Aug. 20, 1935. F. E. ASELTINE 2,011,993

CHARGE FORMING DEVICE

Filed Jan. 29, 1932 5 Sheets-Sheet 1

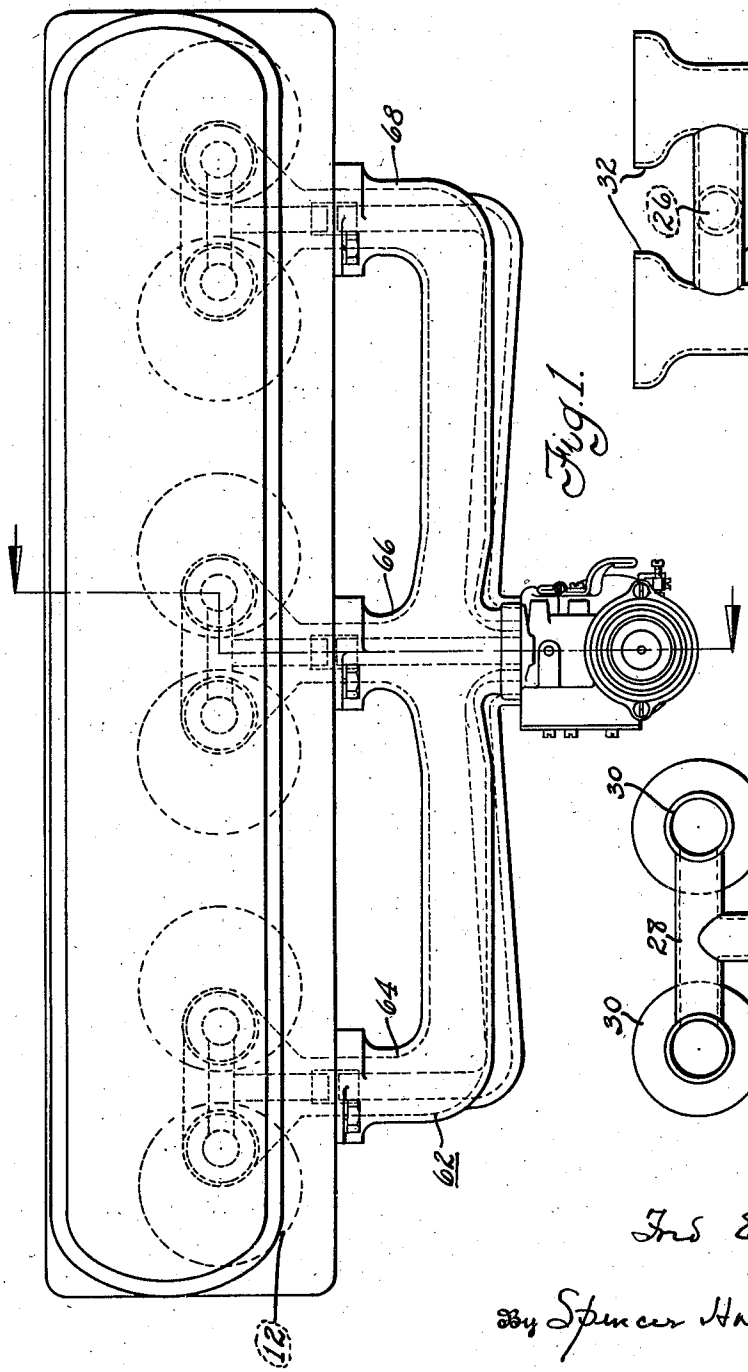

Fig. 1.

Fig. 4.

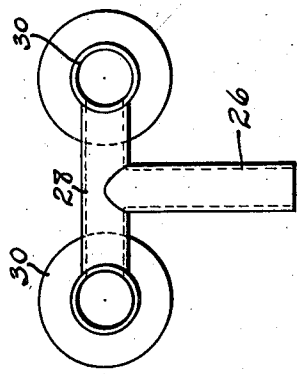

Fig. 3.

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CHARGE FORMING DEVICE

Filed Jan. 29, 1932 5 Sheets-Sheet 2

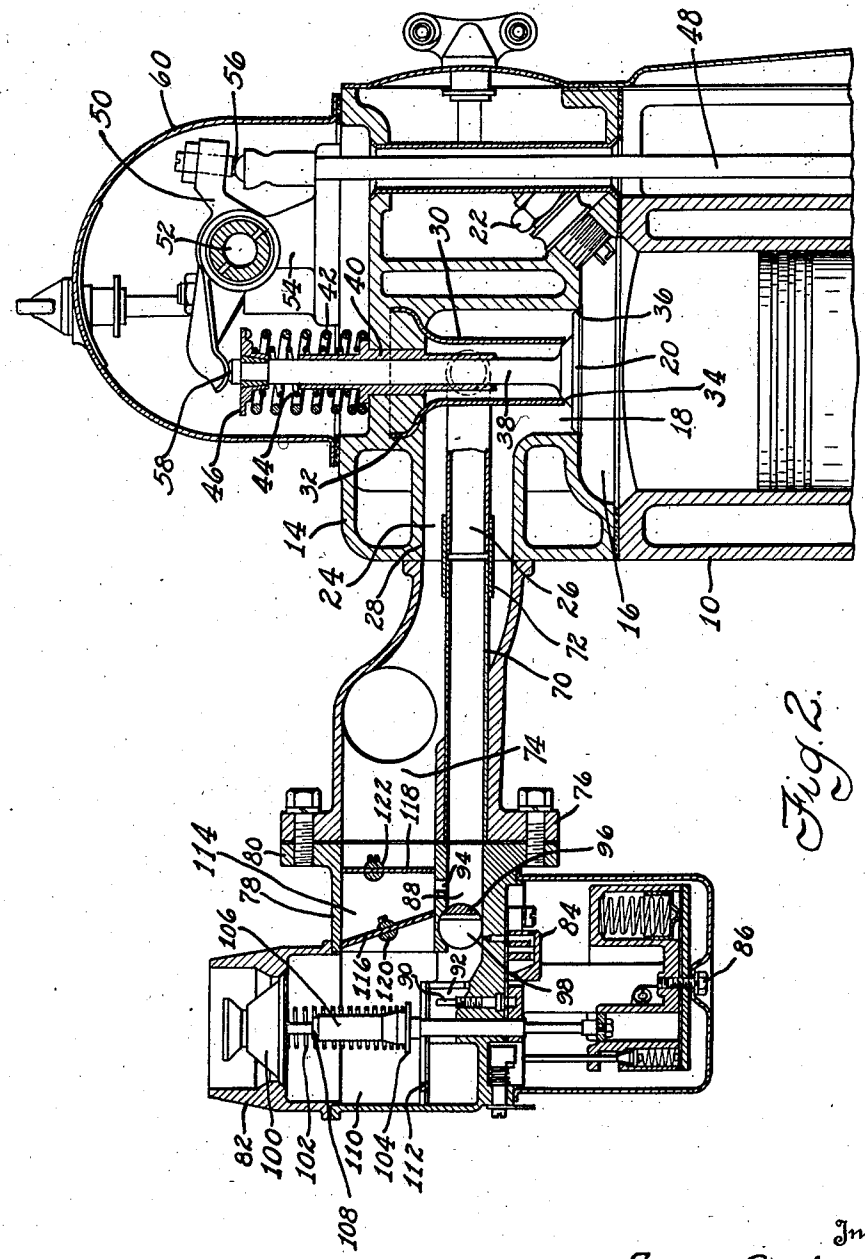

Fig. 2.

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CHARGE FORMING DEVICE

Filed Jan. 29, 1932 5 Sheets-Sheet 3

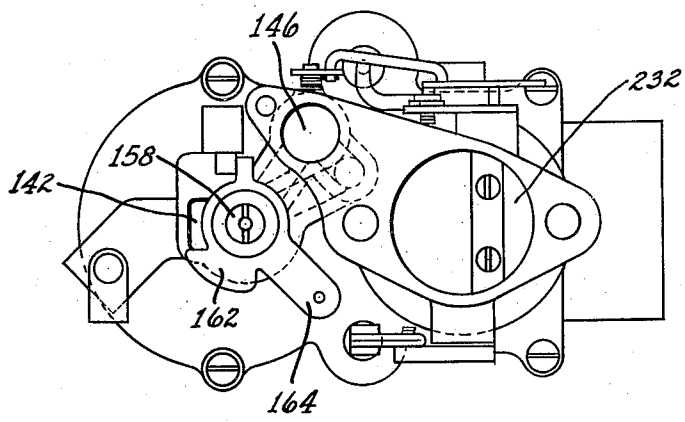

Fig. 6.

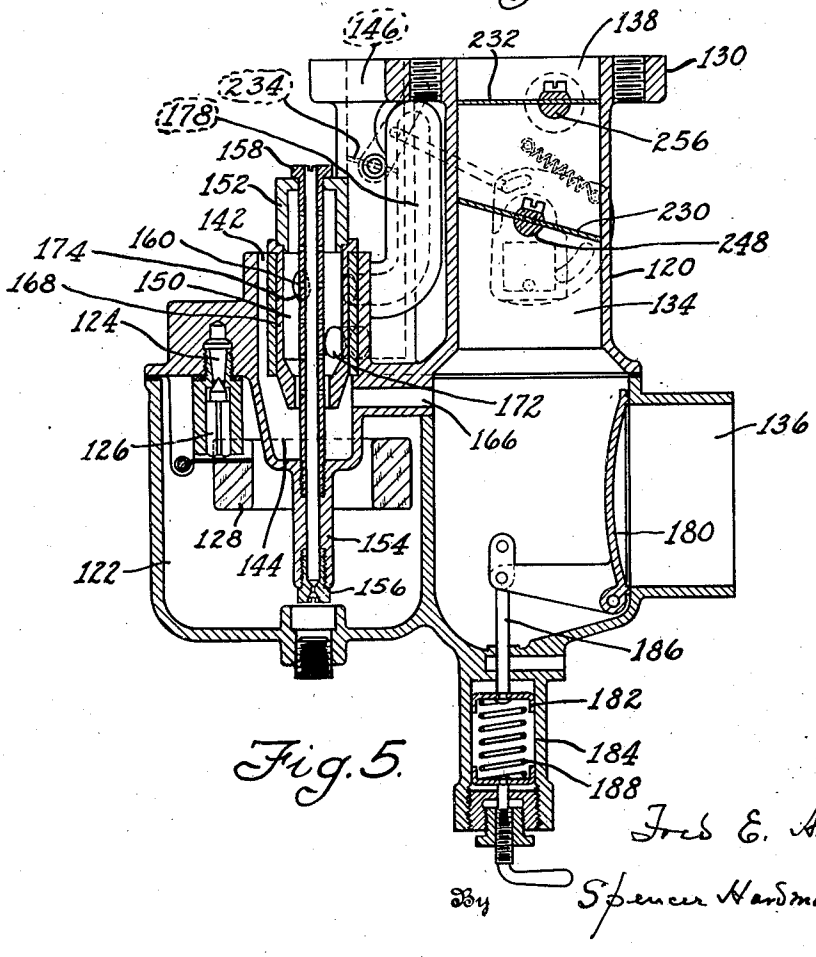

Fig. 5.

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CHARGE FORMING DEVICE

Filed Jan. 29, 1932 5 Sheets-Sheet 4

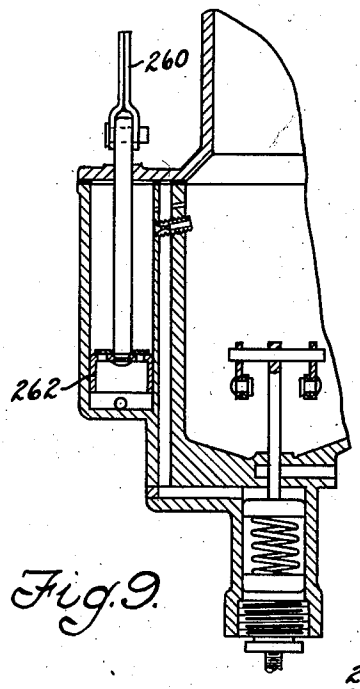

Fig. 9.

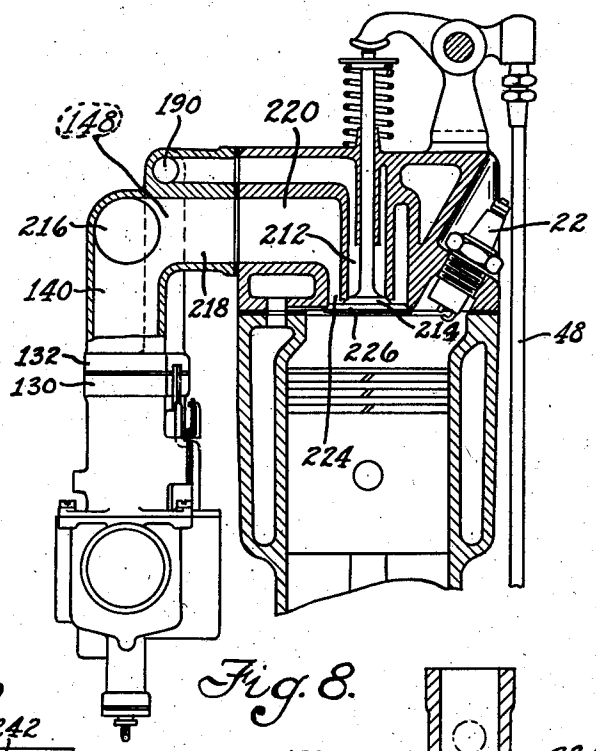

Fig. 8.

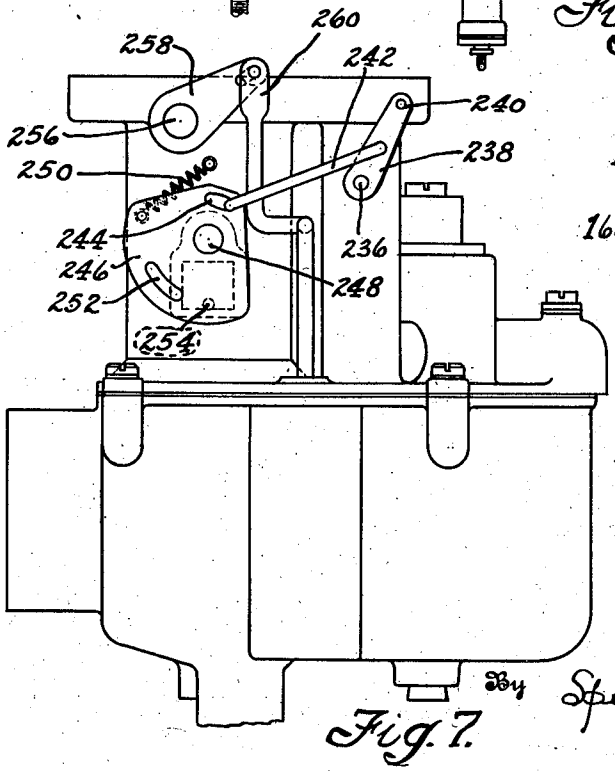

Fig. 7.

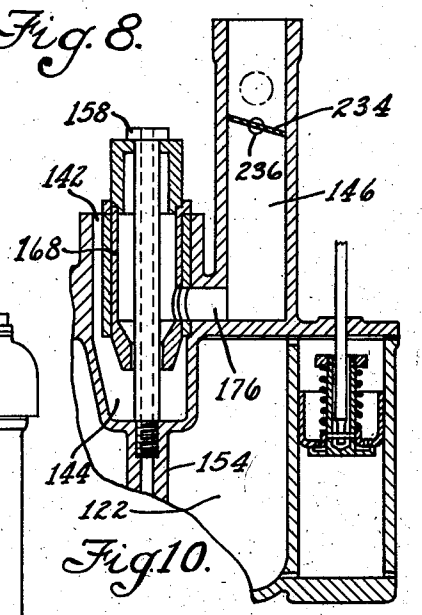

Fig. 10.

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CHARGE FORMING DEVICE

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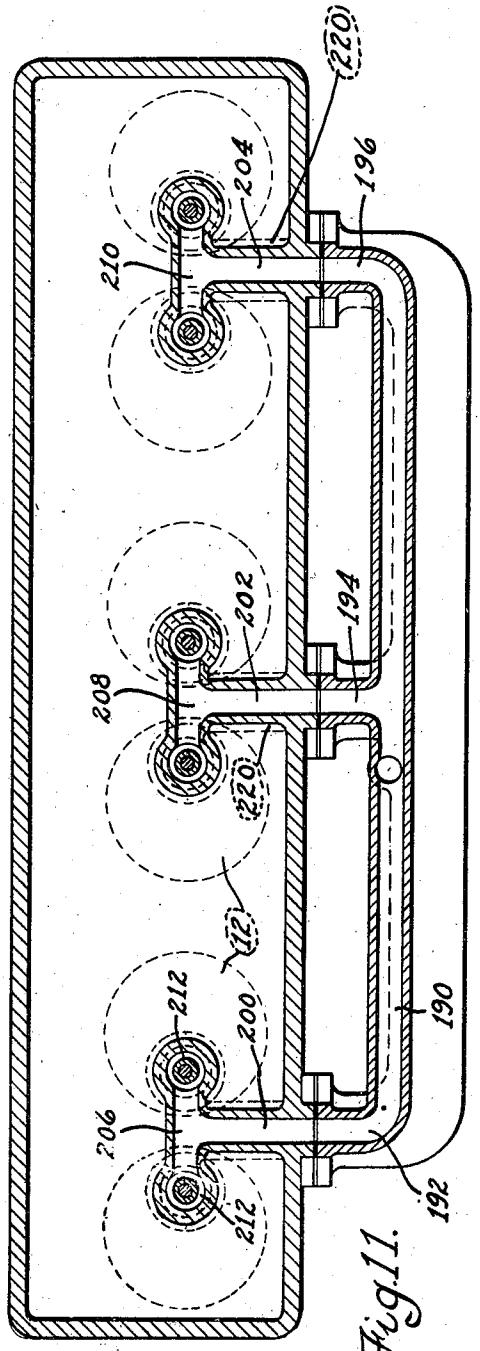

Fig. 11.

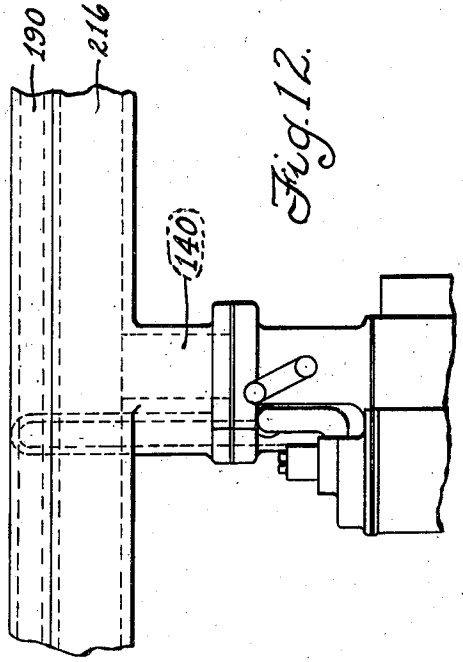

Fig. 12.

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Patented Aug. 20, 1935

2,011,993

UNITED STATES PATENT OFFICE

2,011,993

CHARGE FORMING DEVICE

Fred E. Aseltine, Dayton, Ohio, assignor, by mesne assignments, to General Motors Corporation, Detroit, Mich., a corporation of Delaware

Application January 29, 1932, Serial No. 589,611

17 Claims. (Cl. 123—119)

This invention relates to internal combustion engines and means for supplying the fuel charge thereto, and more particularly to an engine and means for supplying a rich mixture and air separately to the combustion chamber itself.

An engine and charge forming device of this general character are shown in the copending application of Fred E. Aseltine, Serial No. 417,087, filed December 28, 1929, and the present invention in an aspect relates to an improved form of a construction which is broadly old in said application.

It is an object of this invention to provide a device of the character described which is of simple construction and in which a single intake valve is employed to control the admission, both of the rich fuel mixture and the air which is to be mixed therewith, to the combustion chamber.

While this invention is most particularly adapted to a charge forming device such as shown in the aforesaid application in which a plurality of primary mixing chambers are provided each one of which is associated specifically with one of the engine intake parts and is intended to supply a primary mixture to the cylinder or cylinders which are in communication with that particular part. It will be understood that the invention is applicable to other forms of charge forming devices one of which is disclosed in the modified form of the invention illustrated herein, which is very similar in general construction to that shown in applicant's earlier copending application Serial No. 362,190, filed May 8, 1929.

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 plan view of an engine and charge forming device constructed according to the present invention.

Fig. 2 is a vertical section through the charge forming device and the upper portion of the engine block.

Figs. 3 and 4 are enlarged detailed views of the primary mixture inlets.

Figs. 5 to 10 inclusive, show a modified form of the invention, and Figs. 5, 6 and 7 show respectively a vertical section, a plan and elevation of the carburetor unit which forms part of the invention.

Fig. 8 is a view showing the carburetor unit and manifold attached to the cylinder block partly in section.

Figs. 9 and 10 are fragmentary sections showing details of construction of the carburetor unit.

Fig. 11 is a diagrammatic sectional view showing the primary mixture passages in the manifold and cylinder block.

Fig. 12 is a fragmentary front elevation of the modified form of the invention.

Referring to Figs. 1 to 4 inclusive, the engine disclosed in the drawings is, with the exception of the construction of the intake valves and passages leading from the intake ports to the combustion chambers, of the conventional valve-in-the-head type, the engine block being indicated in its entirety by the reference numeral 10. The engine block comprises a plurality of cylinders 12 and a cylinder head 14 is secured to the block in the conventional manner and has combustion chambers 16 formed therein. Each cylinder is provided with an exhaust port, which is not shown herein for the sake of simplicity of disclosure, and an intake port 18, controlled by a valve indicated in its entirety by the reference numeral 20 and more fully described hereinafter. A spark plug 22 is associated with each cylinder to ignite the charge therein. All of the details of construction of the engine are of the usual design found in engines of this type with the exception of the passages for supplying the charge to the combustion chamber and the valves which control the admission of the charge, these details having been modified in the manner hereinafter described.

As clearly shown in Figs. 2 and 4, two separate intake passages 24 and 26 extend from each of the intake ports 28 to the combustion chamber 16. The passage 24 which surrounds the passage 26 conveys pure air to the combustion chamber while the passage 26 conveys a primary mixture of fuel and air supplied to such passage in the manner hereinafter described and discharges such mixture into the combustion chamber where it is mixed with air admitted through the passage 24, under certain operating conditions, which under other conditions the primary mixture alone is supplied to the combustion chamber. The passage 24 is the ordinary intake passage such as employed in the conventional form of engine and the passage 26 comprises a sheet metal tube extending through the passage 24 horizontally and connecting at its inner end with a horizontal tube 28 arranged at right angles to the tube 24 and communicating at its ends with two larger vertical sheet metal tubes 30, which

at their upper ends are spread outwardly as indicated at 32 in Fig. 2. The various sheet metal tubes are secured together by welding or in any other suitable manner and the assembly forms an ingot which is cast in the cylinder head during the casting thereof. It will thus be clear that the primary mixture tube 26 supplies two adjacent cylinders with the rich primary mixture when the cylinder head is provided with Siamese ports, as indicated in the accompanying drawings.

Each tube 30 extends downwardly to a position a little above the outlet of the intake passage 18 and is normally closed by a valve surface 34 formed on the intake valve 20 which is provided with another valve surface 36, which closes the outer passage 24. It will thus be clear that the single valve element 20 is provided with two separate valve surfaces which control the admission of the primary mixture and air to be mixed therewith to the combustion chamber.

The stems 38 of the intake valves are guided in valve guides 40 positioned in the cylinder head casting and are normally held closed by springs 42 and 44 received between a collar 46 on the end of the valve stem and the casting of the cylinder head.

The valves are adapted to be opened by a valve operating mechanism of the same construction as is normally employed in a valve-in-the-head engine. This valve operating mechanism includes push rods 48, which are reciprocated vertically by the cam shaft (not shown) in the usual manner. Each of the push rods operates a rocker arm 50 pivotally mounted on a shaft 52 supported in standards 54 extending upwardly from the cylinder head from the cylinder head casting. The rocker arms are each provided with means indicated at 56 for adjusting the clearance between the push rod and the rocker arm in the usual manner, while the opposite end of the rocker arm is provided with a projecting surface 58 engaging the upper end of the valve stem 38 and on upward movement of the push rods 48 pushes the associated valve stem downwardly to open the valve and admit the separate portions of the charge to the combustion chamber through the passages 24 and 26. The valve operating mechanism is covered by sheet metal housing 60 of the type usually employed with engines of this character.

Associated with the above described engine head is an intake manifold indicated in its entirety by the reference character 62 and having three outlet branches 64, 66 and 68, each of which registers with one of the intake ports 28 when the device is assembled. The manifold is adapted to be secured to the engine block in the conventional manner and when assembled, the primary mixture passages 26 register with primary mixture conduits 70, which are in the form of sheet metal tubes cast in the manifold as fully described in copending application Serial No. 370,179. Tight fitting metal collars 72 surround the conduit 70 and the tubes 26 at their adjacent ends to prevent leakage. The outlet branches of the manifold are all supplied with air through a common inlet 74, which communicates with the secondary air passage in a main carburetor unit adapted to be secured to a flange 76 at the manifold inlet.

The carburetor unit, such as shown in the drawings, is of substantially the same construction as that which is fully described in the application of Fred E. Aseltine et al. Serial No. 370,179, above referred to, and need not be described in detail herein, it being sufficient for the purpose of this disclosure to describe in general terms the principal structural features and mode of operation of this carburetor. The carburetor comprises a main housing 78, provided with a flange 80, which is secured to the flange 76 as shown in Fig. 2. An air inlet coupling 82 is secured in position in an opening in the main housing and may be connected with an air cleaner if desired. A casting 84 is secured to the bottom of the main housing and has certain fuel supply passages and other elements of the carburetor formed therein. A sheet metal fuel bowl is held tight against a flat surface on the main housing by the screw 86 screwed into the casting 84 and fuel is conducted from a main source of supply to the fuel bowl where a substantially constant level of fuel is maintained in the usual manner.

Fuel is supplied from the fuel bowl to a plurality of mixture passages 88, which register with the conduits 70 by means of nozzles 90, which extend into chambers 92 where the fuel issuing from the nozzles is mixed with a small amount of air, this mixture or emulsion, being supplied to the passages 88 through orifices 94. The fuel supply passages are not shown, nor is but one of the primary mixture passages 88 and the associated chambers 92. There are, however, three of the passages 88 and three of the chambers 92 communicating therewith, while a nozzle 90 projects into each of said chambers. The primary mixture passages supply all of the fuel mixture during idling and other low speed operation up to a predetermined position of a primary throttle 96, which extends across all of the mixture passages and is provided with grooves 98, which register therewith. After the throttle has been opened to a predetermined position, the secondary air passage 114 is rendered effective to supply air to the manifold and thus to the passages 24, but during all operation when the throttle has not been opened to the position referred to, the primary mixture is of combustible proportions and is all that is supplied to the combustion chambers.

Air is admitted through the coupling 82 and is controlled by a valve 100 normally held closed by a spring 102, received between the valve and flange 104, projecting from a sleeve 106 which is slidable on a fixed sleeve 108, which guides the stem of the air valve. In order to choke the carburetor to facilitate starting, the valve is manually held closed by means not shown herein but fully described in application Serial No. 370,179. The valve 100 admits air to a main air chamber 110 from which air passes through an opening 112 to the chambers 92 to be mixed with fuel therein as previously described and also to the manifold inlet through a secondary air passage 114, as shown in Fig. 2. The flow of air through the passage 114 is controlled by manually and suction operated valves 116 and 118 secured to shafts 120 and 122 respectively, the valve 116 being operated by the primary throttle 96 through the medium of an operating connection which is designed to allow the primary throttle to be moved to a predetermined position before the valve 116 begins to open as hereinbefore described. This predetermined position of the throttle is one which corresponds to a vehicular speed of approximately 15 to 20 miles per hour and at speeds above this, air is also supplied through the passage 114, the air manifold and the passages 24 to be mixed with the primary fuel mixture within the combustion chambers of the engine.

The valve 118 is operated entirely by engine suction and its opening movement is retarded to some extent to aid in securing satisfactory operation during the acceleration period, the means for controlling this valve being fully described in application Serial No. 370,179. It is believed to be unnecessary to describe the structure of the carburetor unit in greater detail as the improvement which comprises the present invention can be fully understood without further description.

The operation of the device will be obvious from the foregoing description. The primary mixture is supplied at all times through the various primary mixture passages to tubes 30, while under certain operating conditions when the throttle has been opened through a predetermined distance air is also supplied through the secondary air passage 114 of the carburetor, the air manifold and the passages 24. Each engine intake valve 20 controls one of the tubes 30, and one of the passages 24 and on opening movement of such valve, permits the primary mixture to enter the combustion chamber and if the throttle has opened beyond a predetermined position, the valve also admits air through the passage 24 to the combustion chamber, the mixture of air with the primary mixture taking place in the combustion chamber itself. The principle of operation of this device is much the same as that disclosed in the copending application Serial No. 417,087 and the same beneficial results are secured thereby but this device has been simplified by the elimination of a separate intake valve to control the admission of the primary mixture and the valve operating mechanism for operating the additional valve, in this device a single valve performing the work of two valves which were disclosed in the application referred to.

One of the desirable results referred to above is superior fuel distribution. By means of this device no primary mixture tube other than one which is associated with a cylinder in which the piston is on its suction stroke can deliver any fuel as this is the only primary tube which is subjected to engine suction. There is therefore no possibility of puddling of fuel in the manifold outlet branches or the intake passages formed within the cylinder head.

Further by delivering the primary mixture close to the spark plugs and effecting the mixing of air with said primary mixture in the combustion chamber it is possible to operate the engine on a leaner mixture than is possible when other charge forming devices are used, resulting in considerable fuel saving.

It is also found that the engine operation during the acceleration period is improved because when the primary mixture tubes deliver directly to the combustion chambers the variations in velocity of flow through such tubes is minimized, and following opening movements of the throttle there is less dilution of the mixture by admission of auxiliary air during the acceleration period.

In the modified form of the invention disclosed in Figs. 5 to 11 inclusive, the construction of the cylinder block and valve mechanism controlling the passages therethrough is substantially the same as in the form of the invention previously described, but the carburetor unit and manifold are of modified and only one primary carburetive device is employed, which supplies fuel to all of the engine cylinders. The carburetor unit is of substantially the same form as that shown in application Serial No. 362,190, filed May 11, 1929, and will be only briefly described herein except insofar as the earlier device is little changed.

The carburetor unit comprises a casing indicated in its entirety by the reference numeral 120 and comprising a fuel reservoir 122 to which fuel is supplied from a main source of supply through a passage 124 controlled by a valve 126 operated by a float 128 to maintain a substantially constant level of fuel in the fuel reservoir in the usual manner.

The carburetor unit is secured by flanges 130 and 132 to the manifold in the conventional manner, and is provided with a main air passage 134 therethrough, having an air inlet 136 controlled by a suction operated air valve in a manner later described and an air outlet 138 which registers with a corresponding passage 140 in the manifold as shown in Fig. 8. A primary air inlet 142 is provided which admits air to a primary air chamber 144 from which it flows into a primary mixing chamber where it is mixed with fuel to form a primary mixture of fuel and air which is conveyed through primary mixture passages 146 and 148 in the carburetor and manifold respectively, to be mixed with air supplied through the passage 134 under certain conditions as hereinafter set forth.

The construction of the primary mixing chamber and means for supplying fuel thereto is substantially the same as in application Serial No. 362,190, the mixing chamber being formed within a sleeve which is positioned in a centrally depending portion 150 of the top 152 of the main fuel reservoir, as shown in Fig. 5 and more fully described later. Projecting downwardly therefrom into the fuel in the reservoir is a fuel conduit 154 having a metering plug 155 screwed into its lower end, which regulates the supply of fuel. Screwed into the upper end of the conduit 154 is a fuel supply tube 158 having a plurality of fuel feeding orifices 160 adapted to be rendered effective to supply fuel successively, as the suction in the primary mixing chamber increases. Air is supplied to the primary mixing chamber through the above described primary air inlet 142, the size of which may be regulated as desired by means of a valve 162 operated by an operating handle 164 projecting from the valve, while air may also be supplied to the primary mixing chamber through the passage 166 which connects the main air passage with the primary mixing chamber, but it will be understood that this air inlet may be omitted if desired, and all of the air for the primary mixture may be taken through the passage 142 or tube 158.

Formed integrally with the valve 162 and operating lever 164 is a sleeve 168 which projects downwardly into the depending portion of the float chamber top and in which the primary mixing chamber 150 is formed. In the wall of the sleeve 168 are ports 172 and 174 which are adapted to register with 176 and 178 communicating with the primary mixture passage 146 below and above the throttle therein respectively, as the sleeve is rotated to different positions. A suitable operating connection is adapted to extend from the operating lever 164 to a point convenient to the operator of the vehicle, so that the sleeve 168 may be adjusted manually.

The construction of the primary mixing chamber and associated parts of the device is just the same as in application Serial No. 362,190 except in two particulars, so that it will not be more minutely described herein, as it is believed that a description of the operation of the device is

all that is necessary to enable a clear understanding to be had. The two points of difference between the present showing and the earlier device are the following. In the earlier device the air inlet passage 166 is omitted and the passages 176 and 178 connect directly with the passage 134 which is the main mixture passage instead of connecting with a primary mixture conduit such as the passage 146 in this device. The operation is substantially the same as in the earlier case. Manual adjustment of the valve 162 and sleeve 168, not only controls the size of the air inlet supplying air to the primary mixing chamber, but also by control of the passages 176 and 178 regulates the degree of suction communicated to the said mixing chamber so that substantially any desired mixture proportions may be secured. The sleeve 168 is adapted to be moved so that the passage 142 is nearly closed and the passage 178 connecting with the primary mixture passage above the throttle is open, when it is desired to start the engine or when operating at idling or very low speed while at other times the sleeve is moved to adjust the area of the passages 142, 176 and 178 as desired.

It will be understood that the device may be constructed with the ports 172 and 174 in such position that both passages 176 and 178 may be partly open at the same time, or such ports may be so positioned that before either one of such passages begins to open the other is fully closed, the first mentioned construction being deemed preferable.

Admission of air to the main air passage 134 is controlled by a pivoted valve 180, the opening of which is controlled by a dash pot comprising a piston 182 sliding in a cylinder 184 and pivotally connected to the valve by a rod 186. A spring 188 within the dash pot cylinder normally lifts the piston to hold the valve closed, the structure of valve and dash pot being substantially the same as in application 362,190.

As has been stated previously the primary mixture in this device is not delivered directly to the passage 134 as in the device disclosed in the earlier application, but instead the passage 146 communicates with the vertical passage 148 which is cast in the manifold as shown herein or may be formed separately if desired. This vertical passage connects at its upper end with a horizontal passage 190, communicating with three primary mixture outlet passages 192, 194 and 196 which register with corresponding passages 198, 200 and 202 formed in the engine cylinder head, one of which is shown in detail in Fig. 11. Each of the passages 200, 202 and 204 is adapted to supply two adjacent cylinders of the engine as shown in Fig. 11 and to this end said passages connect with horizontal passages 206, 208 and 210 respectively, while each of the latter passages connects with two of the vertical passages 212, the lower end of each of which forms a seat for a beveled surface 214 formed on the engine intake valve, which in closed position entirely closes the primary mixture passage 212 associated therewith.

The riser 140 of the air manifold connects at its upper end with a horizontal passage 216 which communicates with three outlet branches 218 formed in the manifold casting below the primary mixture passages 192, 194 and 196, all of these outlet branches being of the same construction and one of said branches being shown in detail in Fig. 8. Each of the branches 218 communicates with a horizontal passage 220 communicating with two downwardly extending outlets 224 which supply adjacent cylinders with air in the same way that passages 212 supply such cylinders with primary mixture. The delivery end of each outlet 224 forms a seat for the beveled surface 226 on the engine valve, which, when closed, prevents admission of air to the associated cylinder. It will be clear, therefore, that a single engine intake valve controls the admission to the engine cylinder of both primary mixture and air and when the throttle valve of the carburetor air passage is open, the mixture of air with the primary mixture is effected in the combustion chamber of the engine cylinder itself.

The control mechanism for controlling the quantity of mixture supplied to the engine and the proportions of fuel and air therein is somewhat different from that disclosed in application Serial No. 362,190, and this mechanism will, therefore, be briefly described. In the earlier device there is only one throttle in the passage corresponding to passage 134 of this application and such throttle is manually operated. In the present structure the passage 134 is controlled by two valves 230 and 232, the first being manually operable by a lost motion connection operated from a primary throttle 234 in the passage 146, while the valve 232 is operated wholly by suction which is effective thereon after the valve 230 has begun to open. The primary throttle is fixed to a spindle 236 journalled in the casing and secured to the end of the spindle outside the casing is an operating arm 238 having an orifice 240 in which some operating connection extending to the dash of the vehicle is adapted to be connected. Pivotally connected to the arm 238 is an operating link 242, the other end of which is received in a slot 244 formed in a plate 246, secured to a spindle 248 journalled in the housing and on which the air throttle 230 is secured. A spring 250 connected in a very suitable way to said plate 246 and the housing normally holds the throttle 230 in closed position. As the arm 236 is moved in counterclockwise direction to open the primary throttle the latter is opened independently of the throttle 230 until the link 242 engages the left end of slot 244 after which both throttles are moved together. The primary throttle is generally designed to open to a position corresponding to a vehicular speed of substantially 15–20 miles per hour on a level before the throttle 230 begins to open. However, the connections may be varied to permit any amount of independent movement of the primary throttle which may be desired.

The plate 246 is provided with a slot 252 which cooperates with a hole 254 in the housing to admit air at intermediate speeds for a purpose set forth and forming no part of this invention.

The suction operated valve 232 is secured to a shaft 256 journalled in the housing and the shaft has secured at one end thereof an arm 258 to which is pivotally connected a piston rod 260 which operates the piston 262 of a combined dash pot and fuel pump which need not be specifically described as it forms no part of the present invention but is fully described in the earlier application.

It will be clear from the foregoing description that on the modified form of the invention substantially the same results are secured as in the preferred form. Superior fuel distribution is secured because a relatively high velocity is maintained at all times in the primary mixture pas-

sage, preventing accumulation of fuel on the walls thereof as would occur on the manifold walls if a conventional type of carburetor were employed. Other advantages mentioned in connection with the preferred form of the invention are also secured.

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. In combination with a multicylinder engine having a plurality of separate passages formed therein to convey separate charges of fuel mixture and air to each cylinder, a charge forming device comprising a carburetor having a plurality of primary mixing chambers in which a primary mixture of air and fuel is formed, a secondary air passage in said carburetor unit, a plurality of conduits connecting each one of the primary mixing chamber with one of the fuel mixture passages in the engine, an air conduit connecting the secondary air passage with all of the air passages in the engine and a single valve controlling the fuel mixture and air passages associated with each cylinder.

2. In combination with a multicylinder engine having a plurality of separate passages formed therein to convey separate charges of fuel mixture and air to each cylinder, a charge forming device comprising a carburetor unit having a single primary mixing chamber on which a primary mixture of air and fuel is formed, a secondary air passage in said carburetor unit, a branched primary mixture conduit which connects the primary mixing chamber with all of the fuel mixture passages in the engine and an air conduit connecting the secondary air passage with all of the air passages in said engine.

3. In combination with a multicylinder engine having a plurality of separate passages formed therein to convey separate charges of fuel mixture and air to each cylinder, a charge forming device comprising a carburetor unit having a single primary mixing chamber in which a primary mixture of air and fuel is formed, a secondary air passage in said carburetor unit, a branched primary mixture conduit which connects the primary mixing chamber with all of the fuel mixture passages in the engine, an air conduit connecting the secondary air passage with all of the air passages in the engine, and a single intake valve controlling the fuel mixture and air passages associated with each cylinder.

4. In combination with a multicylinder internal combustion engine having separate passages formed therein to convey separate charges of fuel mixture and air to each cylinder, a charge forming device comprising a carburetor unit having a plurality of primary mixture passages in which a primary mixture of air and fuel is formed, a secondary air passage therein, a manifold having a plurality of primary mixture conduits therein connecting each of the primary mixture passages with one of the fuel mixture passages in the engine and an air conduit connecting the secondary air passage with all of the air passages formed in the engine, and a single intake valve for controlling the outlets of said separate passages which communicate with the engine cylinder.

5. A charge forming device for a multicylinder engine having a plurality of intake ports, comprising a plurality of primary carburetors, provided with means for admitting fuel and air thereto, a plurality of passages leading from said primary carburetors to the engine intake ports, means admitting secondary air to be mixed with said primary mixture, passages leading from air admitting means to the engine intake ports, said last named passages being entirely separate from and having no communication with the passages from the primary carburetors, and a single intake valve controlling the outlets of said air and mixture passages which communicate with an engine cylinder.

6. A charge forming device for a multicylinder engine having a plurality of intake ports, comprising a plurality of primary carburetors provided with means for admitting fuel and air thereto, a plurality of passages leading from said primary carburetors to the engine intake ports, a single air inlet supplying secondary air to be mixed with said primary mixture, passages leading from said single air inlet to the engine intake ports, said last named passages having no communication with the primary mixture passages, and a single intake valve controlling the outlets of said air and mixture passages which communicate with an engine cylinder.

7. A charge forming device for a multicylinder engine having a plurality of intake ports, comprising a plurality of primary carburetors, one for each intake port, means for supplying fuel and air to each primary carburetor, a main air inlet, mixture and air conduits extending from said primary carburetors and air inlet respectively, to the engine cylinders, said conduits being separate and having no communication with each other, and a single intake valve controlling the outlets of said air and mixture passages which communicate with an engine cylinder.

8. A charge forming device for a multicylinder engine having a plurality of intake ports, comprising a carburetor unit having a plurality of primary carburetors formed therein, an air inlet passages in said carburetor unit, a manifold interposed between the carburetor and the engine intake ports, passages in said manifold communicating with the primary carburetors and air inlet passage respectively, said passages in the manifold being separate and having no communication with each other, and a single intake valve controlling the outlets of said air and mixture passages which communicate with an engine cylinder.

9. In combination, a multicylinder engine having a plurality of intake ports, each of which comprises a plurality of openings adapted to communicate with separate passages leading to the engine cylinders, a carburetor unit therefor having a mixture outlet passage and an air supply passage formed therein, a manifold interposed between the carburetor unit and the engine intake ports, said manifold having means for conveying the mixture from the carburetor unit to one of the openings at each intake port, means for conveying air from the air supply passage to the other of said openings at each intake port, and a single intake valve controlling the communication of said separate passages with the engine cylinder.

10. In combination, a multicylinder engine having a plurality of intake ports, each of which comprises a plurality of openings adapted to communicate with separate passages leading to the engine cylinders, a carburetor unit therefor having a plurality of primary carburetors and an air supply passage formed therein, a manifold

interposed between the carburetor unit and the engine intake ports, said manifold having a plurality of mixture passages therein, each of which connects one of said primary carburetors with one of the openings at one of said intake ports, air passages in said manifold connecting the air supply passage with one of the openings at all of the intake ports, said mixture and air passages in the manifold having no means of communication with each other, and a single intake valve controlling the communication of said separate passages with the engine cylinder.

11. In combination, a multi-cylinder internal combustion engine having cylinders in each of which is formed a combustion chamber, separate mixture and air ports for admitting separate charges of fuel mixture and air only to each combustion chamber, a charge forming device associated with said engine, said device having means for supplying fuel mixture to said mixture ports under all operating conditions and means for supplying air only to said air ports under certain operating conditions, and a single intake valve for controlling both of said ports.

12. In combination, a multi-cylinder internal combustion engine having cylinders in each of which is formed a combustion chamber, separate mixture ports for admitting separate charges of fuel mixture and air only to each combustion chamber, a charge forming device associated with said engine, said device having a primary mixing chamber and a secondary air inlet, separate conduits connecting the primary mixing chamber with said mixture ports and the secondary air inlet with said air ports, and a single intake valve controlling both of said ports.

13. In combination with a multi-cylinder internal combustion engine in each cylinder of which is formed a combustion chamber, separate mixture and air ports for admitting separate charges of fuel mixture and air only to said combustion chamber, a charge forming device associated with said engine and including means for supplying fuel mixture through said mixture ports under all conditions of operation, means for supplying air to said air ports, and means for controlling the supply of air so constructed that air is not supplied to said air ports at low engine speeds, and a single intake valve for controlling the separate ports which communicate with the combustion chamber.

14. In combination with a multi-cylinder internal combustion engine having separate passages formed therein to convey separate charges of fuel mixture and air to each combustion chamber, a charge forming device associated therewith including a carburetor unit having a primary mixing chamber formed therein, means for supplying fuel and air thereto to form a primary fuel mixture, an auxiliary air inlet in said carburetor unit, separate conduits for conveying the fuel mixture and air from the primary mixing chamber and said air inlet to said separate passages, so constructed that one of said conduits conveys air only and the other fuel mixture, means for controlling the flow through said conduits, said means being constructed to prevent a flow of air through said air conveying conduit under certain operating conditions while permitting a flow of fuel mixture through said mixture conveying conduit, and a single intake valve controlling the communication of said separate passages with the combustion chamber.

15. In combination with a multi-cylinder internal combustion engine having separate passages formed therein to convey separate charges of fuel mixture and air to each combustion chamber, a charge forming device associated therewith including a carburetor unit having a primary mixing chamber formed therein, means for supplying fuel and air thereto to form a primary fuel mixture, an auxiliary air inlet in said carburetor unit, separate conduits for conveying fuel mixture and air from the primary mixing chamber and said air inlet to said separate passages, so constructed that one of said conduits conveys air only and the other fuel mixture, a primary throttle for controlling the flow of fuel mixture through one of said conduits, a secondary throttle operated thereby for controlling the flow of air through the other of said conduits and constructed to begin its opening movement after the primary throttle is partly opened, and a single intake valve controlling the communication of said separate passages with the combustion chamber.

16. In combination with a multi-cylinder internal combustion engine having separate passages formed therein to convey separate charges of fuel mixture and air to each combustion chamber, a charge forming device associated therewith including a carburetor unit having a primary mixing chamber formed therein, means for supplying fuel and air thereto to form a primary fuel mixture, an auxiliary air inlet in said carburetor unit, separate conduits for conveying fuel mixture and air from the primary mixing chamber and said air inlet to said separate passages, so constructed that one of said conduits conveys air only and the other fuel mixture, a primary throttle for controlling the flow of fuel mixture through one of said conduits, a secondary throttle for controlling the flow of air through the other of said conduits, means for operating said throttles concurrently, and a single intake valve controlling the communication of said separate passages with the combustion chamber.

17. In combination with a multi-cylinder internal combustion engine having separate passages formed therein to convey separate charges of fuel mixture and air to each combustion chamber, a charge forming device associated therewith including a carburetor unit having a primary mixing chamber formed therein, means for supplying fuel and air thereto to form a primary fuel mixture, an auxiliary air inlet in said carburetor unit, separate conduits for conveying fuel mixture and air from the primary mixing chamber and said air inlet to said separate passages, so constructed that one of said conduits conveys air only and the other fuel mixture, a primary throttle for controlling the flow of mixture through one of said conduits, a suction operated valve controlling the flow of air through the other of said conduits, means for temporarily retarding the opening of said valve during the acceleration period following opening movement of the throttle, and a single intake valve controlling the communication of said separate passages with the combustion chamber.

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