Feb. 14, 1933. F. E. ASELTINE 1,897,102

CHARGE FORMING DEVICE

Filed April 30, 1929

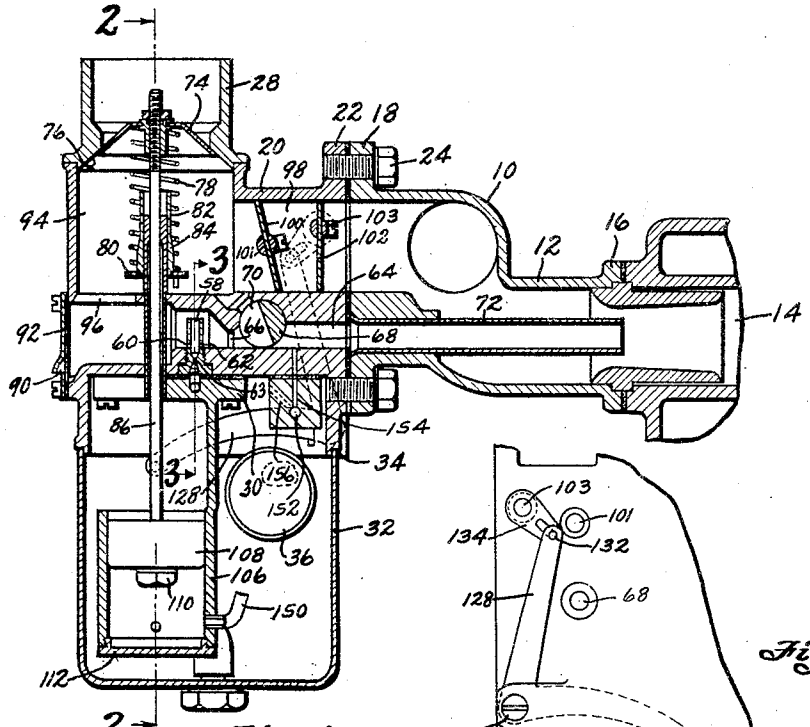

Fig. 1

Fig. 4

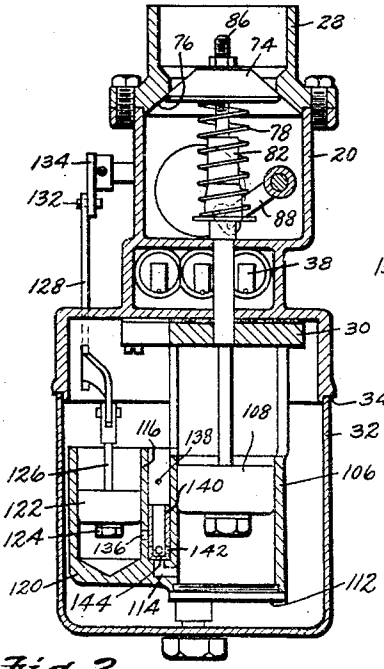

Fig. 2

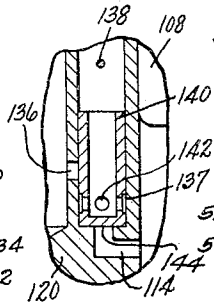

Fig. 5

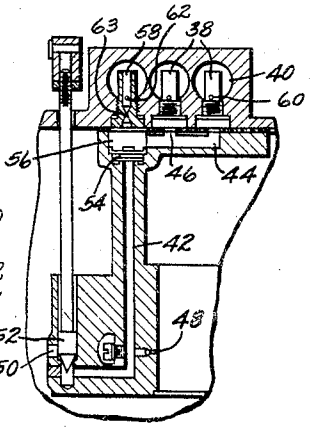

Fig. 3

Inventor

Fred E Aseltine

By Spencer Hardman and Fehr

His Attorneys

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UNITED STATES PATENT OFFICE

FRED E. ASELTINE, OF DAYTON, OHIO, ASSIGNOR TO DELCO PRODUCTS CORPORATION OF DAYTON, OHIO, A CORPORATION OF DELAWARE

CHARGE FORMING DEVICE

Application filed April 30, 1929. Serial No. 359,330.

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 a 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. 288,683, filed June 27, 1928.

In the device disclosed in the above application and other earlier devices of similar character, various means have been provided to control the proportions of air and fuel in the mixture under various operating conditions for the purpose of supplying to the engine a mixture having the desired proportions to properly operate the engine under any operating conditions. Among these proportioning devices are certain structures for regulating the mixture proportions by controlling the admission of air to the carburetor, and it is the primary purpose and object of the present invention to provide simple and improved means for regulating the admission of air to a carburetor whereby the desired mixture is formed therein under all operating conditions.

In earlier devices of this character, a suction operated auxiliary valve is provided which is opened as the throttle is opened to admit auxiliary air under certain operating conditions and means are provided to normally retard the opening movement of this valve, said retarding means being controlled in its action so that it is rendered ineffective on sudden openings of the throttle which cause a relatively great increase in suction effective to open the valve, in order to permit the air valve to open freely under these conditions. The means for controlling the retarding means such as heretofore provided, is more or less complicated in construction and it is a further more specific object of the present invention to provide a carburetor having an auxiliary air valve and means for normally retarding the opening thereof with improved and simplified means for controlling the effectiveness of said retarding means, which is positive in its action and easy to manufacture.

A still further feature of the invention resides in the provision, in a carburetor having a main air valve and an auxiliary air valve of the type described, of a retarding means normally retarding the opening movement thereof and means operated by the main air valve for controlling the effectiveness of the retarding means which controls the opening of the auxiliary air valve.

According to the present invention, these objects are accomplished by the provision of a dash pot resisting the opening movement of the auxiliary air valve, the resistance of which is controlled by a piston mounted in an auxiliary cylinder adjacent the dash pot cylinder and having passages therethrough which, under certain circumstances permit escape of liquid from the dash pot cylinder, thus permitting substantially unretarded movement of the auxiliary valve. The passages in the piston are normally out of register with the passages in the dash pot cylinder, but are adapted to be brought into registry therewith by action of the main air valve on sudden increase of suction within the carburetor in the manner fully set forth in the body of the detailed description which follows.

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 in which the present invention is embodied and the intake port associated therewith.

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

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

Fig. 4 is a fragmentary elevation viewed from the left in Fig. 2.

Fig. 5 is a detail view of the auxiliary piston.

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 on opening in the upper wall of housing 20, in any suitable way. A casting 30, having certain dash pot chambers and fuel passages formed therein, is secured by screws to the lower wall of housing 20, and a sheet metal fuel bowl 32 is held tight against an annular shoulder 34 on the housing 20 by any suitable means. Fuel is conducted from a main source of supply to the fuel bowl through a conduit not shown herein, and the flow of fuel to the bowl is controlled by a float 36, operating in the usual manner to maintain a substantially constant level of fuel therein.

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

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

Each primary fuel nozzle is provided with a main fuel outlet 58 in the top of the nozzle and a secondary fuel outlet comprising two orifices 60 and 62 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 connects 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 above copending applicaiton, 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 elongaed 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. A dash pot is provided to accomplish this result and to prevent fluttering of the valve comprising a cylinder 106 forming part of the casting 30 and a piston 108 secured to the valve stem 82 by any conventional means such as a nut 110 threaded thereon.

The lower end of the dash pot cylinder is closed by a solid plug 112 screwed into the cylinder and a passage 114, leading from the dash pot cylinder to a small auxiliary cylinder 116, formed in the casting 30 adjacent the said dash pot cylinder, allows escape of fuel from the dash pot cylinder on downward movement of the piston in the manner set forth in detail hereinafter.

In order to enable a better understanding of the present invention, which relates to means controlling the motion of the suction operated valve 102, the operation and function of said valve will be very briefly set forth. The purpose of this valve is to temporarily retard the flow of air through the main air passage on opening of the throttle 100 to prevent an increased supply of air reaching the secondary mixing chambers before the increased supply of heavier primary mixture, resulting from increase in suction at the jets, reaches the said mixing chamber and to increase the pressure differential on the primary mixture tubes so as to reduce the time necessary for the primary mixture to reach the secondary mixing chambers, because of the resulting increase in velocity of flow through the said tubes. By means of a fuel pump, which is briefly described later and is fully described in the above mentioned application, additional fuel is injected into the primary mixture passages on opening movements of the throttle to form the enriched mixture necessary for acceleration and the auxiliary air valve 102 reduces the time interval required for such mixture to reach the secondary mixing chamber, while simultaneously increasing the interval required for pure air admitted through passage 98 to reach said secondary mixing chamber in the manner above described. The auxiliary air valve thus enables the enriched primary mixture to reach the secondary mixing chambers as soon as the increased supply of air, so that the mixture supplied the engine ports is temporarily enriched.

Under certain operating conditions it is not desirable to retard the opening of the auxiliary air valve appreciably and, further, it is not necessary to retard the opening of said valve to the same extent at all times. According to the present invention means are provided for retarding the opening of the auxiliary air valve and means for controlling the effectiveness of said retarding means which is operative to vary the resistance offered by said retarding means under different operating conditions, and under certain predetermined conditions to substantially eliminate this resistance and permit the valve to open freely.

This retarding means comprises a dash pot having a cylinder 120 in which slides a piston 122 secured by a nut 124, or in any other desirable manner to a rod 126, pivotally connected at its upper end to a bell crank lever 128, pivoted at 130 on the main housing 20. The other arm of the bell crank lever 128 is connected by a pin and slot connection 132 to an arm 134 secured in any desirable manner to the shaft 103 on which the auxiliary valve is secured. Obviously, any opening movement of the valve 102 will force the piston 122 downwardly, such movement being normally resisted by the pressure of the fuel below the piston which can normally escape only by leakage past said piston.

Under certain circumstances, it is desired to reduce the resistance offered by the above described dash pot to the opening movement of the auxiliary air valve and, as has been indicated above, under certain operating conditions it is desirable to entirely relieve the dash pot so that the valve opens substantially freely. As an example of conditions when free opening of the valve is desirable, it may be assumed that the car, on which the carburetor is used, is coasting relatively rapidly with the clutch engaged and the throttle valve 100 closed. Now, when the car reaches the end of the coast and the throttle is opened, it is not desirable to enrich the mixture because the engine is already running at relatively high speed and, therefore, it is not desirable to retard the opening of the auxiliary air valve appreciably. Further, the requirements for enrichment of the mixture are not the same when the throttle is opened through different distances or from different positions, hence it is not desirable that the resistance offered by the dash pot to movement of the valve shall be always the same.

To variably control the resistance of the dash pot for the auxiliary air valve so as to enable it to offer resistance to the opening of the valve in the manner above indicated as

desirable, the cylinder 120 is provided with a passage 136 through its wall which communicates with a channel 137 formed on the outer surface of the auxiliary piston 140 hereinafter referred to. Slidable within said cylinder 116 is hollow piston 140 having a series of holes 142 in its side wall communicating with the hollow interior of the piston. These holes are normally out of registry with the orifice 136, but are adapted to be brought into registry therewith by pressure of the fuel forced from the main air valve dash pot through the passage 114 against the solid bottom 144 of the piston 140. When the piston 140 is lifted so that the channel 137 is in exact registry with the passage 136, fuel is allowed to escape from the cylinder 120 through passage 136 and orifices 142, relieving the pressure against the piston 122 and permitting substantially free opening of the air valve. Obviously if the piston 140 is not lifted to a position where the passage 136 is in exact registry with the channel 137, the flow through the passage is to some extent restricted and the dash pot offers some resistance to the opening of the valve 102.

The piston 140 is adapted to be lifted to the position where the passage 136 and channel 137 are in exact registry when the throttle 100 is suddenly opened relatively wide under such operating conditions as will cause a sudden and great increase in the suction effective on the main air valve, such as opening the throttle after coasting as above described. A lesser opening of the throttle, or opening the said throttle under other operating conditions which result in a lesser increase of suction at the air valve, will lift the piston 140 into a position where the passage 136 and channel 138 are only partly in register in which position the dash pot will be partially effective.

The dash pot pistons 108 and 122, and the piston 140 may be so fitted in their respective cylinders that on very slow opening of the throttle, the fuel in the various cylinders will leak past the pistons substantially as rapidly as displaced thereby, the air valve being ineffective under these conditions to lift the piston 140 as previously described.

Upward movement of the air valve is limited by a pin 138 extending across the auxiliary cylinder in such position as to stop the upward movement of piston 140 when the piston is in a position where the channel 137 registers fully with the orifice 136.

The fuel pump comprises a delivery conduit 150 extending from the dash pot cylinder 106 to a fuel distributing canal 152, which communicates with three fuel delivery conduits 154, one of which is shown in Fig. 1. Air passages 156, one of which appears in dotted lines in Fig. 1, admit air to the distributing canal 152 to form therein an emulsion of fuel and air which is forced from said canal into the primary mixture passages, as fully set forth in the above mentioned application.

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 160 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 copending application.

While the form of embodiment of the present invention as hereindisclosed, 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, fuel and air inlets therefor, a throttle controlling the flow of mixture therefrom, an auxiliary air passage, a valve controlling flow through said passage and operated by suction effective on said valve, means controlling the movement of said valve and fluid pressure operated means effective under all operating conditions, for regulating the effect of said valve controlling means.

2. A charge forming device for internal combustion engines comprising a mixing chamber, fuel and air inlets therefor, a throttle controlling the flow of mixture therefrom, an auxiliary air passage, a valve controlling flow through said passage, means for resisting the opening movement of said valve, and fluid pressure operated means effective under all operating conditions, for regulating the resistance offered by said resisting means to the movement of the air valve.

3. A charge forming device for internal combustion engines comprising a mixing chamber, fuel and air inlets therefor, a throttle controlling the flow of mixture therefrom, an auxiliary air passage, a valve controlling flow through said passage, a dash pot for resisting the opening movement of said valve, and fluid pressure operated means, effective under all operating conditions, for regulating the resistance offered by said dash pot.

4. A charge forming device for internal combustion engines comprising a mixing chamber, a fuel inlet therefor, a main air valve controlling admission of air thereto, a throttle, an auxiliary air passage, an auxiliary air valve therein, means controlling the operation of the auxiliary air valve and means operated by the main air valve for regulating the action of said controlling means.

5. A charge forming device for internal combustion engines comprising a mixing

chamber, a fuel inlet therefor, a main air valve controlling admission of air thereto, a throttle, an auxiliary air passage, an auxiliary air valve therein, means resisting the opening movement of said auxiliary air valve and means operated by the main air valve for regulating the resistance of said resisting means.

6. A charge forming device for internal combustion engines comprising a mixing chamber, a fuel inlet therefor, a main air valve controlling admission of air thereto, a throttle, an auxiliary air passage, a suction operated air valve in said air passage, means retarding the opening of said valve on increase of engine suction, and means operated by the main air valve for varying the effectiveness of said retarding means.

7. A charge forming device for internal combustion engines comprising a mixing chamber, a fuel inlet therefor, a main air valve controlling admission of air thereto, a auxiliary air passage, a suction operated air valve in said air passage, means normally retarding the opening of said auxiliary air valve and means operated by the main air valve for rendering said retarding means ineffective on opening of the throttle under certain operating conditions.

8. A charge forming device for internal combustion engines comprising a mixing chamber, a fuel inlet therefor, a main air valve controlling admission of air thereto, a throttle, an auxiliary air passage, a suction operated air valve in said air passage, means normally retarding the opening of said auxiliary air valve, and means operated by the main air valve on opening movements of the throttle to reduce the resistance of said retarding means or render said means entirely ineffective.

9. A charge forming device for internal combustion engines comprising a mixing chamber, means for supplying fuel and air thereto, a throttle, an auxiliary air supply passage, a valve controlling flow of air through such passage, means for resisting the opening movements of said valve and means effective on all opening movements of the throttle but operable independently thereof for variably controlling the resistances to opening movements of said valve in accordance with the speed at which the throttle is opened.

10. A charge forming device for internal combustion engines comrising a mixing chamber, means for supplying fuel and air thereto, a throttle, an auxiliary air supply passage, a valve controlling flow of air through such passage, means for resisting the opening movements of said valve, a main air valve, and means operated by said main air valve on opening movements of the throttle for variably controlling the resistance to opening movements of said auxiliary air valve in accordance with the speed at which the throttle is opened.

11. A charge forming device for internal combustion engines comprising a mixing chamber, means for supplying fuel and air thereto, a throttle, an auxiliary air supply passage, a valve controlling flow of air through such passage, means normally resisting the opening of said auxiliary air valve, controlling means operative on rapid opening of the throttle but operable independently thereof to render said resisting means ineffective and on relatively slow opening of the throttle, to render said resisting means partially ineffective.

12. A charge forming device for internal combustion engines comprising a mixing chamber, means for supplying fuel and air thereto, a throttle, an auxiliary air supply passage, a valve controlling flow of air through such passage, means normally resisting the opening of said auxiliary air valve, controlling means operable independently of the throttle but effective on rapid opening of the throttle to render said resisting means ineffective and on relatively slow opening of the throttle to render said resisting means partially ineffective, said controlling means being inoperative to render said resisting means either wholly or partially ineffective during very slow movements of the throttle.

13. A charge forming device for internal combustion engines comprising a mixing chamber, means for supplying fuel and air thereto, a throttle, an auxiliary air supply passage, a valve controlling flow of air through such passage, means operable to retard the opening movements of said air valve, means for variably controlling the effectiveness of said retarding means, and means for operating said last named means when the throttle is opened but constructed so as to operate said controlling means independently of the movement of the throttle.

14. A charge forming device for internal combustion engines comprising a mixing chamber, means for supplying fuel and air thereto, a throttle, an auxiliary air supply passage, a valve controlling flow of air through such passage, means for resisting the opening movements of the auxiliary air valve, a main air valve operated by engine suction, and means operated by said main air valve for varying the resistance of said resisting means in accordance with the variations in suction effective on the main air valve.

15. A charge forming device for internal combustion engines comprising a mixing chamber, means for supplying fuel and air thereto, a throttle, an auxiliary air supply passage, a valve controlling flow of air through such passage, means for resisting the opening movements of the auxiliary air

valve, a main air valve operated by engine suction, and means operated by the main air valve for rendering said resisting means ineffective when the suction operating the main air valve is greatly increased.

16. A charge forming device for internal combustion engines comprising a mixing chamber, means for supplying fuel and air thereto, a throttle, an auxiliary air supply passage, a valve controlling flow of air through such passage, means for resisting the opening movements of the auxiliary air valve, a main air valve operated by engine suction, and means operated by said main air valve for varying the resistance of said resisting means in accordance with the variations in suction effective on the main air valve, said means being rendered partially ineffective when the suction operating the air valve is increased to a lesser degree.

17. A charge forming device for internal combustion engines comprising a plurality of mixing chambers, means for supplying fuel and air thereto, a throttle controlling the flow through all of said mixing chambers, an air valve controlling the admission of air to said mixing chambers, means operable to retard the opening movements of said air valve, means for variably controlling the resistance of said retarding means, means for variably operating said controlling means in accordance with the speed at which the throttle is operated, said operating means for the controlling means being constructed to operate independently of the movement of the throttle.

18. A charge forming device comprising a plurality of secondary mixing chambers, a plurality of primary carburetors supplying a primary mixture of fuel and air to said secondary mixing chambers, means supplying fuel and air thereto, a throttle, an auxiliary air passage for supplying air to said secondary mixing chambers under certain operating conditions, an auxiliary air valve for controlling the flow of air through said auxiliary air passage, means operable to retard the opening movements of said auxiliary air valve, means for variably controlling the resistance of said retarding means, means for variably operating said controlling means in accordance with the speed at which the throttle is operated, said operating means for the controlling means being constructed to operate independently of the movement of the throttle.

In testimony whereof I hereto affix my signature.

FRED E. ASELTINE.