal combustion engines comprising a mixing chamber, means for supplying fuel and air thereto, a throttle controlling the flow of mixture from said chamber, an air valve controlling admission of air to said mixing chamber and adapted to open as the throttle is opened, fluid pressure means for retardingly resisting all opening movements of the air valve under all operating conditions, means for varying the effect of said retarding means, and means operated by movements of the throttle for regulating the action of said last mentioned means.

18. A charge forming device for internal combustion engines comprising a mixing chamber, means for supplying fuel and air thereto, a throttle controlling the flow of mixture from said chamber, an air valve controlling admission of air to said mixing chamber and adapted to open as the throttle is opened, a dash pot for retardingly resisting all opening movements of said air valve under all operating conditions, means for varying the resistance of said dash pot, and means operated by movement of the throttle for regulating the effect of said last mentioned means.

In testimony whereof I hereto affix my signature.

FRED E. ASELTINE.