Oct. 24, 1933. F. E. ASELTINE 1,931,599

CHARGE FORMING DEVICE

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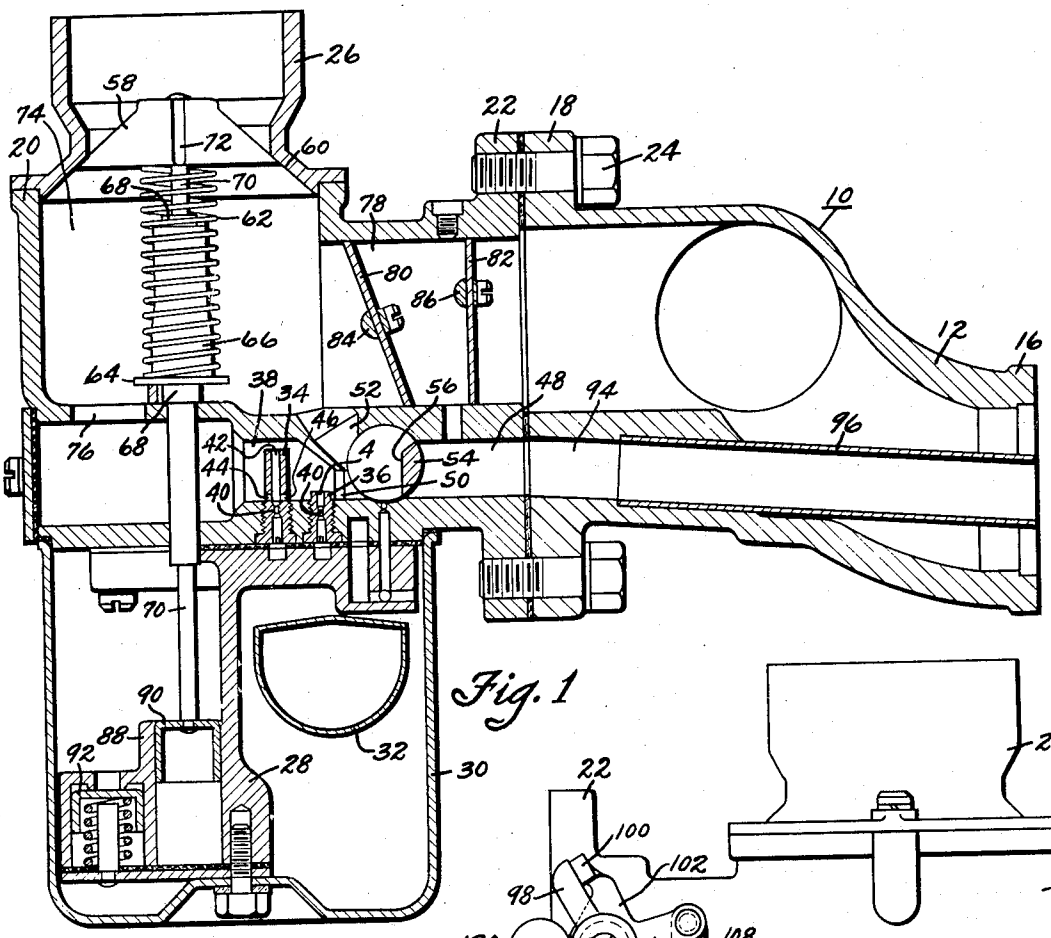


Fig. 1

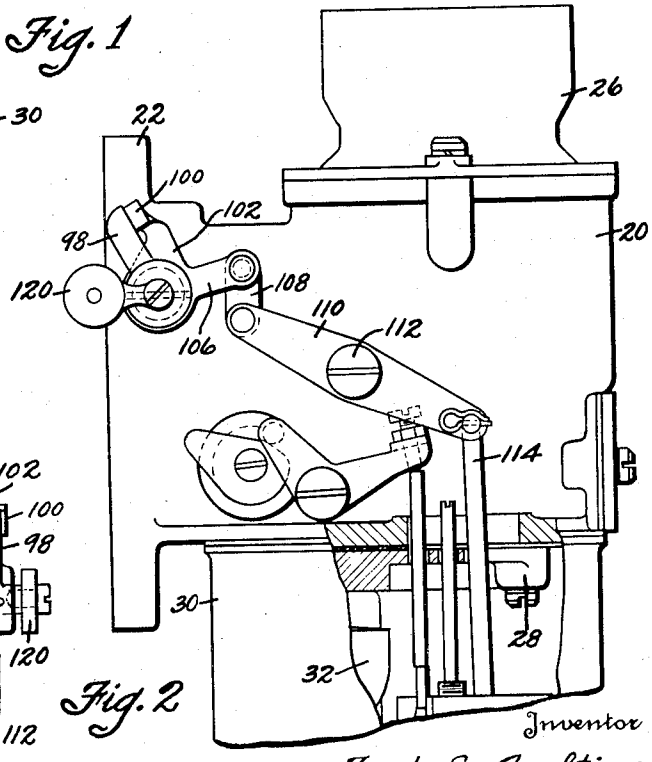


Fig. 2

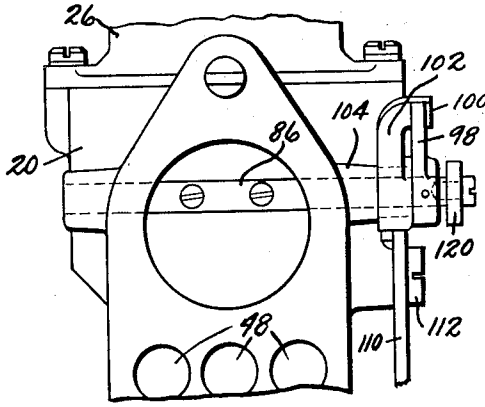


Fig. 3

Inventor

Fred E. Aseltine

By Spencer, Hardman & Fehr

His Attorneys

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CHARGE FORMING DEVICE

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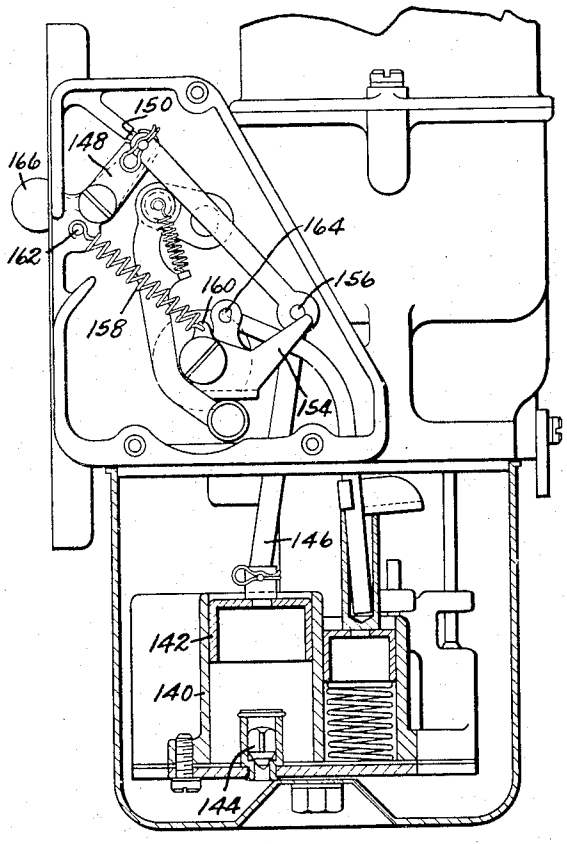


Fig. 5

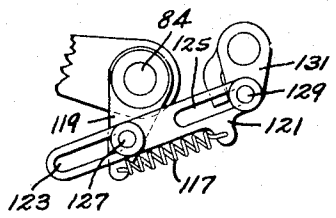


Fig. 7

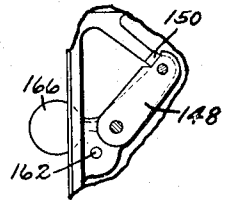


Fig. 8

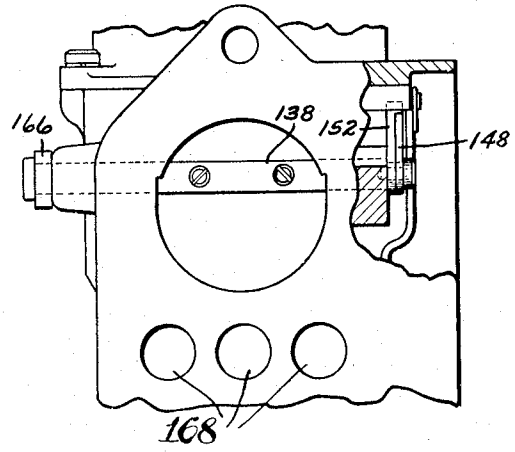


Fig. 6

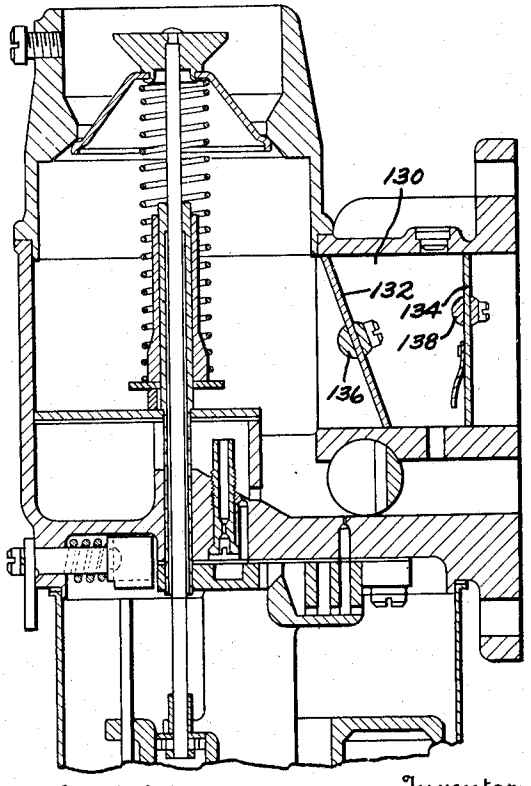


Fig. 4

Inventor

Fred E. Aseltine

By Spencer, Hardman & Fehr

His Attorneys

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CHARGE FORMING DEVICE

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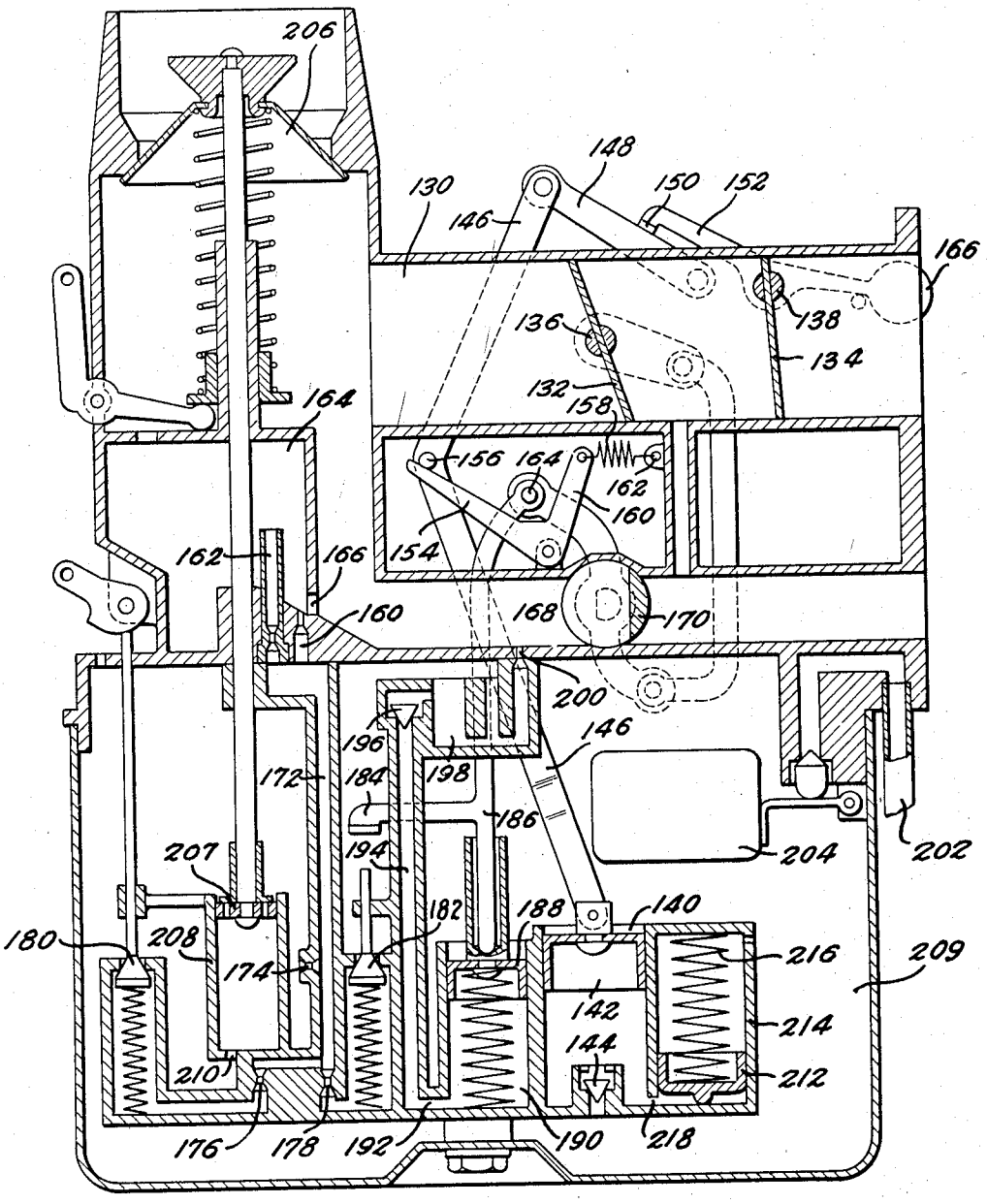


Fig. 9.

INVENTOR
Fred E. Aseltine
BY Spencer Hardman and Fehr
ATTORNEYS

Patented Oct. 24, 1933 1,931,599

UNITED STATES PATENT OFFICE

1,931,599

CHARGE FORMING DEVICE

Fred E. Aseltine, Dayton, Ohio, assignor to Delco Products Corporation, Dayton, Ohio, a corporation of Delaware

Application May 23, 1930. Serial No. 454,914

12 Claims. (Cl. 261—47)

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 fuel and air to one of a plurality of secondary mixing chambers located adjacent to the engine intake ports and in which the primary mixture is mixed with additional air under certain operating conditions.

Devices of this character are shown in the copending application of Fred E. Aseltine et al, Serial Nos. 360,404 and 370,179, filed May 4, 1929 and June 12, 1929 respectively. This invention is shown herein as embodied in both of these devices, since its action is somewhat different in the different constructions.

It is the general object of the present invention to provide means for controlling the admission of secondary air so as to restrict the amount of air supplied through the secondary air passage under all operating conditions in accordance with the engine suction.

More specifically it is an object of the invention to provide devices for controlling the movement of the secondary air valve which are effective to permit the movement of the valve toward open position by suction of the engine, are effective under certain operating conditions to move the valve toward closed position to a degree determined by the suction of the engine and under other operating conditions are effective to close the valve as the throttle is closed.

These objects are accomplished according to the present invention by the provision of means operated by the throttle for closing the valve mechanically as the throttle is closed, the provision of a valve which is operable entirely by engine suction on its opening movements and the provision of a weight for moving the valve toward closed position on reduction of engine suction, while the throttle remains in fixed position, to a position where the engine suction balances the effect of the weight.

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

In the drawings:

Fig. 1 is a vertical section through the carburetor unit and one outlet branch of the manifold.

Fig. 2 is a left side elevation of the carburetor unit partly broken away to show certain parts in section.

Fig. 3 is a fragmentary elevation of the carburetor unit viewed from the left in Fig. 2.

Figs. 4, 5 and 6 are views similar to Figs. 1, 2 and 3 respectively showing the invention embodied in a modified form of carburetor.

Fig. 7 is a detail view of a valve operating connection embodied in the form of device shown in Figs. 1 to 3.

Fig. 8 is a detail view of part of the device shown in Figs. 4 to 6.

Fig. 9 is a diagrammatic view of the device shown in Figs. 4 to 8 inclusive.

The device disclosed in Figs. 1 to 3 and 7 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 of a multi-cylinder engine and each is provided with an attaching flange 16 for securing the manifold to the engine block in the usual way, while adjacent its inlet the manifold is provided with a flange 18 to which the main carburetor unit is adapted to be secured as shown in Fig. 1.

The carburetor unit comprises a main housing 20, having a flange 22, adapted to be secured to the flange 18 by screws 24. An air inlet coupling 26 is secured in an opening in the top of the housing by any suitable means and may be connected to an air cleaner if desired. A casting 28, in which the passages supplying fuel to the nozzles are formed, is secured in any desirable manner to the bottom of the main housing and a fuel bowl 30 is held tight against the bottom of said housing by any suitable means. Fuel is supplied to the bowl by means not shown, and a float 32 maintains a substantially constant level of fuel therein in the usual way.

Two fuel nozzles 34 and 36 are provided in each primary mixing chamber 38, the structure of which is more fully described later. The nozzle 34 supplies all of the fuel at idling and relatively low speed operation, and a part of the fuel at all other times while the nozzle 36 is ineffective until the throttle has been opened a considerable distance and the engine is running at relatively high speed. The nozzles are supplied with fuel through separate fuel pasages, that supplying the nozzles 36 being closed at relative low speed operation. The fuel nozzles, the passages supplying fuel thereto and means for controlling the flow therefrom are fully shown and described in the earlier of the above applications, such structure forming no part of this invention.

Both nozzles 34 and 36 are provided with restrictions 40 to regulate the flow therethrough.

Each low speed fuel nozzle is provided with a main fuel outlet 42 in the top of the nozzle and a secondary fuel outlet comprising two orifices 44 and 46 in the wall of the nozzle near the bottom of the mixing chamber, said nozzles functioning in the manner set forth in application 360,404.

The primary mixing chambers form the enlarged inlet ends of primary mixture passages 48 which are parallel and close together. When the carburetor is secured to the manifold these passages register with primary mixture conduits which convey the primary mixture to the secondary mixing chambers. Restrictions 50 separate the mixing chambers from the remainder of the primary mixture passages, and passages 52 admit air immediately posterior to the restrictions to reduce the velocity of flow past the nozzles, all of this structure being fully described in application 360,404.

A single primary throttle valve 54 operated in a manner briefly described hereinafter extends across all of the primary mixture passages to control the flow therethrough, and is provided with grooves 56 which register with such passages.

Air entering the carburetor is supplied through the coupling 26 and is controlled by a main air valve 58 normally held against a seat 60, by a spring 62 received between the valve and a flange 64 projecting from a sleeve 66, slidably mounted on a stationary sleeve 68, fixed in the main housing and guiding the air valve stem 70. In order to choke the carburetor to facilitate starting, the valve may be lifted by means, (not shown) until the sleeve 66 engages the air valve to hold it closed. Air to carry the starting fuel to the intake ports is admitted through slots 72 in the top of the air valve.

The valve 58 admits air to an air chamber 74 from which it flows to the primary mixing chambers through an opening 76 in the bottom of the chamber and to the secondary mixing chambers through a passage 78 leading to the manifold inlet, and controlled by manually operated valves 80 and 82, secured to shafts 84 and 86 respectively mounted in the main housing, the valve 80 being hereinafter termed a "secondary throttle", for convenience.

The operating means for the primary and secondary throttles forms no part of this invention and is not illustrated herein, but the mode of operation of the throttles will now be briefly set forth in order to enable a better understanding of the operation of the whole device. The secondary throttle is operated by the primary throttle through the medium of operating mechanism which permits certain independent movement of the primary throttle and is generally designed to permit the primary throttle to move independently of the secondary until it reaches a position corresponding to a vehicular speed of approximately 15–20 miles per hour on a level. On further opening of the primary throttle the secondary throttle is moved therewith.

On any increase of suction in the air chamber 74 the air valve 58 is opened to admit more air and the opening of this valve is retarded to prevent fluttering thereof and the admission of sufficient air to temporarily lean the mixture. For this purpose there is provided a dash pot comprising a cylinder 88 and a piston 90 on the end of the air valve stem, and slidable in the cylinder. The cylinder is filled with fuel by leakage around the piston and the resistance of the dash pot is controlled by an auxiliary piston 92 in the manner fully described in application 360,404. However, the structural details of the dash pot are not material to the present invention and any conventional dash pot may be employed.

As previously stated the primary mixture passages communicate, when the device is assembled, with conduits formed in the manifold. The middle one of these conduits is shown herein and comprises a straight passage 94 in the manifold casting in which is received a tube 96 which extends through the branch 12 of the manifold. The conduits supplying primary mixture to the two end branches of the manifold are of the form shown in the earlier application.

The valve 82 is opened, on opening of the valve 80, as in the earlier application, entirely by engine suction and the opening movement of the valve is temporarily retarded for the same purpose, this being to retard the flow of pure air through the secondary air passage while increasing the velocity of flow through the primary mixture passages in order to facilitate enrichment of the mixture during the acceleration period, as fully described in application 360,404.

According to the present invention the connection between the valve 82 and its retarding means is of somewhat different construction than in application 360,404, and comprises an arm 98 secured to one end of the shaft 86 and normally occupying the position shown in Fig. 2, when the secondary throttle 80 is closed. In this position it is engaged by a toe 100, offset laterally from a bell crank lever 102, rotatably mounted on a boss 104 projecting from the main housing and in which the shaft 86 is journalled. The bell crank lever has an arm 106 which is pivotally connected to a short link 108 pivotally connected to a lever 110 pivoted on a pin 112 screwed into the main housing and connected at its opposite end to a rod 114. This rod extends to a piston (not shown) which is slidable in a dash pot cylinder 116, the top of which is shown in Fig. 2. The dash pot is of exactly the same construction as that of the application 360,404, and in order to simplify this disclosure as much as possible has not been shown herein.

Normally, when the valve 80 is closed the valve 82 is held closed by a spring 117, connected at one end to an arm 119, secured to the opposite end of shaft 84 and at its other end to a link 121 having slots 123 and 125 therein through which project pins 127 and 129, extending from the arm 119 and an arm 131 secured to the end of shaft 86, respectively. This construction is shown in Fig. 7 and the parts are held in the position shown therein, when the throttle is closed. In this position the spring 117 is tensioned and through the medium of the link 121, pulls the arm 131 to the left to move the valve 82 in a clockwise direction to closed position. On opening movement of the throttle the arm 119 is moved counter-clockwise relieving the tension of spring 117 and permitting the valve 82 to open under influence of engine suction, while on closing movement of the throttle, the clockwise movement of arm 119 again tensions the spring to effect closing of the valve 82, all as fully set forth in application 360,404.

It will be obvious that on any opening of the valve 82, the arm 98 is moved in a clockwise direction in Fig. 2, and through the various con-

nections extending to the dash pot piston, the latter is lifted until the valve assumes the position determined by the suction. If the throttle 80 be opened wide, and the engine be operating at high speed, the valve 82 will occupy a substantially horizontal position. If, however, the load is increased, as when the vehicle on which the device is employed ascends a hill, the engine speed is decreased with a corresponding decrease in suction. Under such conditions the auxiliary air valve 82 will tend to move toward closed position. In the device disclosed in application 360,404, when the valve 82 is positively connected to the dash pot piston there is nothing to close the valve under these conditions other than the effect of gravity on the parts and this movement is very slow because of the action of the dash pot, the closing spring being ineffective because the throttle remains fixed in wide open position.

According to this invention the valve is not directly connected to the dash pot piston so its closing movement on decrease of suction, is not affected by the piston, and means are provided to move the valve relatively rapidly to the position determined by the engine suction. This means comprises a weight 120 which is secured to the shaft 86 and extends substantially horizontally therefrom, when the valve is in closed position, as in Fig. 2, so that the greatest effect of the weight is had when the valve nears its closed position and the suction effective on the valve is relatively low. This weight causes the valve to float in the air stream and when the throttle is in fixed position, causes the valve to take different positions in accordance with the suction effective on the valve, and to move to such positions relatively rapidly as the suction changes. On such movements of the valve 82, the dash pot piston and connected parts move slowly until the arm 98 engages this arm 100. On closing movements of the throttle 80, the valve is closed by the closing spring as in the earlier device, while the dash pot piston and associated parts are moved to normal position as previously described.

It was found that in the device shown in application 360,404, insufficient restriction to the admission of secondary air might occur temporarily on operation at heavy load with wide open throttle, resulting at times in too low suction at the fuel jets in the primary mixture passages and a temporarily insufficient supply of fuel. This invention is effective to produce at all times the proper degree of restriction on the flow of secondary air, to form a mixture of correct proportions under all operating conditions.

The construction of the secondary mixing chambers and other elements of this device, which have not been shown and described herein are substantially the same as in the earlier application and no further illustration is thought necessary.

In the device shown in the later application 370,179, the piston of the dash pot which controls motion of the auxiliary air valve is moved downwardly when the valve is opened. Consequently, on decrease of suction in the secondary air passage under such operating conditions as previously referred to, the auxiliary air valve will not close at all being held open by the weight of the dash pot piston and connected parts. The above described weight for closing the auxiliary valve is therefore even more useful in the later form of charge forming device than the earlier and its application thereto is shown in Figs. 4, 5, 6 and 8. For the purpose of simplifying the disclosure as much as possible, the specific construction of this later device will not be incorporated herein except those parts immediately associated with the present invention.

In the device shown in Figs. 4, 5, 6 and 8 the secondary air passage is indicated at 130 and is controlled by a secondary throttle 132 and a suction operated valve 134 secured to shafts 136 and 138 respectively journalled in the main housing. The opening movement of the valve 134 is retarded by a dash pot comprising a cylinder 140 and a piston 142 slidable therein, a check valve 144 operating to prevent escape of fuel from the cylinder on opening of the valve but permitting a free return movement of the dash pot piston. The piston 142 is pivotally connected to a link 146 which at its upper end is pivotally connected to an arm 148, which, in the device shown in application 370,179 was secured to the shaft 138 on which the auxiliary valve is mounted. According to this invention the arm 148 is pivotally mounted on the shaft 138 and is adapted to be engaged by a toe 150 projecting laterally from an arm 152 secured to the shaft 138 adjacent the arm 148. On opening movements of the auxiliary valve the toe 150 engages the arm 148 to move the dash pot piston downwardly, the opening of the valve thus being retarded by the dash pot. The valve 134, however, may move toward closed position without having any effect on the dash pot piston as the toe 150 will merely move away from the arm 138.

The parts are normally held in the position shown in Fig. 5, when the throttle is closed. In this position a pivoted arm 154 is held in engagement with a pin 156 projecting from the link 146 by a spring 158, one end of which is connected to an ear 160 projecting from the arm 154 and the other to a pin 162 projecting from the main housing. On opening of the throttle a pin 164 is moved into engagement with the arm 154 and then moves said arm out of engagement with the pin 156 to permit the valve 134 to be opened by engine suction in the manner fully described in application 370,179. On closing movement of the throttle the pin 164 is restored to normal position and the spring 158 operates to close the auxiliary air valve through the medium of the arm 154 and pin 156. If, however, the throttle and the valve are wide open and an increase of load occurs, a decrease in suction is produced and the auxiliary air valve should close to an extent determined by the reduction in suction. With the structure disclosed in application 370,179 this was impossible because nothing was provided to close the valve and the weight of the dash pot piston and connected parts would operate to hold the valve wide open, resulting in unsatisfactory engine operation under such circumstances. According to this invention a weight 166 is provided to close the valve 134 to a position where the weight is balanced by the suction whenever there is an increase of load while the throttle remains in fixed position. This weight is adjustably secured to the opposite end of the shaft from that shown in Fig. 5, in any desirable way, and whenever the suction falls is effective to move the valve toward closed position without disturbing the position of the dash pot piston or connected parts, because under such circumstances the toe 150 is merely moved away from the arm 148, which with the dash pot piston and other connected parts remain stationary as long as the trottle is not

moved. The auxiliary air valve is thus moved to a position under all operating conditions which is dependent upon the engine and at all times restricts the admission of air to a degree determined by that suction.

Fig. 9 is a diagrammatic view of the device shown in Figs. 4 to 8 inclusive, and is provided primarily to show the arrangement of the fuel passages which supply fuel to the mixing chambers, for normal operation and during acceleration, the throttle, air valves and the operating connections therefor and the dash pots which control such air valves. The structure disclosed is very briefly described hereinafter, merely to facilitate an understanding of the general construction and operation of the device.

A plurality of fuel inlets 160 and 162 are provided and supply fuel to each one of three chambers 164 in which an emulsion of fuel and air is formed, the emulsion passing through orifices 166 into angular primary mixture passages 168, there being three of these passages as shown in Fig. 6 and all of such passages are controlled by a primary throttle 170. A fuel passage 172 having a constantly open low speed fuel inlet 174 and two high speed fuel inlets 176 and 178, the effectiveness of which is controlled by valves 180 and 182 respectively, the valve 180 being manually operated and the valve 182 being operated by an arm 184 projecting from a rod 186 connected to the primary throttle for operation therewith and adapted to operate a pump piston 188 for supplying fuel during the acceleration period and more fully described hereinafter.

The pump piston 188 as it moves downwardly expels fuel from a cylinder 190 in which the piston slides through a passage 192 connecting with a vertical passage 194 controlled by a check valve 196 and delivering fuel to an auxiliary fuel reservoir 198, open to the air in the space above the fuel in the float chamber 201. Fuel is supplied from this auxiliary reservoir to the primary mixture passages through orifices 200 in the floor of such passages, one of such outlets being shown in Fig. 9. Fuel is supplied to the float chamber by a conduit 202 and its flow is controlled by a float 204 in the usual way.

An air valve 206 corresponding to the valve 58 of Fig. 1 has a dash pot piston 207 secured to the lower end of the stem on which the valve is mounted, such piston sliding in a cylinder 208 to which fuel is admitted through orifice 210. Opening of the secondary or auxiliary air valve 134 causes downward movement of the piston 142, as previously described. Movement of this piston is resisted by the piston 212 slidable in the cylinder 214 and normally retained in the bottom of such cylinder by the spring 216, an orifice 218 permitting a flow of fuel from the cylinder 140 into the cylinder 214. After movement of the piston 142 ceases, the piston 212 is moved by the spring 216 to the position shown in the drawings so that any subsequent opening of the valve 134 is resisted in the same manner and to the same degree.

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 multicylinder engines, comprising a mixture passage, means for supplying fuel and air thereto, a throttle, an auxiliary air valve for controlling admission of air to said mixture passage, said valve being operated by engine suction on opening movements of said throttle, means controlled by the throttle for closing the valve as the throttle is closed and other means for moving the valve toward closed position while the throttle remains stationary, said additional closing means being so constructed that the closing force exerted thereby on the valve is entirely independent of the position of the throttle.

2. A charge forming device for multicylinder engines, comprising a mixture passage, means for supplying fuel and air thereto, a throttle, an auxiliary air valve for controlling admission of air to said mixture passage, said valve being operated by engine suction on opening movements of said throttle, means controlled by the throttle for closing the valve and other means operated automatically to move said valve toward closed position under certain operating conditions, said automatically operated means being constructed to exert a closing force on the valve which is independent of the position of the throttle controlled means whereby the closing effect of said automatically operated means may be constant while the position of the throttle controlled means varies or may be variable while the throttle controlled means remains in fixed position.

3. A charge forming device for multicylinder engines, comprising a mixture passage, means for supplying fuel and air thereto, a throttle, an auxiliary air valve for controlling admission of air to said mixture passage, said valve being operated by engine suction on opening movements of said throttle, manually operable means for closing the valve, and gravity actuated means operable under certain operating conditions for moving the valve toward closed position, said gravity actuated means being so constructed that the closing force exerted thereby is entirely independent of the position of the manually operated closing means.

4. A charge forming device for internal combustion engines comprising a secondary mixing chamber, a primary carbureting means adapted to deliver a primary mixture of fuel and air to said secondary mixing chamber, a secondary air passage supplying air to said secondary mixing chamber, a suction operated valve in said secondary air passage for controlling the flow therethrough, a spring for normally closing said valve, manually operable means for preventing the closing of said valve by the spring, and other means independent of the spring and said manually operable means for closing said valve under certain operating conditions.

5. A charge forming device for internal combustion engines comprising a secondary mixing chamber, a primary carbureting means adapted to deliver a primary mixture of fuel and air to said secondary mixing chamber, a secondary air passage supplying air to said secondary mixing chamber, a main air valve controlling the admission of air to both said primary carbureting means and secondary mixing chamber, a suction operated valve in said secondary air passage for controlling the flow therethrough, and gravity operated means operable to move said last mentioned valve toward closed position to a degree determined by the engine suction.

6. A charge forming device for internal combustion engines comprising a mixture passage, means for supplying fuel and air thereto, a throttle, an auxiliary air valve controlling admission of air to said mixture passage and adapted to be

opened on opening movements of the throttle, a dash pot for retarding opening movements of said auxiliary air valve but constructed to exert no closing effect on said valve and a weight operable to move said air valve toward closed position independently of the dash pot.

7. A charge forming device for internal combustion engines comprising a mixture passage, means for supplying fuel and air thereto, a throttle, an auxiliary air valve controlling admission of air to said mixture passage and adapted to be opened on opening movements of the throttle, a dash pot for retarding opening movements of said auxiliary air valve but constructed to exert no closing effect on said valve, an arm secured to the shaft of said valve and having a one way connection with the dash pot piston whereby the valve is permitted to move toward closed position independently of the dash pot, and a weight secured to the valve shaft and adapted to move the valve toward closed position.

8. A charge forming device for internal combustion engines comprising a secondary mixing chamber, a primary carbureting means adapted to deliver a primary mixture of fuel and air to said secondary mixing chamber, a secondary air passage supplying air to said secondary mixing chamber, a main air valve controlling the admission of air to both said primary carbureting means and secondary mixing chamber, manually and suction operated valves in said secondary air passage for controlling the flow of air therethrough and gravity operated means for moving the suction operated valve toward closed position under certain operating conditions independently of the position of the manually operable valve.

9. A charge forming device for multicylinder engines, comprising a mixture passage, means for supplying fuel and air thereto, a throttle, an auxiliary air valve for controlling admission of air to said mixture passage, said valve being operated by engine suction on opening movements of said throttle, means controlled by the throttle for closing the valve as the throttle is closed, means operable on reduction of engine suction to move the valve toward closed position while the throttle remains stationary and constructed so as to exert the same closing force in any one position of the valve, irrespective of the position of the throttle.

10. A charge forming device for multicylinder engines, comprising a mixture passage, means for supplying fuel and air thereto, a throttle, an auxiliary air valve for controlling admission of air to said mixture passage, said valve being operated by engine suction on opening movements of said throttle, means controlled by the throttle for closing the valve as the throttle is closed, means operable on reduction of engine suction to move the valve toward closed position while the throttle remains stationary and constructed to exert a progressively increasing closing force as the valve moves toward closed position.

11. A charge forming device for multicylinder engines, comprising a mixture passage, means for supplying fuel and air thereto, a throttle, an auxiliary air valve for controlling admission of air to said mixture passage, said valve being operated by engine suction on opening movements of said throttle, means controlled by the throttle for closing the valve as the throttle is closed, means operable on reduction of engine suction to move the valve toward closed position while the throttle remains stationary, said means comprising a weighted arm movable with the valve and adapted to be moved from a position in which it extends in a substantially horizontal plane when the valve is closed toward a position in a vertical plane as the valve opens, whereby the closing force exerted by the weight decreases as the valve moves toward open position.

12. A charge forming device for internal combustion engines comprising a mixture passage, means for supplying fuel and air thereto, a suction operated auxiliary air valve for admitting air to the mixture passage, a spring for normally holding said valve closed, a throttle for controlling the flow through the mixture passage, means operable by the throttle as it is opened to prevent the spring from holding the valve closed when the throttle is not in closed position, and other means operable independently of the spring and the throttle for moving the valve toward closed position under certain operating conditions.

FRED E. ASELTINE.