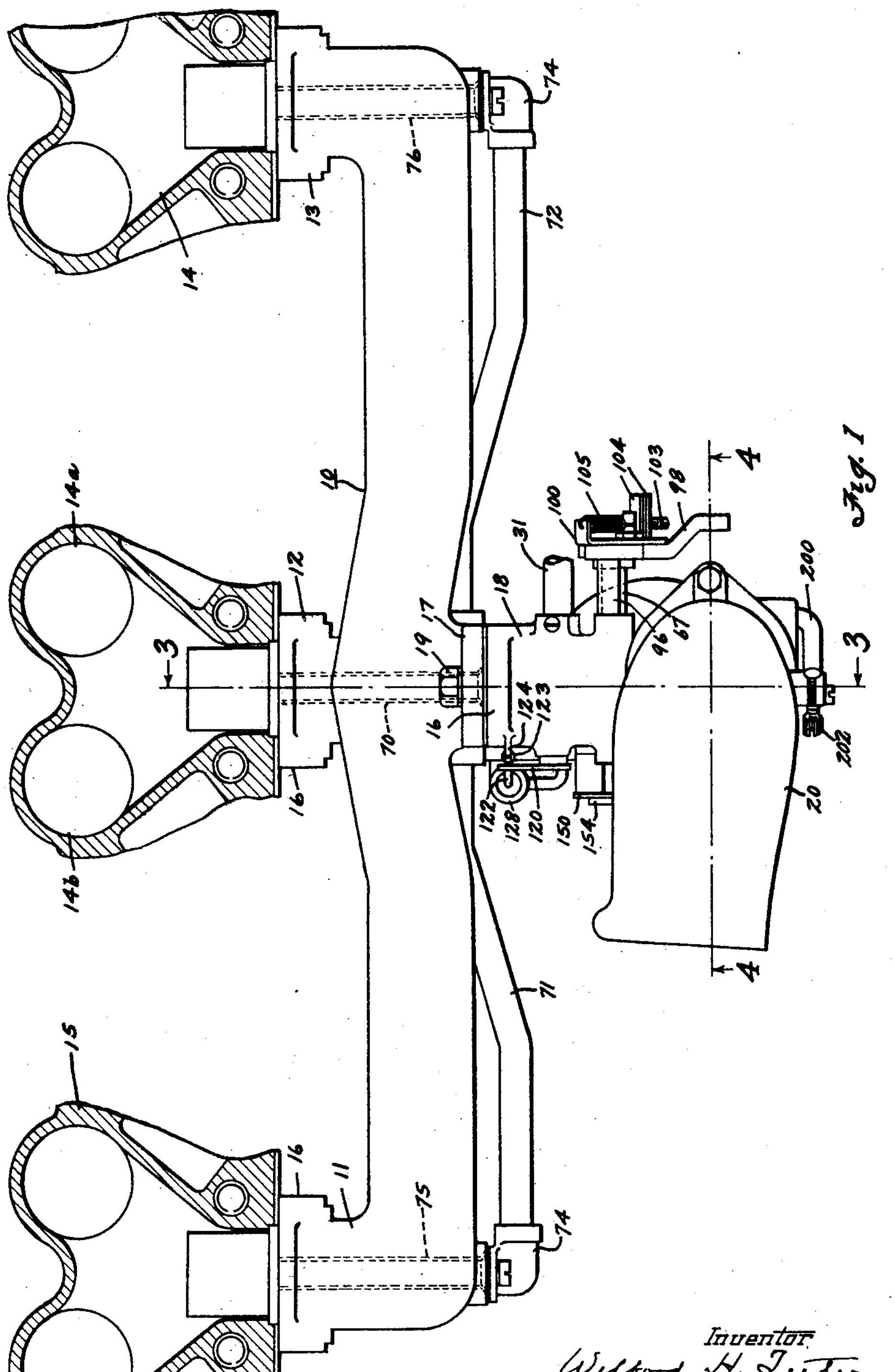
Oct. 18, 1932. W. H. TEETER 1,883,096

CHARGE FORMING DEVICE

Filed July 17, 1928 4 Sheets-Sheet 1

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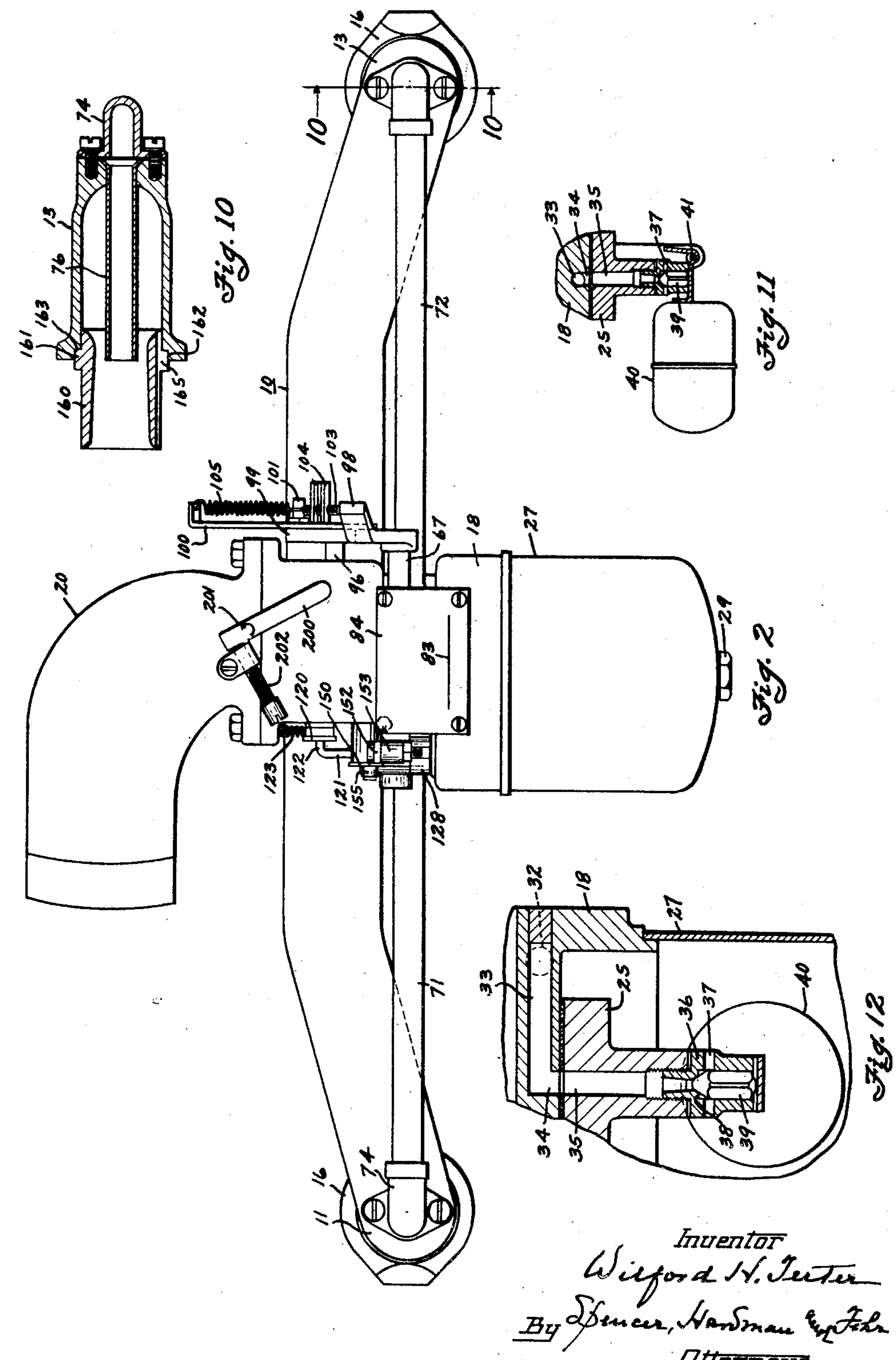


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CHARGE FORMING DEVICE

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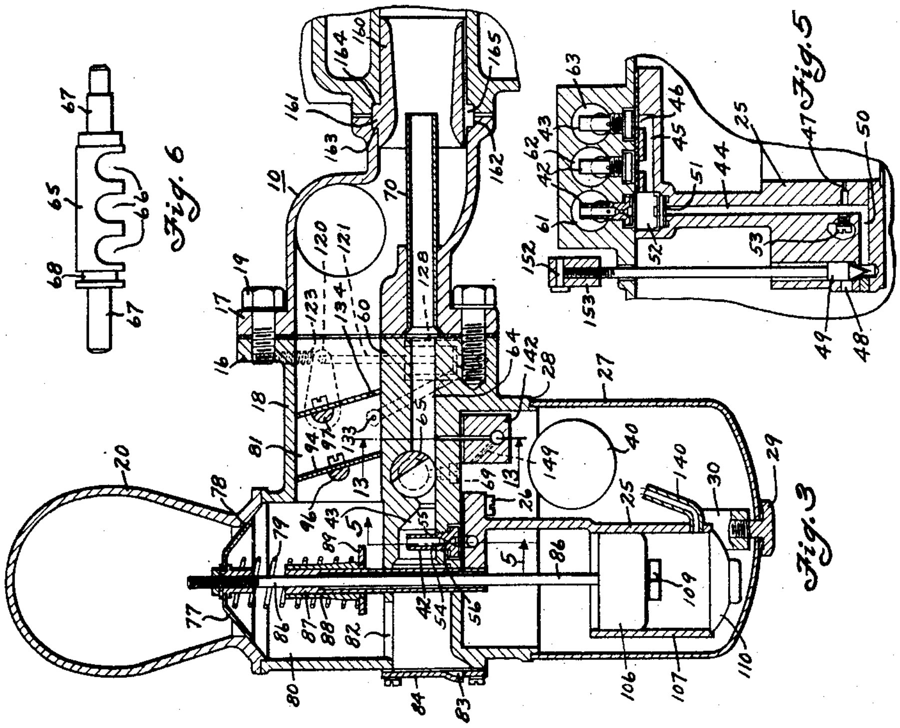
Fig. 6

Fig. 3

Fig. 5

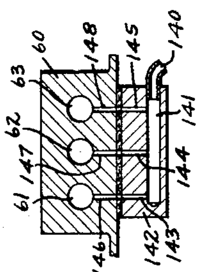
Fig. 13

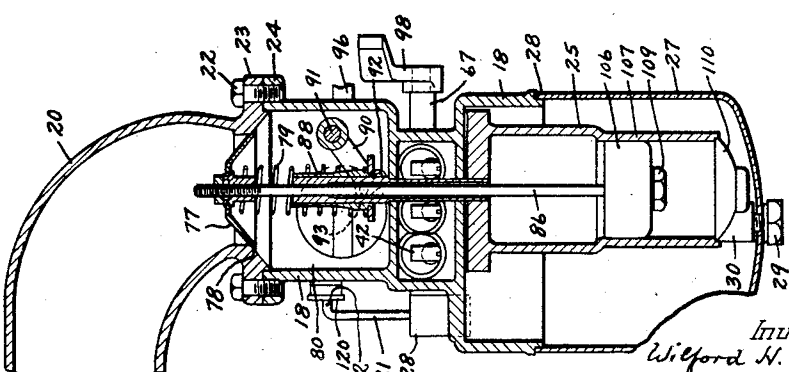
Fig. 4

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CHARGE FORMING DEVICE

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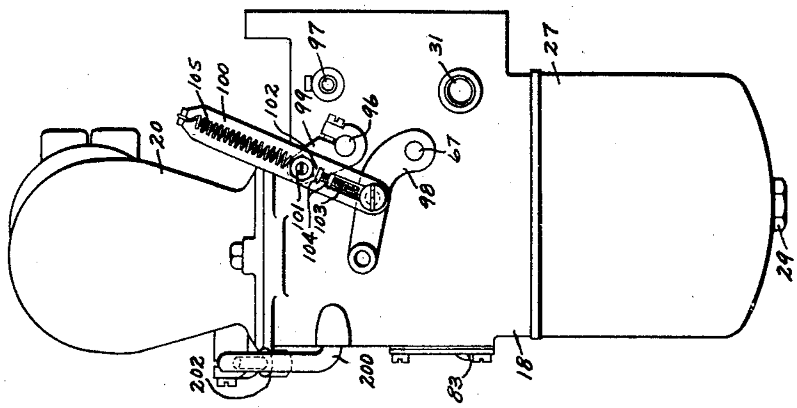

Fig. 7

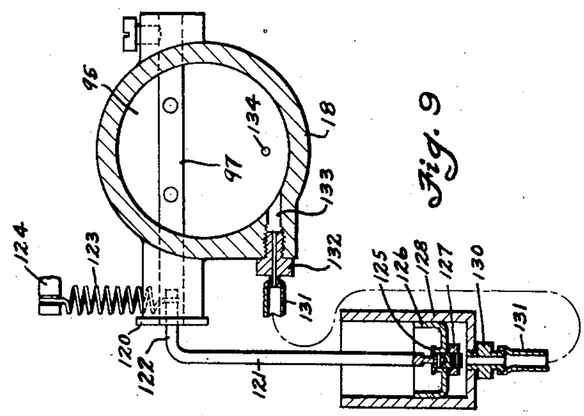

Fig. 9

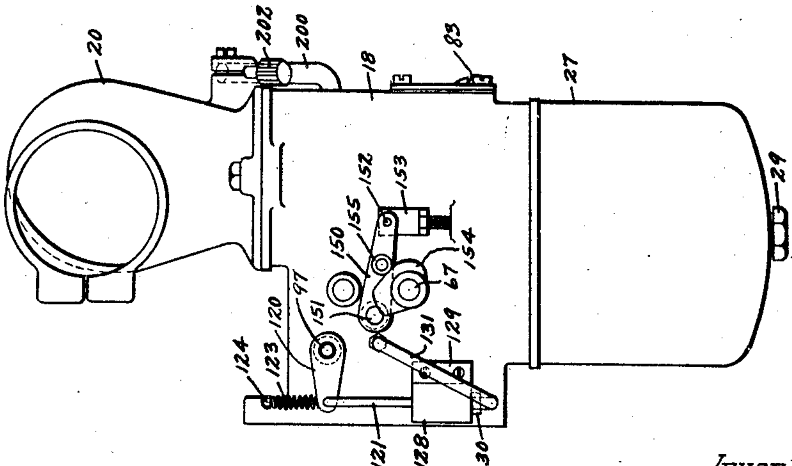

Fig. 8

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1,883,096

# UNITED STATES PATENT OFFICE

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## CHARGE FORMING DEVICE

Application filed July 17, 1928. Serial No. 293,423.

This invention relates to charge forming devices for internal combustion engines, and more particularly to that type of charge forming device which comprises a plurality of primary carburetors for supplying a primary mixture of fuel and air to a plurality of secondary carburetors located adjacent the engine intake ports and to which additional air may be supplied under certain operating conditions through a secondary air passage for admixture with the primary mixture.

Examples of charge forming devices of this type are disclosed in the copending applications of Wilford H. Teeter, Serial No. 221,372, filed September 22, 1927, which matured to Patent 1,819,526 granted Aug. 18, 1931, and Fred E. Aseltine et al., Serial No. 288,683, filed June 10, 1928.

It is the general object of the present invention to provide improved means for controlling the proportions of fuel and air in the mixture, and more particularly to provide improved means for enriching the mixture during the acceleration period, to provide a mixture rich enough in fuel content to give the necessary power for smooth and rapid acceleration.

More specifically, it is the object of the invention to provide means for temporarily restricting the admission of secondary air following any opening movement of the throttle, so that the enriched primary mixture is delivered to the intake ports without delay and without dilution by an excess of secondary air.

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 plan view of the present invention attached to the engine cylinder head, a part of which is shown in section.

Fig. 2 is a side elevation looking toward the engine block.

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

Fig. 4 is a section on line 4—4 of Fig. 1.

Fig. 5 is a fragmentary detail section on the line 5—5 of Fig. 3.

Fig. 6 is a detail view of the primary throttle valve.

Fig. 7 is a side elevation of the main carburetor unit looking from the right in Fig. 2.

Fig. 8 is a side elevation of the main carburetor unit looking from the left in Fig. 2.

Fig. 9 is a detail sectional view, partly diagrammatic, showing the means for retarding the opening of the secondary air valve.

Fig. 10 is a section through the secondary mixing chamber on line 10—10 of Fig. 2.

Figs. 11 and 12 are detail sections at right angles to each other of the float valve mechanism and fuel inlet passage controlled thereby.

Fig. 13 is a detail section on the line 13—13 of Fig. 3.

It will be observed that the main air passage which admits air to the secondary mixing chambers has in some instances in this specification been termed a "secondary" air passage, while the air flowing through such passage has been termed "secondary" air. These terms have been used to distinguish from the "primary" air passage and "primary" air which goes to the primary mixing chambers.

The device disclosed herein comprises a main air manifold indicated in its entirety by the reference character 10, and having three outlet branches 11, 12 and 13 each of which is adapted to communicate with one of the ports 14 of a multicylinder engine. Each port serves two adjacent cylinders through valve ports 14*a* and 14*b*, as clearly indicated in Fig. 1. The cylinder head is shown in three separate fragments 15, but it will be understood that it may be an integral structure. The branches 11, 12 and 13 are each provided with an attaching flange 16, for attaching the manifold to the engine block in the conventional manner. Adjacent the inlet of the manifold is provided a flange 17 to which may be secured the main carburetor unit as shown in Fig. 3.

The main carburetor unit comprises a main housing in the form of a single casting 18, attached by screws 19 to the flange 17. An air inlet horn 20, the flow of air through which is regulated in a manner later described, is secured in position over an opening in the upper wall of said housing by screws 22 which pass through flanges 23 and 24 on the horn and housing respectively. A casting 25 having certain dashpot chambers and fuel passages, described in detail hereinafter, formed therein is secured by screws 26 to the lower wall of the main housing 18, a gasket being provided between the castings to make a tight joint, and a sheet metal fuel bowl 27 is held tight against a shoulder 28 on said main housing 18 by means of a screw 29 which is screwed into a post 30 depending from and integral with the casting 25.

A fuel line leading to a main source of fuel supply (not shown) is connected to a nipple 31, screwed into the main housing 18 as shown in Fig. 1. This nipple may have a screen secured therein in a manner well known so that incoming fuel must pass through the screen and said nipple communicates with a bore 32 formed in the wall of housing 18, the bore 32 connecting with bore 33 also in the wall of said housing as shown in Fig. 12. At its inner end the bore 33 connects with a vertical bore 34, which in turn communicates with a bore 35 in casting 25. A plug 36 is screwed into the lower end of bore 35 and is provided with lateral fuel outlets 37 through which the fuel flows into the float chamber. Cooperating with valve seat 38 is a valve 39 controlled by a float 40 pivoted at 41. The valve operates in the usual manner to maintain a constant fuel level in the said float chamber.

Fuel is conducted from the fuel bowl to a plurality of primary fuel nozzles 42 located in the primary mixing chambers 43 formed in the central part of the main housing which may be termed the distributor block. The construction of the distributor block and cooperating elements comprising the primary carburetors will be more fully described hereinafter. To permit the fuel to flow from the fuel bowl to the primary nozzles 42 the casting 25 is provided with a vertical fuel channel 44 which communicates at its upper end with a horizontal fuel canal 45 which connects with each of the nozzles 42 through holes 46. Fuel is admitted from the fuel bowl to the channel 44 at low speed through a metering orifice 47. All of the fuel flowing to the fuel nozzles 42 up to a certain predetermined engine speed, for example that corresponding to a vehicular speed of 20 miles per hour passes through the metering orifice 47. For higher speeds than said predetermined speed fuel is also admitted to the fuel channel 44 through an orifice 48 controlled by a fuel valve 49, operated in a manner fully described hereinafter, and thence through a horizontal channel 50, connecting with the lower end of channel 44.

Fuel is lifted from the fuel bowl through the nozzles 42 to the primary mixing chambers by the suction therein. When the throttle is moved toward closed position to reduce the engine speed there is a sudden reduction in suction on the vertical column of fuel between the fuel bowl an the nozzle which might permit this column of fuel to drop sufficiently to cause a temporary fuel starving of the engine unless means were provided to prevent the dropping of such column of fuel. To prevent this action a check valve 51 is received in an enlarged chamber 52 at the junction of channels 44 and 45 and on reduction of suction in the primary mixing chambers seats on the bottom of such chamber, preventing downward flow through the channel 44.

The metering orifice 47 is drilled in the casting 25 and the drill hole on the opposite side of the channel 44 is plugged by a screw 53.

Each primary fuel nozzle is shown herein as provided with a main fuel outlet in the top of the nozzle and a secondary fuel outlet comprising two holes 54 and 55 formed in the vertical wall of the nozzle and diametrically opposite each other as shown in Fig. 3. At higher speeds there is sufficient suction in the primary mixing chambers to cause fuel to flow from the main fuel outlet in the top of each primary nozzle, as well as from the holes 54 and 55. At idle or very low speed, however, there is insufficient suction to cause such a flow of fuel, the fuel at such time standing in the nozzle at a point between the top of the nozzle and the orifices 54 and 55, flowing from such orifices by action of gravity. Each fuel nozzle is provided with a restricted fuel metering orifice 56.

In the carburetor disclosed herein the central portion of the main casting constitutes the distributor block and is indicated at 60 in Fig. 3. The distributor block has three primary mixture passages 61, 62 and 63 formed therein, such passages being parallel to each other and close together as indicated in Fig. 5. These passages extend straight through the block, and passages 61 and 63 connect with L-shaped passages formed in the manifold, the outlet ends at such passages terminating in the side walls of the central branch of the manifold where they are connected with primary mixture pipes hereinafter described. The inlet ends of the primary mixture passages where the nozzles project into such passages are of larger diameter than the outlet ends thereof and between the inlet and outlet end of each passage its cross-sectional area is constricted as indicated at 64, such constriction reducing the velocity of the air current passing the nozzle for a purpose hereinafter set forth.

The flow of primary mixture through the passages 61, 62 and 63 is controlled by a single throttle valve 65 which extends across all of the primary mixture passages, and has grooves 66 therein which register with the said passages 61, 62 and 63. This throttle valve is rotatably mounted in the housing 18 and has spindles 67 projecting from each end outside the housing 18 on which are secured certain valve actuating devices later described. A groove 68 is provided in the throttle which cooperates with the inner end of a screw 69, adjustably in the casting, to prevent longitudinal movement of the said throttle. The primary mixture passage 62 is in alignment with a tube 70 which is received in a boss in the branch 12, while the passages 61 and 63 communicate with pipes 71 and 72 respectively. These pipes are connected at one end to the outlets of passages 61 and 63 while the other ends of such pipes connect with elbows 74 detachably secured to the manifold branches 11 and 13, the outlet ends of such elbows being in alignment with tubes 75 and 76 which are secured in manifold branches 11 and 13 respectively in any suitable manner. Primary mixture is drawn by engine suction from the primary mixing chambers through the pipe connections above described, and tubes 70 and 75 and 76 to the secondary mixing chambers in which such tubes terminate. The primary mixture may be mixed with additional air in the secondary mixing chambers in a manner more fully described later.

Substantially all the air entering the carburetor flows through the air horn 20, the flow therethrough being controlled by a main air valve 77, normally held against a seat 78 by a spring 79. Air flows past the valve 77 to a main air chamber 80 formed in the housing 18. An air conduit 81 controlled by a valve mechanism hereinafter described connects the air chamber with the main air manifold while an orifice 82 in the floor of the air chamber permits a flow of air from the chamber 80 to the primary carburetors.

When the carburetor is chocked to start the engine the air valve 77 is held against its seat by means presently described to completely close the main air inlet. To provide sufficient air to carry the starting fuel from the primary nozzles to the engine when the carburetor is chocked as described an air inlet 83 is provided. This inlet is an elongated slot formed in a plate 84 secured to the housing 18 as shown in Fig. 3.

The main air valve 77 is adjustably secured on a stem 86 slidably mounted in a guide sleeve 87 fixed in the main housing 18. Surrounding the guide sleeve 87 is a slidable sleeve 88, the lower end of which has a projecting disc 89 secured thereto, the disc providing a seat for the air valve spring 79. Means are provided for raising this sleeve to a position where the upper end thereof will engage the air valve to hold it against its seat to choke the carburetor. This means comprises an arm 90 secured to a rock shaft 91 rotatably mounted in the wall of the main housing 18. The arm at its inner end has two pins 92 and 93 secured therein between which the disc 90 is received. The shaft 91 projects through the wall of the casing and at its outer end is bent to form an arm 200 having a hole 201 therein in which some form of operating connection, extending from a point convenient to the operator may be attached. An adjustable stop screw 202 is received in a lug detachably secured to the air horn as indicated in Fig. 2. By adjustment of the stop screw the normal position of the sleeve 88 may be determined to regulate the tension of spring 79. Ordinarily the stop screw is so adjusted that the main air valve will open slightly during idling.

During operation at all engine speeds below that corresponding to a vehicular speed of substantially 20–25 miles per hour on a level road the mixture formed in the primary carburetors is of properly combustible proportions and such mixture is conveyed to the engine without dilution by admixture with additional air in the secondary mixing chambers. At higher engine speeds, unless means are provided to prevent such action, the velocity of the air current passing the nozzles becomes so great that a velocity head is built up at the nozzles and increases to such a degree that fuel is caused to flow from the nozzles rapidly enough to form a primary mixture which is super-rich in fuel content. To prevent this increase in fuel flow the air passage 81 leading from chamber 80 to the main air manifold is opened in a manner hereinafter described, to permit a flow of air through the secondary air passage. This admission of air through the secondary air passage not only dilutes the mixture but also prevents as great an increase in air velocity at the nozzles as would otherwise occur.

Flow of air from the chamber 80 to the secondary carburetors is controlled by two valves, a manually operated butterfly throttle 94 and a suction operated valve 95. The valve 94 is fixed on a shaft 96 which is journalled for rotation in the walls of the housing 18, and is operated simultaneously with throttle 65 through connections hereinafter described. The valve 95 is fixed to a shaft 97 which may be positioned off center with respect to the valve, a greater portion of the valve being below the shaft than above. The shaft 97 is supported for rotation in the walls of the housing 18 and is operated primarily by the engine suction, its operation being controlled by devices described later.

The operating connections for the throttle valves will now be described. Fixed on the end of one of the throttle spindles 67 outside the housing 18 is an operating arm 98 having a hole in its free end to be connected to some suitable form of operating connection extending to a point convenient to the operator of the vehicle. This operating arm 98 is connected through a lost motion connection to an arm 99 secured by a split clamp to the end of shaft 96 outside the casing. An operating link 100 is pivotally connected to the arm 98, and a pin 101 projecting from the free end of arm 99 projects through a slot 102 in the link 100. A regulating screw 103 is threaded in lugs 104 projecting from the operating link and may be adjusted to regulate the length of the slot 102, the upper end of the said screw constituting the lower end of said slot. A tension spring 105 is connected at one end to the upper end of the link 100 and at its other end to the pin 101. The spring tends to hold the pin 101 against the upper end of slot 102. With both throttles closed the parts are in the position shown in Fig. 9, with the pin 101 in engagement with screw 103. As the operating arm 98 is rotated in a clockwise direction to open the primary throttle valve 65 the link 100 moves downwardly to a position where the upper end of slot 102 strikes pin 101 before the operating arm 99 of the air throttle 94 is moved so that the primary throttle is partly opened before the air throttle begins to open. The screw 103 serves as a stop to limit the closing movement of the primary throttle and adjustment of said screw regulates the throttle opening at idling.

On opening movement of either throttle valve the suction below the air valve 77 is increased and the air valve is opened against the tension of its spring permitting an inrush of air to the secondary mixing chambers which will be sufficient to lean the mixture unless means are provided to retard the opening movement of said valve. By retarding the opening of the valve the leaning of the mixture as well as fluttering of the air valve may be prevented. It will be understood, of course, that opening of the air valve may be sufficiently retarded on opening of the throttle to enrich the mixture for acceleration, but in this particular embodiment of the invention opening of the air valve is not retarded to that extent.

To retard the opening movement of the air valve the lower end of the valve stem 86 has secured thereto a piston 106 which slides in a cylinder 107 formed in the casting 25. The piston is secured to the stem 86 by means disclosed in the copending case above referred to, a nut 109 holding the piston in place. The lower end of the cylinder is closed by a closure member 110, having a valve controlled inlet (not shown) therein, and permitting free upward movement of said piston, but retarding the downward movement thereof and opening movement of the valve.

The dashpot cylinder 107 may be provided with a by-pass in its wall which allows liquid to pass around the piston when the piston passes below the upper end of said by-pass, thus relieving the dashpot. As this by-pass forms no part of the present invention and its construction and function is fully described in the above mentioned applications it is not shown herein.

When the main throttle valve 94 is opened the suction in the chamber 80 below the air valve 77 is so greatly increased that although the suction at the nozzles is increased and at the same time the opening movement of the main air valve is retarded to some extent to prevent leaning of the mixture the additional air flow into the secondary mixing chambers through the main air passage, past the throttle valve 94 would be so rapid as to prevent any enrichment of the mixture immediately, and such enrichment is necessary to provide sufficient fuel for proper engine acceleration.

The opening movement of the air valve 95 is retarded primarily for producing at all times, when the throttle 94 is opened, a sufficient pressure differential between the inlet and outlet ends of the primary mixing tubes to create a velocity of flow through such tubes great enough to transport the primary mixture from the primary mixing chambers to the secondary mixing chambers almost instantaneously. In the device disclosed herein an accelerator pump forces fuel for acceleration into the primary mixing tubes to form a super-rich mixture therein. It is a considerable distance from the point where fuel enters the primary mixture passages to the secondary mixing chambers where it is mixed with pure air flowing past throttle 94, and if the air valve 95 were allowed to open freely an appreciable time interval would be necessary for the rich primary mixture to travel through this distance, obviously a greater time interval than that required for the lighter pure air to travel from the throttle 94 to said secondary mixing chambers. By providing means to delay the opening of the valve 95 relative to throttle 94 two results are accomplished, first the production of a high pressure differential between the inlet and outlet ends of the primary mixture passages which maintains a high velocity of flow through such passages at all times; second the retarding of the inflow of pure air to the secondary mixing chambers. By maintaining the high velocity of flow through the primary mixture passages the time interval required for the primary mixture to travel the distance above referred to is greatly reduced. At the same time the retardation of the air flow by means of valve 95 increases the time interval necessary for pure air to reach the secondary mixing chambers, so that these two time intervals approach each other, in fact are substantially equalized, so that the rich primary mixture and the air flowing past throttle 94 reach the secondary mixing chambers at substantially the same time.

According to the present invention means are provided to retard the opening of said valve 95 comprising an arm 120 secured, outside the housing 18, on the end of the shaft 97 on which said valve is mounted. A rod 121 is bent at its upper end to form a short horizontally extending leg 122 which projects through a suitable slot in the free end of the arm 120, and the said leg 122 is connected to the lower end of a helical spring 123, the upper end of which is suitably connected to a lug 124 projecting from the flange by means of which the carburetor unit is attached to the manifold. This spring tends at all times to draw the free end of the arm 120 upwardly to open the valve 95. The above mentioned slot permits motion of the end of the rod relative to arm 120, as the end of said arm moves in an arcuate path. The lower end of the rod 121 has a flanged coupling member 125 secured thereto and a piston 126 is clamped between the flange on said member and a nut 127 threaded thereon. This piston fits closely in a cylinder 128 having an attaching flange 129 projecting therefrom which is bolted to the housing 18. The piston is slidable in the cylinder by spring 123 but its movement is controlled by engine suction. To this end a nipple 130 is screwed into the bottom of the cylinder 128 and is connected in any suitable manner to a pipe 131 to form a tight joint therewith. This pipe is connected at its opposite end to a similar nipple 132 screwed into a bore 133 extending through the wall of housing 18 at a point between the valve 95 and the main air throttle 94, as shown in Fig. 3.

The valve 95 is provided with a small hole 134 and when the throttle 94 is closed the engine suction maintained at points posterior to the valve 95 is communicated through said hole to the space between valves 95 and throttle 94, and through the pipe 131 to the space in cylinder 128 below the piston. This suction is greater when the main throttle is closed than at any other time and the valve 95 is held closed by the suction below the piston 128 which is sufficient to overcome the force of the spring 123 tending to open said valve. It will be understood that when the throttle 94 is closed the suction maintained in the passage 81 on both sides of the valve 95 is substantially the same and the force of the spring is the only force tending to open the said valve.

As the throttle 94 opens the suction in the passage 81 anterior to valve 95 is reduced, creating a pressure differential on opposite sides of the valve which is added to the force of spring 123 tending to open said valve. At the same time there is a flow of air from passage 81 through pipe 131 to the cylinder 128 which will reduce the vacuum in said cylinder and permit the valve 95 to open when the vacuum is reduced enough to be insufficient to overcome the force tending to open the valve. As the valve 95 opens and the vacuum below the piston 126 is reduced, the piston rises until a condition of balance is reached, that is, until the vacuum below the piston is just enough to balance the force tending to open the valve. The upward movement of the piston must be slow because of the small size of the pipe 131 which admits air to relieve the vacuum below the piston, hence the opening movement of the valve 95 is very considerably delayed relative to the opening of the throttle 94.

On closing of the throttle 94 the action of the air valve is substantially the reverse of that above described. The vacuum at points posterior to the throttle will, of course, be increased on closing movements of said throttle, which will result in a withdrawal of air from below the piston 126, and pulling the piston down until the vacuum tending to lower the piston is balanced by the force tending to open the valve 95 and raise the piston.

As previously stated the opening of the valve 95 is temporarily retarded on opening of the main air throttle to accelerate the flow of primary mixture sufficiently to prevent said mixture from lagging behind the flow of air through the manifold during the acceleration period, thus preventing the formation of a lean mixture at the secondary mixing chambers during the acceleration period. In the device disclosed in this application the primary mixture is enriched by the action of a fuel pump operated simultaneously with the opening of the throttle. This fuel pump forms no part of but is described below to enable a better understanding of the whole charge forming device which is shown in the drawings.

The air valve dashpot, comprising piston 106 and cylinder 107, constitutes the pump which operates whenever the piston moves downwardly on opening of the air valve, and the by-pass is not entirely uncovered before the downward movement of the piston begins. A fuel delivery conduit 140 is received at its lower end in a hole in the cylinder 107 near the bottom thereof while the upper outlet end of said conduit connects with a fuel channel 141 in a block 142, secured in any desirable manner to the bottom of the distributor block in a position somewhat posterior to the primary throttle as indicated in Fig. 3. The block 142 extends across all of the primary mixture passages and fuel passages 143, 144 and 145 are formed in said block and communicate with passages 146, 147 and 148 in the wall of the distributor block, and communicating with the primary mixture passages 61, 62 and 63 respectively, as shown in Figs. 3 and 13. Two air channels

149, one of which is shown in Fig. 3 admit air to the fuel channel 141, the entering air forming an emulsion with the fuel which issues from passages 146, 147, and 148 into the primary mixture passages.

The reason for admission of air to the fuel channel 141 is to prevent the high suction maintained in the primary carburetors acting to draw fuel from the dashpot cylinder independently of the pumping action of the piston 106. It will be understood that under all conditions of operation a very considerable degree of suction is maintained in the primary mixing chambers and unless the fuel delivery passage between the dashpot cylinder and the primary mixture passage be vented to atmosphere at some point therein, this high suction would operate to lift fuel from the dashpot cylinder at all times, whereas it is desirable to deliver fuel from the dashpot cylinder to the primary mixture passage only when the throttle is opened to cause downward motion of the piston 106. By admitting air to the fuel channel 141 the suction effective to lift fuel through conduit 140 is never great enough to lift the fuel to the channel 141, but is sufficient to lift the fuel only to some point intermediate the dashpot cylinder and said channel, preferably to a point immediately below the channel.

When the throttle is opened the suction in the air chamber 80 is increased and air valve 77 and piston 106 are forced downwardly forcing fuel upwardly through conduit 140 and outlets therefrom to the primary mixture passages during the downward movement of the piston, air being mixed with the fuel in channel 141 as previously described. If the dashpot cylinder is provided with the above mentioned by-pass pumping action continues only as long as the piston 106 is in position to close the upper ends of the by-pass. As soon as the by-pass is uncovered the pumping action ceases and further downward movement of the piston operates merely to force fuel from the lower part of the cylinder through the by-pass to the upper part of the cylinder.

In addition to the above described devices operating to enrich the mixture for acceleration, means are provided for supplying additional fuel at higher speeds by opening the fuel valve 49 previously referred to. This means comprises an arm 150 pivoted at 151 on the outside of housing 18 as shown in Fig. 8. Projecting from the opposite end of the arm 150 is a pin 152 which is received in a bore in an enlarged head 153 into which the valve 49 is screwed. A cam 154 is fixed on the spindle 67 projecting from the opposite end of the throttle shaft 65 to that on which its operating arm 98 is secured, and cooperating with this cam is a roller 155 mounted for rotation on a pin projecting from the arm 150. A considerable portion of the cam is concentric relative to its operating shaft so that it is ineffective to raise arm 150 to open the fuel valve until a certain predetermined speed is reached, for example an engine speed corresponding to a vehicular speed of 20–25 miles per hour. By using a cam of different shape the engine speed at which the fuel valve begins to open may be regulated as desired. Also by adjusting the valve in its head 153 the normal position of the valve prior to its opening movement by arm 150 may be determined.

The secondary mixing chambers comprise Venturi tubes 160 or other flow accelerating elements. There are three of these venturis 160 which are identical in construction and are positioned in the branches 11, 12 and 13 of the manifold 10, in such relation to the primary mixing tubes, that the point of greatest depression or suction in each Venturi tube is immediately adjacent the outlet end of the primary mixing tube associated therewith. Each venturi is provided with an annular projecting rib 161 which fits, when the manifold is attached to the engine block, both in the engine intake port and in a recess 162 in the end of the associated branch of the manifold, the rib engaging shoulders 163 and 164 in the manifold and intake port respectively, when the venturi is in position. A channel 165 is formed in the outer wall of said venturi, at the bottom of the element when the device is assembled, to permit any fuel which precipitates out of the mixture and collects on the wall of the manifold branch to flow into the engine intake port. The Venturi tubes cause the air entering the air manifold to move past the ends of tubes 70, 75 and 76 at high velocity creating in each of the tubes a high suction at all times.

It will be understood that while the device, for retarding the passage of air through the secondary air passage on opening of the air throttle, which constitutes the present invention, is disclosed, for convenience, in this application as embodied in a charge forming device having means for enriching the primary mixture, the invention is in no way limited to such a charge forming device. Such invention will produce desirable results when embodied in a charge forming device in which enriching fuel is not injected into the primary mixture concurrently with the retardation of air flow through the secondary air passage. It will be clear that such air should not be permitted to reach the secondary mixing chambers on opening of the air throttle, before the increased quantity of primary mixture resulting from opening of the primary throttle reaches said mixing chambers, whether said primary mixture is increased in fuel content or not.

It will be understood that, while the valve 96 has been shown and described herein as off center with respect to its operating shaft 97, so that said valve is opened in part by engine suction, said shaft may be at the center of the valve and the latter opened entirely by the action of the spring 123 if such construction be desired.

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 having in combination, a mixing chamber, a fuel inlet therefor, a throttle controlling the flow of mixture from said mixing chamber, a secondary air passage admitting air to said mixing chamber, a main air port admitting air to said mixing chamber and secondary air passage, means in said secondary air passage operated by the engine suction for retarding the flow of air through said passage, and means operated by the suction anterior to said last mentioned means for controlling its operation.

2. A charge forming device for internal combustion engines having in combination, a secondary mixing chamber, a primary carburetor for supplying a primary fuel mixture thereto, a throttle controlling the flow of mixture from the said mixing chamber, a secondary air passage conveying air to said secondary mixing chamber for dilution of said primary mixture, means in said secondary air passage operated by engine suction for retarding the flow of air through said secondary air passage, and means operated by the suction in the secondary air passage for controlling the operation of said last mentioned means.

3. A charge forming device for internal combustion engines having in combination, a secondary mixing chamber, a primary carburetor for supplying a primary fuel mixture thereto, an air inlet port for supplying air to said primary carburetor and said secondary mixing chamber, a passage conveying air from said air port to said secondary mixing chamber, a valve in said passage regulating the flow of air to said secondary mixing chamber independent of said primary carburetor, and means operated by the suction in the secondary air passage to retard the opening movement of said valve.

4. A charge forming device for internal combustion engines having in combination, a secondary mixing chamber, a primary carburetor supplying fuel mixture thereto, a secondary air passage admitting air to said secondary mixing chamber, a manually operable throttle in said secondary air passage, an automatic valve in said passage, and means operated by the suction in the secondary air passage for retarding the opening movement of said automatic valve.

5. A charge forming device for internal combustion engines having in combination, a secondary mixing chamber, a primary carburetor supplying fuel mixture thereto, a primary throttle controlling the flow of fuel mixture, a secondary air passage admitting air to said secondary mixing chamber, a manually operable throttle in said secondary air passage, an automatic valve in said passage, means opening said valve as the primary throttle is opened, and means operated by engine suction for retarding the opening movement of said automatic valve.

6. A charge forming device for internal combustion engines having in combination, a secondary mixing chamber, a primary carburetor supplying fuel mixture thereto, a primary throttle controlling the flow of fuel mixture, a secondary air passage admitting air to said secondary mixing chamber, a manually operable throttle in said secondary air passage, an automatic valve in said passage, said valve being opened by a spring and engine suction on opening movement of the primary throttle and means also operable by engine suction for retarding the opening movement of said valve.

7. A charge forming device for internal combustion engines having in combination, a secondary mixing chamber, a primary carburetor supplying fuel mixture thereto, a secondary air passage admitting air to said secondary mixing chamber, a manually operable throttle in said secondary air passage, an automatic valve posterior to the throttle and subject to engine suction, and means operated by the suction in the air passage for retarding the opening movement of said valve.

8. A charge forming device for internal combustion engines having in combination, a secondary mixing chamber, a primary carburetor supplying fuel mixture thereto, a primary throttle controlling the flow of fuel mixture, a secondary air passage admitting air to said secondary mixing chamber, a manually operable throtttle in said secondary air passage, an automatic valve in said passage, means for opening said valve as the primary throttle is opened, and means operated by engine suction for holding said valve closed while the throttle is closed and retarding the opening movement of said valve as the throttle is opened.

9. A charge forming device for internal combustion engines having in combination, a secondary mixing chamber, a primary carburetor supplying fuel mixture thereto, a primary throttle regulating the flow from said primary carburetor, a secondary air passage admitting air to said secondary mixing chamber, a secondary throttle valve controlling the flow through said secondary air pas-

sage, an automatic air valve also controlling the flow through said secondary air passage, and means operable by engine suction for retarding the opening movement of said automatic valve.

10. A charge forming device for internal combustion engines having in combination, a secondary mixing chamber, a primary carburetor supplying fuel mixture thereto, a primary throttle regulating the flow from said primary carburetor, a secondary air passage admitting air to said secondary mixing chamber, a secondary throttle valve controlling the flow through said secondary air passage, common operating means for said throttles, an automatic air valve also controlling the flow through said secondary air passage, and means operable by engine suction for retarding the opening movement of said automatic valve.

11. A charge forming device for internal combustion engines having in combination, a secondary mixing chamber, a primary carburetor supplying fuel mixture thereto, a primary throttle regulating the flow of mixture from said primary carburetor, a secondary air passage admitting air to said secondary mixing chamber, a secondary throttle valve controlling the flow through said secondary air passage, common operating means for said throttles constructed to partially open the primary throttle before the secondary throttle starts to open, and means operable by engine suction for retarding the flow through said secondary air passage on opening movement of said secondary throttle.

12. In a charge forming device for a multicylinder engine having a plurality of intake ports, the combination of an air manifold having branches leading to said intake ports, a plurality of primary carburetors, one associated with each branch of the air manifold to supply fuel mixture thereto, a single air intake passage admitting air to said manifold, a throttle for controlling the flow through said passage, an automatically operated valve for modifying the effect of said throttle, and means operable by engine suction for retarding the opening movement of said valve.

13. A charge forming device for internal combustion engines having in combination, a plurality of secondary mixing chambers, a plurality of primary carburetors for supplying primary mixture thereto, conduits for conveying said primary mixture to the secondary mixing chambers, a secondary air passage admitting air to said secondary mixing chambers, a throttle for controlling the flow of air through said secondary air passage, and automatic means operable by engine suction on opening of said throttle to retard the flow of air through said secondary air passage, whereby a decrease in vacuum at the outlets of said primary mixture conduits is prevented.

14. A charge forming device for internal combustion engines having in combination, a secondary mixing chamber, a primary carburetor supplying fuel mixture thereto, a secondary air passage admitting air to said secondary mixing chamber, a throttle therein, an air inlet port supplying air to both said primary carburetor and secondary air passage, means retarding the flow of air through said air inlet port on opening movement of the throttle, and independent means operable by engine suction for retarding the flow through said secondary air passage on opening of said throttle.

15. A charge forming device for internal combustion engines having in combination, a secondary mixing chamber, a primary carburetor for supplying fuel mixture thereto, a secondary air passage for admitting air to said secondary mixing chamber, an automatic valve controlling the flow of air through said passage, a dashpot for retarding the opening movement of said valve and means communicating the suction of the secondary air passage to said dashpot to control the operation thereof.

16. A charge forming device for internal combustion engines having in combination, a secondary mixing chamber, a primary carburetor for supplying fuel mixture thereto, a secondary air passage for admitting air to said secondary mixing chamber, an automatic valve controlling the flow of air through said passage, a dashpot for retarding the opening movement of said valve, said dashpot comprising a cylinder, a piston therein connected to said valve, and means for communicating the suction of the secondary air passage to said cylinder, whereby the movements of said piston and valve are controlled by the suction communicated to said cylinder.

17. A charge forming device for internal combustion engines having in combination, a secondary mixing chamber, a primary carburetor for supplying fuel mixture thereto, a secondary air passage for admitting air to said secondary mixing chamber, a throttle for controlling the flow through said air passage, an automatically operated valve in said passage, means controlling the operation of said valve comprising a dashpot and a suction connection extending from the cylinder of said dashpot to the secondary air passage on the engine side of the throttle, whereby the valve is held closed when said throttle is closed but is permitted to open as the throttle is opened and the vacuum posterior to said throttle is reduced.

18. A charge forming device for internal combustion engines comprising a secondary mixing chamber, a primary carburetor for supplying a primary fuel mixture thereto, a primary throttle for controlling the flow

of fuel mixture, a secondary air passage supplying air to said secondary mixing chamber, an air throttle therein, a suction operated valve in said air passage for retarding the flow of air therethrough, and means operated by the suction in the air passage posterior to the air throttle for controlling the operation of said valve.

19. A charge forming device for internal combustion engines comprising a plurality of secondary mixing chambers, a plurality of primary carburetors for supplying a primary mixture of fuel and air to said secondary mixing chambers, a single secondary air passage for supplying air to all of said secondary mixing chambers, a manually operable throttle therein, a suction operated valve therein adapted to retard the flow of air therethrough on opening movements of the throttle, and suction operated means for retarding the opening movement of said valve.

20. A charge forming device for internal combustion engines comprising a plurality of secondary mixing chambers, a plurality of primary carburetors for supplying a primary mixture of fuel and air to said secondary mixing chambers, a single secondary air passage for supplying air to all of said secondary mixing chambers, a manually operable throttle therein, a suction operated valve therein adapted to retard the flow of air therethrough on opening movements of the throttle, and means operated by the suction in said secondary air passage for retarding the opening movements of said valve.

21. A charge forming device for internal combustion engines comprising a plurality of secondary mixing chambers, a plurality of primary carburetors for supplying a primary mixture of fuel and air to said secondary mixing chambers, a single secondary air passage for supplying air to all of said secondary mixing chambers, a manually operable throttle therein, a suction operated valve therein adapted to retard the flow of air therethrough on opening movements of the throttle, and means operated by the suction in the air passage between the throttle and the suction operated valve for retarding opening movements of the latter.

In testimony whereof I hereto affix my signature.

WILFORD H. TEETER.