Nov. 18, 1930. F. E. ASELTINE 1,782,333

CHARGE FORMING DEVICE FOR INTERNAL COMBUSTION ENGINES

Filed Jan. 26, 1925 4 Sheets-Sheet 1

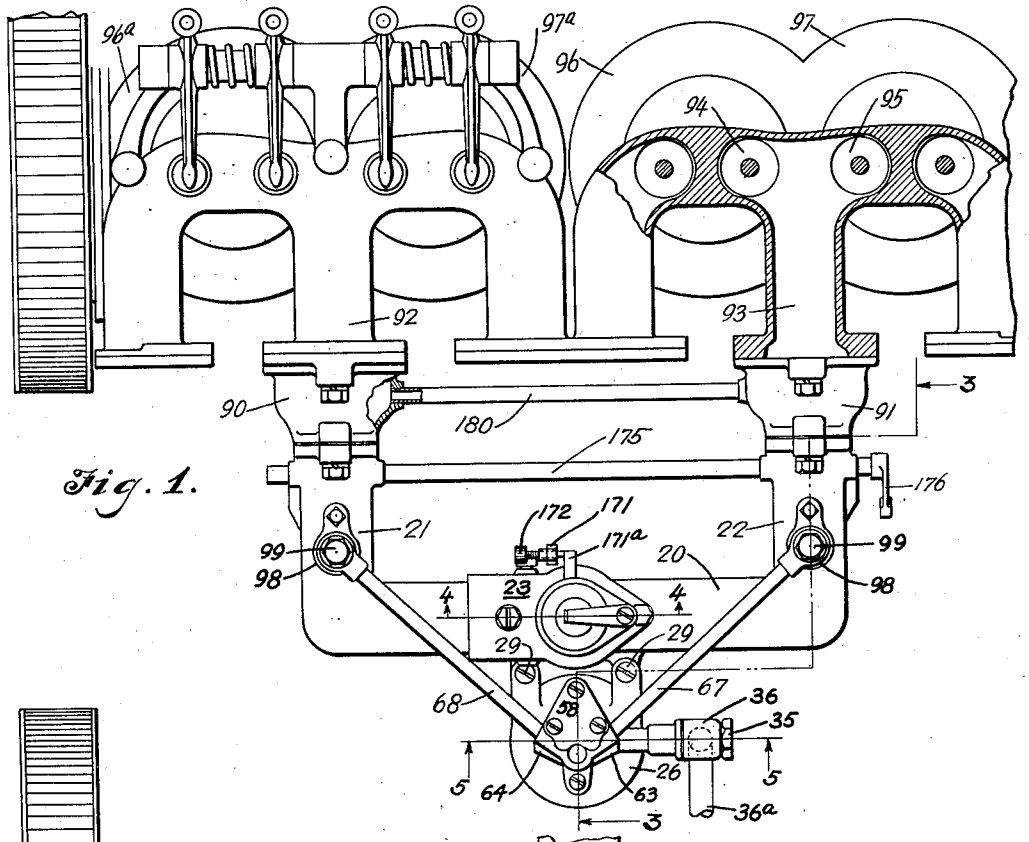


Fig. 1.

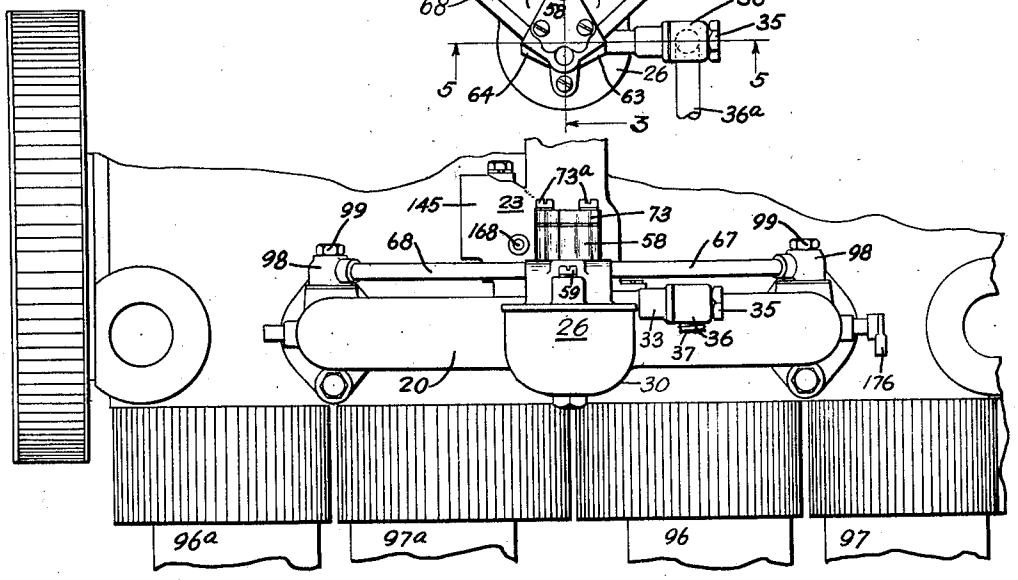


Fig. 2.

Inventor

Fred E. Aseltine

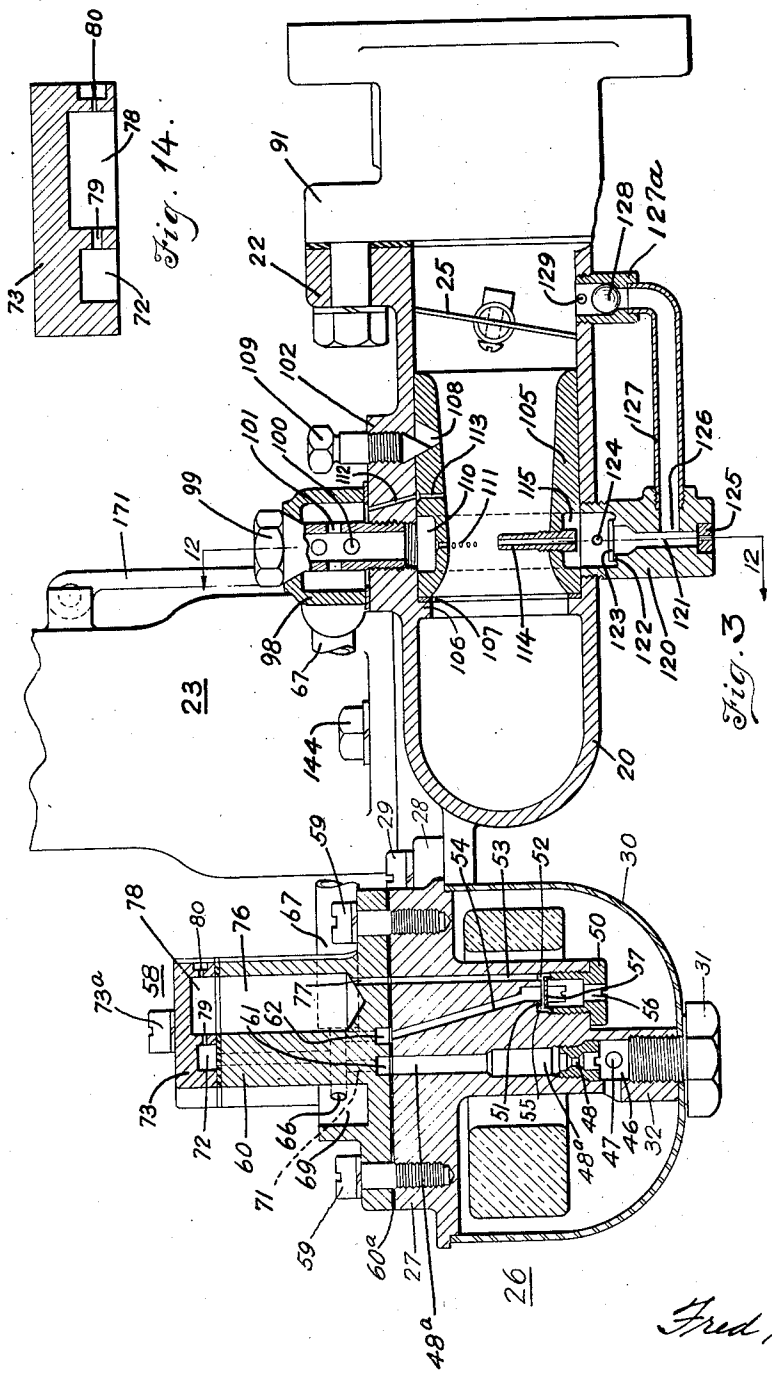
By Spencer, Lewall & Hardman

Attorney

Nov. 18, 1930. F. E. ASELTINE 1,782,333

CHARGE FORMING DEVICE FOR INTERNAL COMBUSTION ENGINES

Filed Jan. 26, 1925 4 Sheets-Sheet 2



Inventor
Fred E. Aseltine

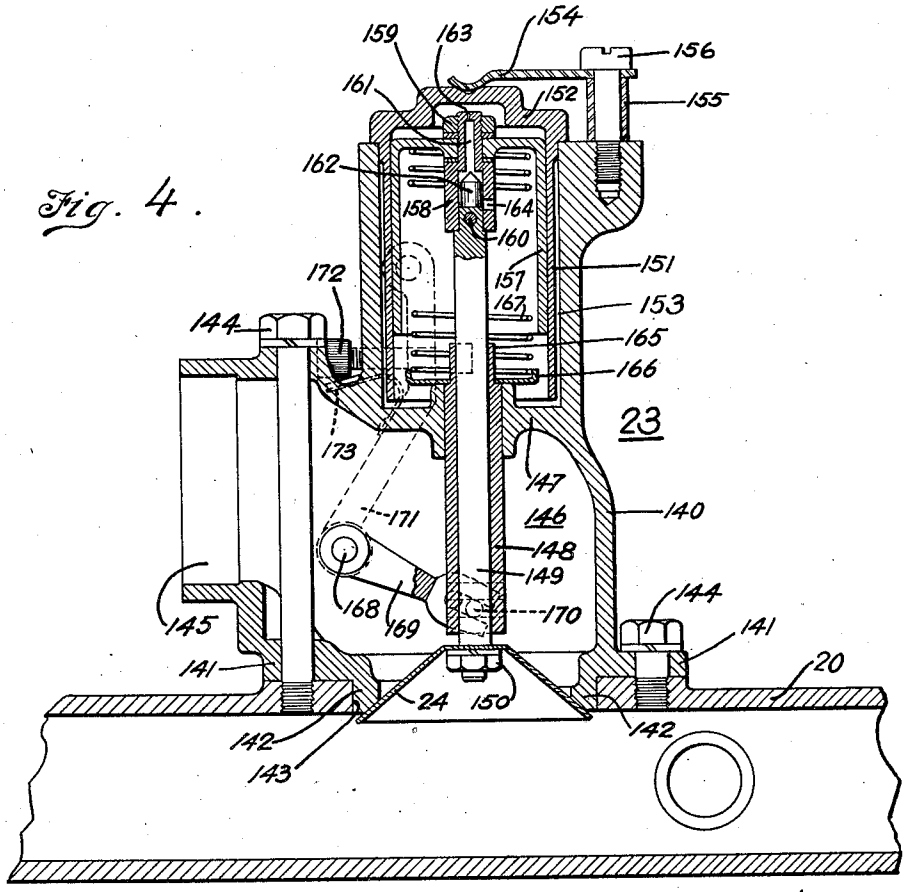
By Spencer, Semmell & Hardman
his Attorneys

Nov. 18, 1930. F. E. ASELTINE 1,782,333

CHARGE FORMING DEVICE FOR INTERNAL COMBUSTION ENGINES

Filed Jan. 26, 1925 4 Sheets-Sheet 3

Fig. 4.



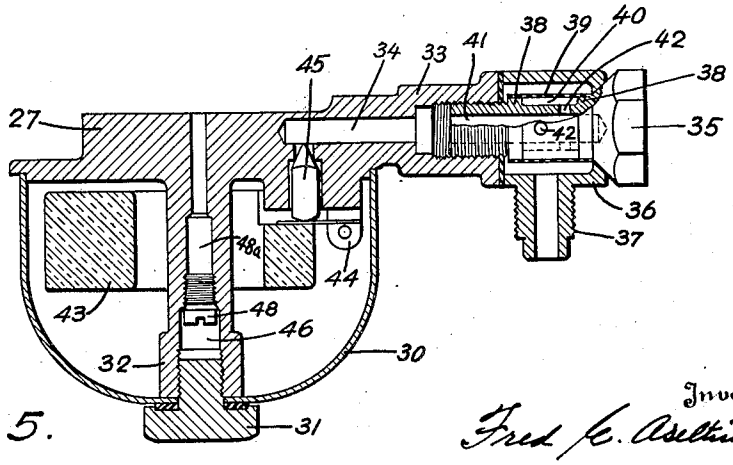


Fig. 5.

Inventor

Fred E. Aseltine

By Spencer, Sawall & Hardman

his Attorneys

Nov. 18, 1930. F. E. ASELTINE 1,782,333

CHARGE FORMING DEVICE FOR INTERNAL COMBUSTION ENGINES

Filed Jan. 26, 1925 4 Sheets-Sheet 4

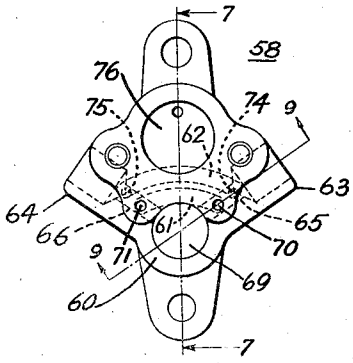


Fig. 6.

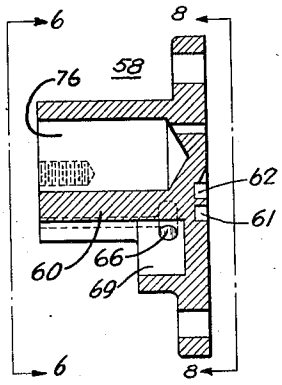


Fig. 7.

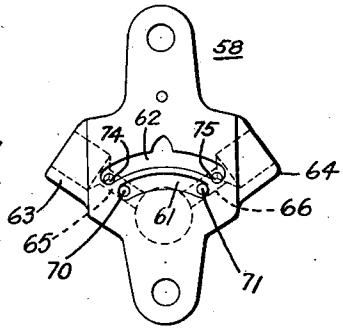


Fig. 8.

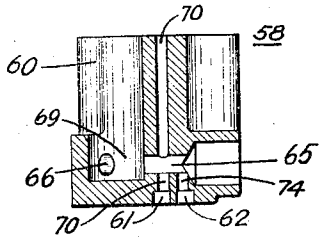


Fig. 9.

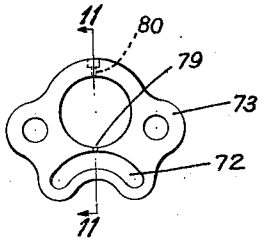


Fig. 10.

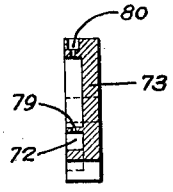


Fig. 11.

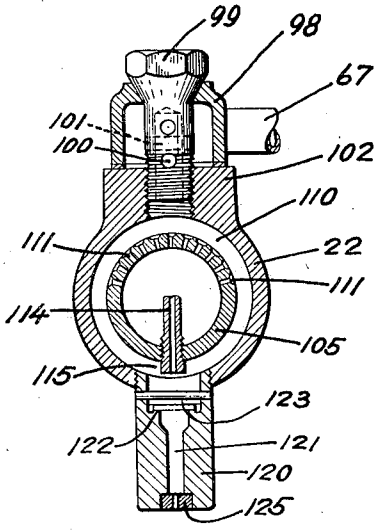


Fig. 12.

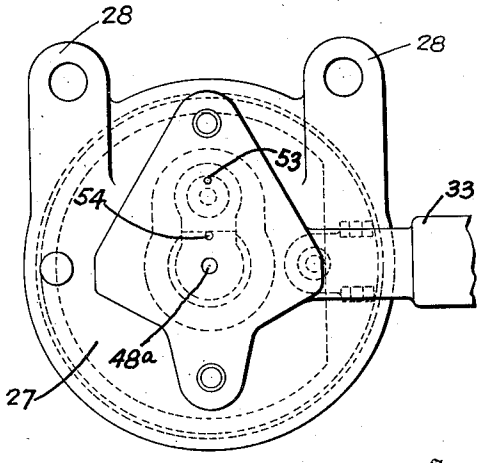


Fig. 13.

Inventor

Fred E. Aseltine

By Spencer, Semmell & Hardman

his Attorneys

Patented Nov. 18, 1930

1,782,333

UNITED STATES PATENT OFFICE

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

CHARGE-FORMING DEVICE FOR INTERNAL-COMBUSTION ENGINES

Application filed January 26, 1925. Serial No. 4,665.

This invention relates to improvements in charge forming devices for internal-combustion engines.

The problem of fuel distribution to the several cylinders of a multicylinder internal-combustion engine has always been a complex one, especially when such distribution is made through a single intake manifold. Due to the characteristics of engines of this type and especially during the starting and warming-up operations thereof, the fuel flow through the manifold has been found to be unequal, its distribution uneven and, therefore, the operation of the engine irregular and comparatively inefficient. To overcome these disadvantages, the application of heat to the fuel-delivering conduit has been resorted to. This, although facilitating the distribution to a degree, has proven a detriment to the volumetric efficiency of the engine and thus the operation of the engine has not been greatly benefited, especially from the power standpoint.

It is among the objects of the present invention to deliver a charge of liquid fuel to the respective cylinders of a multicylinder internal-combustion engine without the application of heat to facilitate the distribution; and to supply air in the desired proportion for each charge of liquid fuel delivered to the respective cylinders of a multi-cylinder internal combustion engine, under all possible operating conditions.

A further object of the invention is to provide a simple means for regulating the proportions of fuel and air in the mixture whereby a mixture of the desired proportions to secure the most satisfactory operation of the engine under all operating conditions, while maintaining the greatest possible volumetric efficiency is supplied.

Another object is to provide a charge forming device for multicylinder engines with a single adjusting element for varying the fuel and air ratio.

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 the present invention is clearly shown.

The device of the present application delivers to the respective cylinders of a multicylinder internal-combustion engine an equal fuel and air charge of proper proportions without the application of heat to any portion of the device. It includes a manifold having a single air intake provided with a controllable air-regulating means whereby each cylinder on the intake stroke of the piston therein will be supplied with the proper amount of air. A liquid fuel reservoir is provided, with which separate conduits communicate, so constructed and arranged as to deliver a proper charge of liquid fuel into the air stream flowing through the respective branches of the manifold, said fuel delivery into the air stream being adjacent the cylinder intake port.

The air stream in the manifold is regulated by a spring-controlled intake valve in the air inlet port of the manifold, said valve respectively increasing or decreasing the air supply in accordance with the increase or decrease of engine suction. A single adjusting element is provided in connection with the valve whereby the tension of said spring is adjusted, thereby controlling the range of operation of the valve as regards the engine suction.

In the drawings:

Fig. 1 is a plan view of the device attached to a four-cylinder engine;

Fig. 2 is a side elevation of the parts shown in Fig. 1;

Fig. 3 is a sectional view taken along the line 3—3 of Fig. 1;

Fig. 4 is a section taken along the line 4—4 of Fig. 1;

Fig. 5 is a fragmentary view taken along the line 5—5 of Fig. 1;

Fig. 6 is a plan view of the distributing block in the direction of the line 6—6 of Fig. 7;

Fig. 7 is a section taken through Fig. 6 along the line 7—7;

Fig. 8 is a bottom view taken in the direction of the line 8—8 of Fig. 7;

Fig. 9 is a section taken on the line 9—9 of Fig. 6;

Fig. 10 is a bottom view of the distributor block cap;

Fig. 11 is a section of Fig. 10, taken along the line 11—11;

Fig. 12 is a section taken on line 12—12 of Fig. 3;

Fig. 13 is a plan view of the fuel supply reservoir with the distributing block removed; and

Fig. 14 is an enlarged detail section similar to Fig. 11.

The device as shown in the present drawings is applicable to either a two or four-cylinder engine and includes a manifold 20, having a pair of branches 21 and 22. On a two-cylinder engine each branch communicates with its respective cylinder. However, on a four-cylinder engine, as shown in the present drawings, each manifold branch is in communication with the common intake port of each two adjacent cylinders, particularly shown in Figs. 1 and 2.

A single air inlet control mechanism 23 is provided in the manifold, intermediate the two branches 21 and 22, said inlet control mechanism including a suction-controlled air valve 24. The air inlet mechanism provides the air supply for each branch of the manifold.

A fuel and air mixer, or secondary mixing device is provided in each branch of the manifold, said mixer being arranged adjacent the respective cylinder intakes.

Each branch passage also includes a control valve or throttle 25 positioned between the mixer and the cylinder intake ports. A common means is provided to operate concurrently the different throttles. Secured to and supported by the manifold in any suitable manner is a fuel reservoir 26. This reservoir is supplied with liquid fuel from the main fuel tank, (not shown in the present drawings).

Separate conduits lead from the reservoir to the respective manifold branches and are adapted to deliver liquid fuel from the reservoir to the mixers in said branches, said fuel being mixed with air to form a primary mixture of liquid fuel and air which is mixed with additional air in said mixer, as more fully described later.

Referring particularly to Figs. 3, 5 and 13, the fuel reservoir 26 is shown comprising a supporting cover 27 having feet 28, which are secured to the manifold by means of screws 29. The bottom surface of the cover has a circular groove which receives the edge of the fuel bowl 30. A stud 31 extending through a hole in the bottom of the bowl, screws into a portion 32 of the cover and thus holds the bowl in position on said cover.

A laterally-extending portion 33 of the cover is provided with a passage 34, the outer end of which is screw-threaded to receive a hollow stud 35 which supports and maintains the fuel inlet housing 36 in position on the portion 33. A nipple 37 is formed on the housing 36, providing a connection for the main fuel supply pipe 36ª leading from the main fuel tank (not shown). The stud 35 has two circumferential flanges 38 which support a screen element 39, forming a chamber 40 between the stud and screen element. Passage 41 in the stud 35 communicates with the chamber 40 by means of transverse passages 42. From the foregoing it may be seen that fuel from the main fuel tank may flow through the nipple 37, enter the housing 36, pass through the screen 39 into the chamber 40, thence through passages 42 into the passage 41 of the stud 35, from whence the fuel will pass into the passage 34 formed in the laterally-extending portion 33 of the fuel bowl cover, and enter said fuel bowl through the port of valve 45.

A float element 43 is provided in the bowl 30 and is secured to a hinge 44 carried by the cover 27. This float element operates the valve 45 to maintain a substantially constant level of fuel in the fuel bowl 30 in the usual way.

The downward projection 32 of the cover 27 has a longitudinal passage 46, the bottom end of which is counterbored and screw-threaded to receive the stud 31. Transverse passages 47 form communication between the longitudinal passage 46 and the fuel bowl 30. Within the passage 46 there is provided a metering element 48 having an orifice which limits the quantity of liquid fuel passing from the bowl into the passage 48ª above the metering device.

Adjacent the passage 46, the projection 32 is provided with a screw-threaded bore adapted to receive the hollow screw 50. The inner surface or ceiling of this bore has a concentric annular projection 51 so arranged as to form a circular groove 52 in said ceiling. A vertical passage or conduit 53 is provided in the cover 27, one end of said passage communicating with the outside upper surface of said cover while the other end of the conduit terminates in the groove 52. Another conduit 54, angularly arranged in the cover 27, has its outer end terminating in the upper surface of said cover while its inner end terminates within the projection 51 formed in the ceiling of the cutaway portion. The hollow screw 50, mentioned before, when in position in the cutaway portion forms a chamber 55 in said portion between the inner end of the screw and the ceiling of said bore, said chamber being termed the "valve chamber" hereinafter. The screw 50 has a longitudinal passage which is restricted at its outer end as at 56. The inner end of the screw has a valve seat formed thereon, on which the disc valve 57 is adapted normally

to rest. The annular projection 51 acts as a valve seat for the valve 57 when it is lifted off the seat formed on the screw 50.

From the aforegoing it may be seen that as long as the valve 57 is on its seat on the screw 50, communication between the conduits 53 and 54 is complete through the chamber 55. At the same time the chamber 55 is shut off from communication with the passage 56 of the screw and consequently from the interior of the bowl 30. However, when the valve is held on its upper seat, or more specifically, resting against the projection 51, the communication between the conduits 53 and 54 is cut off and the communication between the conduit 53 and the passage 56 is completed through the chamber 55.

The fuel reservoir cover 27 supports a fuel distributing block 58, secured to said cover by means of screws 59. A gasket 60[a] is positioned between the cover 27 and the distributing block 58 to prevent leakage of fuel at this joint. The distributing block 58 is clearly shown in Figs. 3, 6, 7, 8, 9, 10 and 11. It comprises a body portion 60 having oppositely-extending ears, provided with holes for receiving the screws 59. In the bottom surface of the distributing block as shown in Fig. 8, there are provided two channels 61 and 62, termed "canals" hereinafter. The canal 61 functioning as a distributing canal, communicates with passage 48[a] and the canal 62 communicates with the conduit 54 when the distributing block is in position on the cover 27.

The block 58 is provided with two angularly-arranged and oppositely-disposed lug portions 63 and 64 having passages 65 and 66, respectively. Each of these passages has a counterbored portion to receive its respective fuel conduit 67 and 68. The passages 65 and 66 communicate also with a common primary air well 69 to admit sufficient air to facilitate flow of liquid fuel through conduits 67 and 68. The canal 61 communicates with vertical passages 70 and 71, the passage 70 forming communication between one end of the canal and the passage 65, while the passage 71 forms communication with the opposite end of the canal and the passage 66.

The passages 70 and 71 extend up through the distributing block to the upper surface thereof and communicate with a channel 72 formed in the distributor block cover 73. The passage 70 communicates with one end of this channel 72 while the passage 71 communicates with the opposite end thereof. The head 73 is secured to the distributor block by means of screws 73[a], a gasket being placed between the head and the block to prevent leakage of fuel and air at this point.

The canal 62 is connected with vertical passages 74 and 75, the passage 74 connecting with one end of the canal and forming communication between said canal and the passage 65 while the passage 75 forms communication between the opposite end of the canal and the passage 66. The canal 62 communicates with the conduit 54 whose other end communicates with the valve chamber 55.

The numeral 76 designates the auxiliary reservoir supplying fuel to the accelerator well and which comprises a hollowed-out portion in the distributing block 58. From the bottom of this well 76 a passage 77 leads to the conduit 53 in the reservoir cover 27.

The distributing block cover 73 has a bore 78 which forms the upper end of the well 76. A passage 79 provides communication between the bore 78 and the channel 72. Another passage 80 somewhat smaller in diameter than the passage 79 opens the well 76 to atmosphere, for purposes to be described (see Fig. 14).

As has been mentioned previously, the body 60 of the distributing block 58 is connected with conduits 67 and 68. These conduits lead to secondary mixing devices provided in the passages of the manifold branches 21 and 22. Referring to Figs. 1 and 2, these branches of the manifold are shown secured to coupling elements 90 and 91, respectively, said coupling elements in turn being secured to the block in registration with intake ports 92 and 93, respectively, each of which communicates with the valve pockets of two adjacent cylinders in the embodiment shown. Each of said ports 92 and 93, as shown in the fragmentary view, Fig. 1, communicates with two valve ports, such as ports 94 and 95 of two adjacent cylinders 96 and 97.

In Figs. 3 and 12 a secondary mixing device is clearly shown in detail. The conduits 67 and 68 diverge from the distributor block 58 toward the two manifold branches 21 and 22, respectively. Both these conduits and mixing device being similar, the mixing device associated with the branch 22 of the manifold will be referred to, to simplify the description.

Conduit 67 leading from the distributor block 58 has its delivery end connected to a housing 98, said housing forming what is termed the "fuel-relay chamber." The housing 98 is positioned upon a raised platform 102 formed on the branch of the manifold and is held in position thereon by means of a hollow screw 99, the open end of said screw being screwed into a threaded passage in the top of the manifold branch, while the closed or head end of the screw is tapered to fit into a corresponding conical opening in the housing, for the purpose of providing a fuel-and-air-tight connection therewith.

The screw 99 has transverse passages 100 and 101 which form communication between the interior of the housing 98 and the inner passage of the screw 99. The transverse pas-

sage 100 is so located in the shank of the screw, that when said screw is in the position as shown in Fig. 3, that is, its final position for holding the housing 98 tightly against a gasket on the platform 102, the transverse passage 100 will be slightly above the surface of said platform, thereby forming a sump within the relay chamber, said sump acting as a trap for a part of the fuel supplied to the relay chamber and from which said fuel is supplied to the secondary mixing chamber by means other than the main fuel inlet passage and for a purpose to be later set forth.

As shown in Fig. 3, a Venturi tube 105 is formed or inserted in the branch passage 22. When the venturi consists of a separate inserted member, a conical end screw 109 may be provided in the manifold branch, the conical end of said screw projecting into a tapered hole 108 in the Venturi tube in such a manner that when the screw is operated the tapered end thereof will engage with one edge of the hole 108, thus forcing said Venturi tube against a gasket 107 which rests on a circular shoulder 106 formed in the manifold, thereby rigidly holding the venturi in position. An annular groove 110 is formed about the outer periphery of the Venturi tube 105, said groove being intersected by the axis of screw 99.

The Venturi tube is so disposed that a plane perpendicular to its axis and intersecting the constricted throat portion also intersects the annular groove 110 and includes the axis of the passage in hollow screw 99. The annular groove 110 is in communication with the constricted throat of the venturi above the transverse axial plane thereof. This communication may be established by a plurality of holes 111, as illustrated, or by a slot.

A passage or conduit 112 is formed in the manifold branch 22 and aligns with a passage 113 in the venturi. These two passages 112 and 113 form communication between the sump in the fuel relay chamber and the Venturi tube, the point of communication of the passage 113 being positioned between the engine end of the Venturi tube and said holes 111. As can be seen in the Fig. 3, the throttle 25 is adjacent the mouth of the Venturi tube. The annular groove 110 forms a chamber between the casing of the manifold branch and the Venturi tube. The lower half of this chamber constitutes an "accelerating well" 115.

The numeral 114 designates a vertical nozzle which is secured in the body of the Venturi tube in such a position that said nozzle is in axial alignment with the screw 99. The lower end of this nozzle extends into the accelerating well 115 while the upper end of said nozzle extends into the constricted throat portion of the venturi, being level with the axis thereof.

Adjacent the bottom end of the nozzle 114 the casing of the manifold branch is provided with a screw-threaded opening for receiving the valve housing 120. This valve housing is provided with a longitudinal passage 121 having a valve seat 122 at its inner end, upon which the disc valve 123 is adapted to rest. A stop in the form of a transverse pin 124 may be provided to limit the upward travel of the valve. The lower end of housing 120 has a small orificed element 125 for controlling the admission of air to the passage 121 at this point. A transverse passage 126 communicates with the passage 121 and registers with one end of a pipe 127, the other end of which is connected to a nipple 127^a screwed into the manifold branch between the throttle 25 and the engine intake, and receiving a ball-check valve 128, which controls the functioning of the pipe 127 in the manner hereinafter described. A transverse pin 129 or equivalent stop limits the movement of the ball-check valve 128.

The manifold 20 is provided with a single air inlet 23 which is positioned intermediate the manifold branches 21 and 22 (see Fig. 4). The air inlet device of this embodiment includes a housing 140 having a base 141 adapted to rest on the manifold. A flange portion 142 extends and fits into an opening 143 in the manifold. The housing 140 is secured to the manifold by means of bolts 144. The housing 140 has an opening 145 through which the air enters into the chamber 146. An intermediate wall 147 is provided having bosses which form a guide for an adjustable sleeve 148. A stem 149 extends through this sleeve and has a valve 24 secured at its one end by means of the nut 150. The valve 24 is positioned in the outlet of the chamber 146 and therefore controls the admission of air to the manifold, having its seat formed on the inside edge of the flange portion 142. The housing 140 is preferably cylindrical above the intermediate wall 147, and is hollowed-out to receive the cylinder 151. The upper end of the cylinder is closed by means of the cylinder head 152. Only a short length of the cylinder 151 is of such a diameter that it will tightly fit within the cylindrical part of the housing 140. The greater length of the cylinder projecting into said cylindrical portion is of lesser diameter than the bore of the latter thereby providing a space 153 between the cylinder 151 and the cylindrical portion of the housing. The cylinder 151 is maintained in position in the housing by means of spring clip 154 mounted on a column 155 and adapted to be held in cylinder-retaining position by means of the screw 156, which screws into a lug formed on the housing 140.

Within the cylinder 151 there is provided a piston 157, the closed end having an opening which fits over a reduced portion of a check valve housing 158. The piston and

valve housing are held together by means of a nut 159. The stem 149, to one end of which the valve 24 is secured, extends up through the adjustable sleeve 148 and is provided with a reduced portion at its upper end which fits into the counterbored part of a longitudinal passage 161 formed in the valve housing 158. The stem 149 and the valve housing 158 are secured together by means of pin 160. Counterboring the longitudinal passage 161 to receive the stem 149 provides a shoulder in said passage, the edge of which forms a seat for the check valve 162, which is positioned in the space between the end of the stem 149 and the shouldered portion of the passage 161. At the upper end of the passage 161, or the end opposite the valve 162, the passage is reduced as shown at 163, forming communication between the passage 161 and the inside of the cylinder 151 between the piston 157 and the cylinder head 152. A transverse passage 164 in the wall of the valve housing 158 forms communication between the chamber in which valve 162 is located and the interior of the piston 157 below the seat of said valve 162.

The upper end of adjustable sleeve 148 extends through the wall 147 as before stated, into the cylindrical portion of the housing 140, this end of said sleeve being provided with a reduced portion 165. A spring seat cup 166 is carried by said sleeve and rests against the shoulder formed by the reduced portion 165. A compression spring 167 is interposed between the cup 166 and the head of the piston 157. The spring 167 tends to force the piston toward the cylinder head 152 and thereby yieldably hold the valve 24 in engagement with its seat on flange 142.

The housing 140 is provided with a lug which carries a shaft 168, one end of said shaft extending into the chamber 146 while the opposite end extends to the exterior of the housing. Carried by said shaft 168, within the chamber 146, is an arm 169 having a bifurcated end, each portion of which is provided with a forked extremity. The forked ends of this lever fit about the pins 170 extending transversely from the opposite sides of sleeve 148. On the outer end of the shaft 168 a lever 171 is secured, the free end of which may be connected to any suitable operating means. An adjusting screw 172 is positioned in a lug formed on the lever 171, the end of said screw being adapted to engage with a lug 171ª formed on the housing 140, which acts as a stop for the screw 172 limiting the movement of said lever whereby the range of tension of the spring 167 may be varied. A spring clip 173 secured to the lever 171 in any suitable manner and engaging the head of adjusting screw 172 tends to hold said screw in its adjusted position.

The several throttles in the manifold branch passages are secured to a common operating rod 175 to which is secured a lever 176 adapted to be connected to any suitable throttle operating means convenient to the operator. Movement of the lever 176 will concurrently move all the throttles.

In Fig. 1 there is shown an equalizer tube 180 forming communication between the mixture passages at the engine sides of the throttles as between the interiors of the elements 90 and 91. This tube operates in a manner hereinafter fully described.

The operation of the device in connection with the embodiment illustrated will now be described.

Assuming that the engine has been started and is operating to propel the vehicle at a speed somewhere about 15 miles per hour, vacuum will be created in the valve pockets and intake ports 92 and 93 on each intake stroke of the pistons of the respective cylinders associated with said intake ports. For convenience of illustration, the means and method of delivering a fuel charge to intake port 93 for cylinder 97 will be described.

Upon a suction stroke of the piston of cylinder 97, the valve 95 being open, vacuum will be created in the port 93, therefore, also in element 91 and in the manifold branch 22. Suction in this branch 22 will create a suction in the fuel conduit 67 due to its connections with the said manifold branch and consequently a suction in the passage 48ª of the fuel reservoir 26. Suction in the passage 48ª will draw the fuel from the bowl 30 through transverse passages 47 through the limiting orifice 48 into the passage 48ª and then into the canal 61. The suction in the conduit 67 will draw the fuel from the canal 61 through the vertical passage 70 into the passage 65, whence the fuel will enter the conduit 67.

In order to facilitate the flow of fuel through this conduit and delivery thereof to the secondary mixing device, the said conduit is open to the primary air well 69 by means of the passage 65, thus a supply of air will flow from the well 69 through the passage 65 and enter the conduit with the fuel, at the point of communication between the passage 65 and vertical passage 70. The mixture of fuel and air will then flow through the conduit 67 and enter fuel-relay chamber in the housing 98. From this chamber the fuel and air mixture will flow through the transverse passages 100 and 101 into the longitudinal passage of the screw 99 and then pass into the upper part of the chamber formed by the annular groove 110.

Suction in the port 93 and in coupling element 91 will create a subatmospheric condition in the manifold 20, as before stated, thus causing the valve 24 to be moved against the tension of the spring 167, thereby permitting air to enter opening 145 into chamber 146 and

flow past the valve 24 into the manifold, said air then flowing to the manifold branch 22. Passing through the constricted throat portion of the venturi 105 the velocity of the air current will increase; creating a greater suction at the orifies 111 than elsewhere in the manifold, which suction is effective to draw the fuel and air mixture from the annular groove 110 into this air stream forming a properly combustible mixture which is drawn through the hollow coupling 91 into the intake port 93, past the valve 95, into the cylinder 97.

As soon as the piston of cylinder 97 completes its intake stroke, this same method of fuel delivery to the other cylinders will be repeated in proper sequence.

Variations in engine suction will vary movement of the valve 24 which, due to the effect of the spring and the dash-pot effect of the piston 157, will regulate the air supply flowing past this valve into the conduit. Consequently the variations in suction which affect the air valve 24 will also affect the amount of fuel drawn from the reservoir 26 through conduits 67 and 68 into the respective fuel-relay chambers and thus the fuel and air ratio will be held substantially constant during variations of engine suction, thereby maintaining the efficiency of the motor.

It has been found necessary, in order to secure uniform distribution of the fuel to the various engine cylinders, or in other words, to prevent the possibility of one cylinder receiving a greater amount of fuel than another, to provide the equalizing tube 180, which establishes communication between the interior of the two coupling elements 90 and 91 on the engine side of the throttle. It will be noted that the firing order of the engine disclosed in the illustrated embodiment of the invention is cylinders 96ª—97ª—97—96. It will thus be seen that cylinder 97ª fires immediately after the cylinder 96ª, which is supplied with fuel mixture through the same intake port, while the cylinder 96ª fires immediately after the firing of cylinders 97 and 96, both of which communicate with a different intake port of the engine. When the piston in the cylinder 97ª makes its suction stroke, the vacuum existing in the intake passage between the throttle and that particular engine cylinder will be relatively high because of the fact that the cylinder 96ª, which also communicates with the same intake passage, has fired immediately before. However, when the piston in cylinder 96ª makes its suction stroke, there will be a relatively low vacuum in the intake passage communicating with that cylinder because during the firing of cylinders 97 and 96, immediately preceding the firing of cylinder 96ª, the engine intake valves communicating with the intake passage 92 have both been closed and for this reason substantially atmospheric pressure has existed in the passage 92 during the firing of such cylinders. Therefore, when the piston in cylinder 96ª makes its suction stroke, there will be a certain amount of inertia which must necessarily be overcome before the fuel delivered to the branch 21 of the manifold can be drawn into the cylinder 96ª. On the contrary, when the piston in cylinder 97ª makes its suction stroke, this inertia does not have to be overcome and, therefore, there will be less fuel delivered to the cylinder 96ª than to the cylinder 97ª unless some compensating means is provided. The equalizing tube 180 constitutes a compensating means which is provided for the purpose of communicating to the space 90 the partial vacuum which is created in the space 91 during the firing of cylinders 96 and 97 and conversely, such tube communicates to the space 91 the partial vacuum which is created in the space 90 during the firing of cylinders 96ª and 97ª, thus eliminating the question of inertia and substantially equalizing the suction in the passages 92 and 93 during the suction strokes of the piston in all the various engine cylinders, which will result in substantially the same amount of fuel being supplied to each of the cylinders.

While the engine is operating at the speed mentioned hereinbefore, that is, at approximately 15 miles per hour, and at speeds higher than that, the process of filling the auxiliary reservoir 76 is being carried on. This is done in the following manner: As has been mentioned before, suction is produced in the passages 65 and 66 of the distributor block. Due to this suction in these passages a suction will also be produced in the priming canal 62 due to its communication with the passages 65 and 66 by means of the vertical passages 74 and 75, respectively. Suction in the priming canal 62 will cause a suction in the conduit 54 and consequently in the valve chamber 55. Thus the valve 57 will be lifted from its seat on the screw 50 and be drawn and held against the projection 51 forming the upper valve seat for the said valve, thereby shutting off communication between the conduit 54 and the valve chamber 55.

Due to the extension of the vertical passages 70 and 71, which connect the suction passages 65 and 66 with the fuel-distributing canal 61, a suction will also be produced in the channel 72 of the distributing block head 73. A subatmospheric condition in this channel 72 will create a subatmospheric condition in the auxiliary reservoir 76 due to passageway 79 forming communication between the channel 72 and well 76. A subatmospheric condition in the reservoir 76 will, after the valve 57 has been drawn against its upper seat, cause fuel to flow from the fuel bowl 30 through the reduced portion 56 of the longitudinal passage in the screw 50, thence into the valve chamber 55,

since valve 57 is now seated on its upper seat, and into the auxiliary reservoir 76 through the conduit 53. This flow to the auxiliary reservoir will continue while the engine is running above an ordinary idling speed, or at a speed in which the vehicle will be propelled at substantially 15 miles per hour, or more. The sizes of the orifices 79 and 80 are such, however, that the suction in the auxiliary reservoir is never great enough to lift the fuel to the level of orifice 79, so that fuel is not drawn through such orifice into the primary mixture conduits 67 and 68 during operation of the engine at speeds of 15 miles per hour, or more.

Now, as soon as the operator changes the throttle position so that the engine speed is reduced below the 15-mile per hour, or approximately that speed, the suction in and through the conduits 67 and 68 will be reduced, thereby reducing the suction in the priming canal 62 and conduit 54 thus, the valve 57 will be released and permitted to assume its position on the valve seat of the screw 50. Suction also will be reduced in the channel 72 and consequently in the space above the fuel in the auxiliary reservoir 76. Air entering the very small bleed port 80 will aid in relieving the depression above the fuel level in reservoir 76. This bleed port 80 is too small however to prevent the suction through passage 79 from raising fuel into the reservoir 76 at the higher engine speeds, as described in the preceding paragraph. The fuel in the reservoir 76 will now flow through the conduit 53 into the valve chamber 55, pass upwardly through the conduit 54, enter the canal 62 and flow through the vertical passages 74 and 75, from whence this additional fuel charge will be directed with the regular fuel charges, through the conduits 67 and 68 to their respective relay chambers 98 from which the accelerating wells 115 are replenished. The additional fuel charge delivered to each relay chamber raises the level of fuel therein until it overflows through the transverse passages 100 and 101 of the hollow screw 99 to the annular groove 110 formed about the venturi 105, the greater portion of this liquid fuel flowing to and settling in the bottom of this groove which has been termed the "accelerating well" 115.

If for any reason the operator suddenly opens the throttles 25, a sudden increased suction will be transmitted to the throat of the venturi 105 and also to the air valve 24. The air valve 24 will open to a greater degree, permitting an increased volume of air at higher velocity to flow into and through the manifold past the nozzle 114, positioned in the constricted throat portion of the venturi.

The air rushing through the constricted throat portion of the venturi 105, into which the nozzle 114 projects, will create a suction on the end of this nozzle and consequently in the accelerating well 115, thus tending to draw the fuel from the well through the nozzle. This action will cause the valve 123 to be lifted and the ball-check valve 128 to be drawn tightly against its seat. Due to the accelerating well 115 now being open to atmosphere by means of the minute orifice 125, the fuel in said well will be drawn up through the nozzle 114 and directed into the air stream passing through the venturi. Thus this additional fuel supply will provide the proper ratio of fuel and air for accelerating the engine. As soon as the engine has attained the speed for which the throttles have been adjusted, the filling-up process of the auxiliary reservoir 76 will again be established for the purpose of replenishing the liquid fuel supply in the accelerating well 115 when the engine speed is again reduced to idling.

The passage 127 really performs two functions. When the throttle valve is in nearly closed position and the suction at the posterior end of said passage is greater than the suction at the nozzle 114, this suction is communicated by passage 127 to the passage 121 so as to hold the valve 123 closed and prevent fuel being drawn into the secondary mixing chamber from the accelerator well at a time when admission of such additional fuel is not desirable. At the same time air is drawn into the intake passage through the passage 127 and tends to sweep into the adjacent engine port any fuel tending to collect on the walls of the intake passage. When, however, the throttle is opened to a position where the suction at the nozzle 114 is greater than at the posterior end of the passage 127, the check valve 128 seats and prevents any mixture from the intake passage being drawn through the passage 127 and out the nozzle 114, thus preventing interference with the proper operation of the accelerator well by excess dilution of the fuel flowing therefrom.

As has been mentioned heretofore, the transverse passage 100 of the screw 99 is positioned slightly above the bottom of the fuel-relay chamber so that when the auxiliary reservoir 76 discharges to fill the accelerating well 115 during reduced engine speed a portion of this additional fuel supply coming to the fuel-relay chamber will be retained in this chamber by means of the sump resulting from the elevation of the passage 100 above the bottom of the relay chamber. Retention of this small fuel charge is for the following purposes: When an internal-combustion engine is suddenly throttled down from a high speed to a comparatively low speed, the air flow through the manifold is substantially reduced. Thus suction on the openings 111 will be greatly reduced and con-

sequently the fuel flowing from the screw 99 into the annular passage 110 will have a tendency to flow past the openings 111 into the accelerating well 115 rather than pass through said openings into the greatly reduced air stream flowing through the venturi. This it may be clearly understood will have a starving effect upon the engine and thus cause the same to operate unevenly or even stall. To avoid this disadvantage, passages 112 and 113 have been provided which form communication between the fuel-relay chamber and the Venturi tube at a point between the passages 111 and the throttles 25. Thus the liquid fuel retained in the sump of relay chamber will flow by gravity through the passages 112 and 113 and enter the air stream flowing through the venturi, thereby providing an additional fuel supply to maintain a proper fuel-air ratio in the mixture delivered to the engine until the engine has adjusted itself to this sudden change in throttle position.

In order to compensate for variations in temperature due to external and engine conditions so that a richer fuel mixture may be delivered to the engine at certain temperatures and a leaner mixture at other temperatures, the adjustment lever 171 may be operated from any suitable position in the car for changing the tension of the spring 167 so that more or less suction will be required to open the valve 24 for providing richer or leaner fuel mixtures. This device also permits adjustments to be made to compensate for variations in engine operation due to air leaks caused by imperfect seating of the valves. The screw 172 provided on the lever 171 may be adjusted to vary the range of movement of this lever. More specifically, by adjusting the screw 172 the normal position of the lever may be so changed that the tension of the spring 167 when the valve 24 is seated may be varied to obtain a richer or leaner fuel mixture as is desired.

The valve mechanism which includes valve chamber 158 and valve 162 provided in connection with the piston 157, is so associated with the closed end cylinder 151 as to provide a dash-pot effect which tends to stabilize the action of the valve 24 at constantly varying suctions. The cylinder 151 may be constructed of a material whose coefficient of expansion is different from that of the material from which the piston 157 is constructed, so that temperature changes will be compensated for to maintain efficient operation of this device either in the winter or the summer. In the embodiment described, the cylinder 151 may be made of a material, such as brass, and the piston 157 may be made of a material, such as iron. The coefficient of expansion of the cylinder 151, being higher than that of the piston 157, it follows that when the environment of the cylinder and piston is relatively warm the cylinder will have expanded more than the piston with the result that the piston works freely. Hence the air inlet valve 24 opens to its stabilized position more quickly after a sudden opening of the throttle valves 25 in warm weather than in cold weather. Therefore the momentary enrichening of the mixture, due to the slow opening of valve 25, is less in warm than in cold weather. Thus the mixture ratio for sudden acceleration is adapted to temperature conditions.

Attention is called to the fact that in this device no means is provided for heating either the primary mixture, the main air manifold, or the secondary mixture which is supplied to the engine intake ports. In fact, the only heating of the mixture which is possible is due to the conduction of heat from the block to the outlet branches of the manifold. However, because of the reduction in temperature due to the evaporation of the fuel, the heating effect produced by conduction is substantially offset, so that the mixture supplied to the engine ports is a cold mixture of liquid fuel and air.

While reference is made throughout the specification and claims to equal distribution of the fuel, there may be some slight variation in the amount of fuel delivered to the various cylinders brought about by variations in friction in the various fuel and mixture passages which are the result of manufacturing inaccuracies as well as the variations which may result from other slight manufacturing inaccuracies which may be present. However, the amount of fuel supplied to each cylinder is so nearly the same that the above mentioned variations are negligible.

While the form of embodiment of the 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 an internal-combustion engine comprising, in combination: an air conduit having an air inlet and communicating with the intake port of an engine cylinder; a fuel-relay chamber adjacent the cylinder intake; means for delivering a charge of liquid fuel to said relay chamber; a venturi in the conduit having a constricted throat portion in communication with the relay chamber whereby fuel is directed from said chamber into the venturi at its constricted throat portion; and means for delivering a portion of the fuel charge in the relay chamber into the venturi at a point between the constricted throat portion and the cylinder intake.

2. A charge forming device for an internal-combustion engine comprising, in combination: an air conduit having an air inlet and communicating with the intake port of an

engine cylinder; a fuel-relay chamber adjacent the cylinder intake; means for delivering a charge of liquid fuel to said relay chamber; a venturi in the conduit having a constricted throat portion in communication with the relay chamber whereby fuel is directed from said chamber into the venturi at its constricted throat portion; a control valve in the air conduit between the venturi and cylinder intake; and means for delivering a portion of the fuel charge in the relay chamber into the venturi at a point between its constricted throat portion and the control valve.

3. A charge forming device for multicylinder engines comprising, in combination: an air conduit having a plurality of branch passages each one of which communicates with the intake ports of two adjacent engine cylinders; a single air inlet in said conduit for providing a supply of air to all the branch passages; a throttle valve in each of the respective branch passages; a source of liquid fuel supply; means including individual primary carburetors for delivering a primary mixture of liquid fuel and air into each branch passage adjacent but anterior to the throttle valves; and an equalizing conduit interposed between the adjacent branch passages and forming communication between their respective portions on the cylinder side of the throttle valve.

4. In combination, an internal combustion engine having a plurality of intake ports, an air manifold having a branch leading to each inake port, a common main air inlet for all of said branches, an engine suction controlled valve in said main air inlet whereby the depression in said air manifold varies with the engine speed, and individual primary carbureting means for supplying substantially equal quantities of an over-rich mixture of air and liquid fuel to each branch of said air manifold relatively close to said engine intake ports.

5. In combination, an internal combustion engine having a plurality of intake ports, an air manifold having a branch leading to each intake port, a common main air inlet for all of said branches, an engine suction controlled valve in said main air inlet whereby the depression in said air manifold varies with the engine speed, and individual primary carbureting means for supplying substantially equal quantities of an over-rich mixture of air and liquid fuel to each branch of said air manifold relatively close to said engine intake ports, and a depression equalizing duct intercepting said branches of said air manifold at a point adjacent said engine intake ports.

6. In combination, an internal combustion engine having a plurality of intake ports, an air manifold having a branch leading to each intake port, a common main air inlet for all of said branches, an engine suction controlled valve in said main air inlet whereby the depression in said air manifold varies with the engine speed, and individual primary carbureting means for supplying substantially equal quantities of an over-rich mixture of air and liquid fuel to each branch of said air manifold relatively close to said engine intake ports, a throttle valve interposed in each of said branches between the inlet of said overrich mixture and the engine port, and common manual means for concurrently opening and closing said throttle valves.

7. In combination, a four-cycle internal combustion engine having a plurality of pairs of cylinders and a common intake port for each pair, an air manifold having a branch leading to each intake port, a common main air inlet for all of said manifold branches, an engine suction controlled valve in said main air inlet whereby the depression in said air manifold varies with the engine speed, and individual primary carbureting means for supplying an over-rich mixture of air and liquid fuel to each of the outlet branches relatively close to the intake ports, said primary carbureting means being constructed to deliver substantially equal quantities of fuel to all of said outlet branches.

8. In combination, a four-cycle internal combustion engine having a plurality of pairs of cylinders and a common intake port for each pair, an air manifold having a branch leading to each intake port, a common main air inlet for all of said branches, an engine suction controlled valve in said main air inlet whereby the depression in said air manifold varies with the engine speed, and individual primary carbureting means for supplying substantially equal quantities of an overrich mixture of air and fuel to each of said branches relatively close to said intake ports, a throttle valve interposed in each of said branches between the inlet of said overrich mixture and the engine port, and common manual means for concurrently operating said throttle valves.

9. In combination, a four-cycle internal combustion engine having a plurality of pairs of cylinders and a common intake port for each pair, an air manifold having a branch leading to each intake port, a common main air inlet for all of said branches, an engine suction controlled valve in said main air inlet whereby the depression in said air manifold varies with the engine speed, and individual primary carbureting means for supplying substantially equal quantities of an overrich mixture of air and fuel to each of said branches relatively close to said intake ports, a throttle valve interposed in each of said branches between the inlet of said overrich mixture and the engine port, and common manual means for concurrently operating said throttle valves, and a de-

pression equalizing duct intercepting said branches on the engine side of said throttle valves whereby the initial depression at the engine intake ports is substantially the same for each cylinder.

10. A charge forming device for internal combustion engines comprising a mixing chamber, fuel and air inlets therefor, a main fuel reservoir supplying fuel to said fuel inlet, an auxiliary fuel reservoir, means for maintaining a sufficient vacuum in said auxiliary reservoir during operation at higher engine speeds to draw fuel thereto from said main fuel reservoir, and an accelerating well to which fuel is fed from said auxiliary reservoir at low engine speeds, the vacuum maintained in the auxiliary reservoir during operation at low speed being insufficient to draw fuel thereto.

11. A charge forming device for internal combustion engines comprising a mixing chamber, fuel and air inlets therefor, a main fuel reservoir supplying fuel to said fuel inlet, an auxiliary fuel reservoir, extending above said main reservoir, means for maintaining a sufficient vacuum in said auxiliary reservoir during higher engine speeds to draw fuel thereto from said main fuel reservoir, an accelerating well positioned below the said auxiliary reservoir and a fuel conduit connecting said well with the auxiliary reservoir to convey fuel to said well at low engine speeds, the vacuum maintained in said auxiliary reservoir at said low speeds being insufficient to overcome the effect of gravity on the fuel.

12. A charge forming device for internal combustion engines comprising a mixing chamber fuel and air inlets therefor, a main fuel reservoir supplying fuel to said fuel inlet, an auxiliary fuel reservoir, means for maintaining a sufficient vacuum in said auxiliary reservoir during higher engine speeds to draw fuel thereto from said main fuel reservoir, an accelerating well to which fuel is adapted to flow from said auxiliary reservoir at low engine speeds and a fuel inlet connected to said well and adapted to supply additional fuel to said mixing chamber when the throttle is opened to increase the engine speed.

13. A charge forming device for internal combustion engines comprising a mixing chamber, fuel and air inlets therefor, a main fuel reservoir supplying fuel to said fuel inlet, an auxiliary fuel reservoir, an accelerating well connected therewith, means for maintaining a vacuum in said auxiliary reservoir which varies substantially as the engine speed varies, whereby the vacuum in said auxiliary reservoir at high engine speeds is sufficient to draw fuel thereto from the main reservoir and at low speeds is reduced to permit fuel to flow from said reservoir to said well, and means for preventing a flow of fuel to the main reservoir from said auxiliary reservoir on reduction of vacuum therein.

14. A charge forming device for internal combustion engines comprising a mixing chamber, fuel and air inlets therefor, a main fuel reservoir, an auxiliary fuel reservoir communicating therewith, means for maintaining a vacuum in said auxiliary reservoir at higher engine speeds to draw fuel thereto, an accelerating well connected to said auxiliary reservoir, means whereby the vacuum in said auxiliary reservoir is reduced at lower engine speeds to simultaneously empty the auxiliary reservoir and fill said accelerating well, and a fuel inlet connected to said accelerating well and adapted to supply additional fuel to the mixing chamber when the throttle is opened to increase the engine speed, whereby the accelerating well is emptied as the auxiliary reservoir is filled.

15. A charge forming device for internal combustion engines comprising a mixing chamber, fuel and air inlets therefor, a main fuel reservoir supplying fuel to said fuel inlet, an auxiliary fuel reservoir, an accelerating well adapted to be supplied with fuel from said auxiliary fuel reservoir, a fuel inlet connected to said well and supplying additional fuel to said mixing chamber for acceleration, and means for causing said reservoir to empty and the well to fill simultaneously, and vice versa.

16. A charge forming device for internal combustion engines comprising a mixing chamber, fuel and air inlets therefor, a main fuel reservoir supplying fuel to said fuel inlet, an auxiliary fuel reservoir, an accelerating well adapted to be supplied with fuel from said auxiliary fuel reservoir, a fuel inlet connected to said well and supplying additional fuel to said mixing chamber for acceleration, and means for subjecting to auxiliary reservoir and well to engine suction whereby the reservoir is filled and the well is emptied at higher engine speeds while the well is filled and the reservoir is emptied at low engine speeds.

17. A charge forming device for internal combustion engines comprising a plurality of mixing chambers each of which is adapted to supply fuel mixture to a separate engine intake port, a separate fuel inlet for each mixing chamber, a main fuel reservoir supplying all of said fuel inlets, an auxiliary fuel reservoir connected with said main reservoir and supplied with fuel thereby, a plurality of accelerating wells each of which is adapted to supply additional fuel to one of said plurality of mixing chambers and means conducting fuel from said auxiliary reservoir to both said accelerating wells.

18. A charge forming device for internal combustion engines comprising a plurality of secondary carburetors, a plurality of pri-

mary carburetors adapted to supply a rich mixture thereto, a fuel reservoir for supplying fuel to all of said primary carburetors, an auxiliary fuel reservoir connected to said main reservoir, and supplied with fuel therefrom, a plurality of accelerating wells each of which is connected with said auxiliary reservoir to receive fuel therefrom, and means conveying fuel from said accelerating wells to said secondary carburetors to enrich the mixture for acceleration.

19. A charge forming device for internal combustion engines, comprising an air intake passage adapted to be connected to an engine intake port, a fuel reservoir, a fuel conduit communicating with the fuel reservoir and air intake, an auxiliary fuel reservoir, means connecting the upper portion of said reservoir with said air intake whereby the pressure in said reservoir varies in accordance with the engine suction, means connecting said auxiliary reservoir with the main fuel reservoir and with the fuel conduit and means opening communication between the main and auxiliary fuel reservoirs to admit fuel to the latter when the engine suction is high, and opening communication between the auxiliary reservoir and the fuel conduit when the engine suction is low.

20. A charge forming device for multi-cylinder internal combustion engines having, in combination, an air manifold having a plurality of outlet branches adapted to register with the engine intake ports and a main air inlet admitting air to all of said branches, an automatically operated valve in said main air inlet, throttling means for regulating the quantity of mixture supplied to the engine, and devices for forming a primary mixture of air and liquid fuel and for delivering said primary mixture to each outlet branch of the manifold relatively close to the engine intake ports, said devices being constructed to deliver equal quantities of fuel to all of said outlet branches.

21. A charge forming device for a multi-cylinder internal combustion engine having, in combination, an air manifold having a plurality of outlet branches adapted to register with the engine intake ports and a main air inlet admitting air to all of said branches, an automatically operated valve in said main air inlet, throttling means for regulating the quantity of mixture supplied to the engine, primary carbureting means for forming a primary mixture of air and liquid fuel and for delivering the primary mixture to each branch of the manifold, said primary carbureting means being constructed to deliver substantially equal quantities of fuel to all of said branches, and means for supplying additional fuel to each manifold outlet branch on opening movements of said throttling means to enrich the mixture during acceleration.

22. A charge forming device for internal combustion engines comprising a main intake passage, means supplying air thereto, throttling means for regulating the quantity of mixture supplied to the engine, means for supplying fuel and air to form a primary mixture of air and liquid fuel, a primary mixture conduit adapted to convey said primary mixture to the main air intake passage, additional means effective during engine operation under certain predetermined conditions to supply additional fuel to the primary mixture conduit, and an accelerating well adapted to receive such additional fuel from said conduit.

23. A charge forming device for internal combustion engines comprising, a main intake passage, means supplying air thereto, throttling means for regulating the quantity of mixture supplied to the engine, means for supplying fuel and air to form a primary mixture of air and liquid fuel, a primary mixture conduit adapted to convey said primary mixture to the main intake passage, and additional fuel supply means operative on closing movements of the throttle to supply additional fuel to the primary mixture conduit.

24. A charge forming device for internal combustion engines comprising, a main intake passage, means supplying air thereto, throttling means for regulating the quantity of mixture supplied to the engine, means for supplying fuel and air to form a primary mixture of air and liquid fuel, a primary mixture conduit adapted to convey said primary mixture to the main intake passage, additional fuel supply means operative on closing movements of the throttle to supply additional fuel to the primary mixture conduit, and a well communicating with said primary mixture conduit and adapted to be filled with fuel when said additional fuel supply means is operative.

25. A charge forming device for internal combustion engines comprising, a main intake passage, means supplying air thereto, throttling means for regulating the quantity of mixture supplied to the engine, means for supplying fuel and air to form a primary mixture of air and liquid fuel, a primary mixture conduit adapted to convey said primary mixture to the main intake passage, additional fuel supply means operative on closing movements of the throttle to supply additional fuel to the primary mixture conduit, a well communicating with said primary mixture conduit and adapted to be filled with fuel when said additional fuel supply means is operative, and means adapted to supply fuel from said well to the main intake passage when the throttle is opened.

26. A charge forming device for internal combustion engines comprising, a main intake passage, means supplying air thereto, throttling means for regulating the quantity

of mixture supplied to the engine, means for supplying fuel and air to form a primary mixture of air and liquid fuel, a primary mixture conduit adapted to convey said primary mixture to the main intake passage, and additional fuel supply means operative when the engine speed falls below a certain predetermined speed to supply additional fuel to the primary mixture conduit.

27. A charge forming device for internal combustion engines comprising, a main intake passage, means supplying air thereto, throttling means for regulating the quantity of mixture supplied to the engine, means for supplying fuel and air to form a primary mixture of air and liquid fuel, a primary mixture conduit adapted to convey said primary mixture to the main intake passage, additional fuel supply means operative when the engine speed falls below a certain predetermined speed to supply additional fuel to the primary mixture conduit, and a well communicating with said primary mixture conduit and adapted to be filled with surplus fuel therefrom when said additional fuel supply is operative.

28. A charge forming device for internal combustion engines comprising, a main intake passage, means supplying air thereto, throttling means for regulating the quantity of mixture supplied to the engine, means for supplying fuel and air to form a primary mixture of air and liquid fuel, a primary mixture conduit adapted to convey said primary mixture to the main intake passage, additional fuel supply means operative when the engine speed falls below a certain predetermined speed, to supply additional fuel to the primary mixture conduit, a well communicating with said primary mixture conduit and adapted to be filled with surplus fuel therefrom when said additional fuel supply means is operative, and means adapted to supply fuel from said well to the main intake passage when the engine speed is increased above said predetermined speed.

29. A charge forming device for multicylinder internal combustion engines comprising, an air manifold having a plurality of outlet branches adapted to register with the engine intake ports and means supplying air to all of said branches, throttling means for regulating the quantity of mixture supplied to the engine, means for forming a primary mixture of air and fuel, a plurality of separate primary mixture conduits adapted to convey the primary mixture to the manifold branches, and a common fuel supply means adapted to supply additional fuel to all of said primary mixture conduits during engine operation under certain predetermined operating conditions.

30. A charge forming device for multicylinder internal combustion engines comprising, an air manifold having a plurality of outlet branches adapted to register with the engine intake ports and means supplying air to all of said branches, throttling means for regulating the quantity of mixture supplied to the engine, means for supplying fuel and air to form a primary mixture, a plurality of primary mixture conduits adapted to convey the primary mixture to the manifold branches, a reservoir adapted to supply additional fuel to all of said primary mixture conduits during engine operation under certain predetermined operating conditions, and a well associated with each primary mixture conduit and adapted to be filled with surplus fuel from its associated mixture conduit when said additional fuel supply means is operative.

31. A charge forming device for multicylinder internal combustion engines comprising, an air manifold having a plurality of outlet branches adapted to register with the engine intake ports and means supplying air to all of said branches, throttling means for regulating the quantity of mixture supplied to the engine, means for supplying fuel and air to form a primary mixture, a plurality of primary mixture conduits adapted to convey the primary mixture to the manifold branches, a reservoir adapted to supply additional fuel to all of said primary mixture conduits during engine operation under certain predetermined operating conditions, a well associated with each primary mixture conduit and adapted to be filled with surplus fuel from its associated mixture conduit when said additional fuel supply means is operative, and means connecting each well with one of the manifold branches and adapted to supply fuel thereto from the well during operation of the engine under other predetermined operating conditions.

32. A charge forming device for multicylinder internal combustion engines comprising, an air manifold having a plurality of outlet branches adapted to register with the engine intake ports and means for supplying air to all of said branches, throttling means for regulating the quantity of mixture supplied to the engine, means for supplying fuel and air to form a primary mixture, a plurality of primary mixture conduits adapted to convey the primary mixture to the manifold branches, a reservoir adapted to supply additional fuel to said primary mixture conduits on reduction of manifold suction, a well associated with each primary mixture conduit and adapted to be filled with surplus fuel from its associated mixture conduit when said additional fuel supply means is operative and means connecting each well with one of the manifold branches and adapted to supply fuel thereto on increase of manifold suction.

33. A charge forming device for internal combustion engines comprising, a main in-

take passage communicating with the engine intake port, a fuel reservoir, a throttle controlling the quantity of fuel mixture supplied the engine, a primary carburetor comprising, mixture forming means secured to the top of the fuel reservoir, and a primary mixture conduit connecting said primary mixture forming means with the main intake passage at a point adjacent the engine intake port.

34. A charge forming device for internal combustion engines comprising, a main intake passage communicating with the engine intake port, a restriction in said intake passage to increase the velocity of flow therethrough, a fuel reservoir, a throttle controlling the quantity of fuel mixture supplied the engine, a primary carburetor comprising mixture forming means secured to the top of the fuel reservoir and a primary mixture conduit connecting said mixture forming means with the main intake passage at the restriction therein.

35. A charge forming device for internal combustion engines comprising, a main intake passage communicating with the engine intake port and having a restriction therein adjacent said port, a throttle for regulating the quantity of mixture supplied to the engine, means forming a primary mixture of air and fuel, a primary conduit communicating with the main intake passage at the point of restriction therein and conveying primary mixture thereto, means supplying additional fuel to said primary mixture passage under certain operating conditions, a well adapted to be filled with surplus fuel from said mixture passage while said additional fuel supply means is operative, and means connecting said well and the main intake passage at the point of restriction therein to supply fuel thereto under certain operating conditions.

36. A charge forming device for internal combustion engines comprising, a main intake passage communicating with the engine intake port, a throttle, a fuel reservoir, a primary carburetor comprising, a primary mixing chamber secured to the top of said fuel reservoir, a primary mixture conduit adapted to convey the primary mixture to the main intake passage, a fuel passage connecting the fuel reservoir with the primary mixing chamber and normally supplying fuel thereto, and an additional fuel passage adapted to supply fuel to said primary mixing chamber only under certain predetermined operating conditions, and an accelerating device receiving such fuel from the primary mixture conduit.

37. A charge forming device for internal combustion engines comprising, a main intake passage communicating with the engine intake port, a throttle, a main fuel reservoir, a primary carburetor comprising, a primary mixing chamber secured to the top of said fuel reservoir, a primary mixture conduit adapted to convey the primary mixture to the main intake passage, a fuel passage connecting the main fuel reservoir with the primary mixing chamber and normally supplying fuel thereto, an auxiliary fuel reservoir and a passage connecting said auxiliary reservoir with the primary mixing chamber and adapted to supply fuel thereto only under certain predetermined operating conditions, and an accelerating well receiving such additional fuel from the primary mixing chamber.

38. A charge forming device for internal combustion engines comprising, an intake passage adapted to deliver combustible mixture to an engine intake port, a main fuel reservoir, a throttle, a distributor block secured to the top of the reservoir, a mixing chamber formed therein and adapted to deliver fuel mixture to the intake passage, fuel supply means connecting the mixing chamber with the main fuel reservoir, an auxiliary fuel reservoir formed in said distributor block, and an auxiliary fuel supply passage connecting said auxiliary reservoir with the mixing chamber to supply fuel thereto.

39. A charge forming device for internal combustion engines comprising, an intake passage adapted to deliver combustible mixture to an engine intake port, a main fuel reservoir, a throttle, a distributor block secured to the top of the reservoir, a mixing chamber formed therein and adapted to deliver fuel mixture to the intake passage, fuel supply means connecting the main fuel reservoir with the mixing chamber and adapted to supply fuel thereto under all operating conditions, an auxiliary fuel reservoir formed in said distributor block and an auxiliary fuel supply passage connecting said auxiliary reservoir with the mixing chamber to supply fuel thereto only under certain predetermined operating conditions.

40. A charge forming device for internal combustion engines comprising, an intake passage adapted to deliver combustible mixture to an engine intake port, a main fuel reservoir, a throttle, a distributor block secured to the top of the reservoir, a mixing chamber formed therein and adapted to deliver fuel mixture to the intake passage, a fuel supply passage connecting the main fuel reservoir with the mixing chamber and adapted to supply fuel thereto under all operating conditions, an auxiliary fuel reservoir formed in said distributor block and an auxiliary fuel supply passage connecting the auxiliary reservoir with the mixing chamber and adapted to supply fuel thereto on reduction of suction therein.

41. A charge forming device for internal combustion engines comprising, an intake passage adapted to deliver combustible mixture to an engine intake port, a main fuel reservoir, a throttle, a distributor block secured to the top of the reservoir, a mixing chamber formed therein and adapted to de-

liver fuel mixture to the intake passage, a fuel supply passage connecting the main fuel reservoir with the mixing chamber and adapted to supply fuel thereto under all operating conditions, an auxiliary fuel reservoir formed in said distributor block and having a fuel supply passage connecting with the main fuel reservoir, a suction passage connecting the auxiliary fuel reservoir and the mixing chamber whereby fuel is drawn into said reservoir on increases of suction in the mixing chamber and a fuel delivery passage connecting the auxiliary reservoir with the mixing chamber to supply fuel thereto on reduction of suction in said mixing chamber.

42. A charge forming device for internal combustion engines comprising, an intake passage adapted to deliver combustible mixture to an engine intake port, a main fuel reservoir, a throttle, a distributor block secured to the top of the reservoir, a mixing chamber formed therein and adapted to deliver fuel mixture to the intake passage, means for supplying fuel and air to said mixing chamber, an auxiliary fuel reservoir formed in said distributor block and having a fuel supply passage connecting with the main fuel reservoir, a suction passage connecting the auxiliary fuel reservoir with the mixing chamber, a fuel delivery passage connecting with the fuel supply passage and communicating with the mixing chamber, a check valve adapted to close the fuel delivery passage, while permitting flow through the other passage on increase of suction in the mixing chamber, and to open the fuel delivery passage while closing the fuel supply passage on decrease of mixing chamber suction, whereby the auxiliary reservoir is filled as the mixing chamber suction is increased and is emptied into the mixing chamber on decrease of suction therein.

43. A charge forming device for internal combustion engines comprising, an intake passage adapted to deliver combustible mixture to an engine intake port, a main fuel reservoir, a throttle, a distributor block secured to the top of the reservoir, a mixing chamber formed therein and adapted to deliver fuel mixture to the intake passage, means for supplying fuel and air to said mixing chamber, an auxiliary fuel reservoir formed in said distributor block and extending above said mixing chamber, a passage supplying fuel to said auxiliary reservoir from the main fuel reservoir, a suction passage connecting the auxiliary reservoir with the mixing chamber whereby fuel is drawn into said chamber on increase of mixing chamber suction and a fuel passage connecting the auxiliary fuel reservoir with the mixing chamber and adapted to feed fuel thereto by gravity under certain operating conditions.

44. A charge forming device for multi-cylinder engines comprising, an intake manifold, throttling means, a main fuel reservoir, a fuel distributor block having a plurality of mixing chambers formed therein and adapted to supply a primary mixture to the intake manifold, a fuel canal in the base of the distributor block and adapted to supply fuel to all of said mixing chambers, and means for supplying fuel to said canal from the main fuel reservoir.

45. A charge forming device for multi-cylinder engines comprising, an intake manifold, throttling means, a main fuel reservoir, a fuel distributor block having a plurality of mixing chambers formed therein and adapted to supply a primary mixture to the intake manifold, a main fuel distributing canal formed in the distributor block and adapted to supply fuel to all of said mixing chambers under all operating conditions, and an auxiliary fuel canal formed in the distributor block and adapted to supply fuel to said mixing chambers only during certain predetermined operating conditions.

46. A charge forming device for multi-cylinder engines comprising, an intake manifold, throttling means, a main fuel reservoir, a fuel distributor block having a plurality of mixing chambers formed therein and adapted to supply a primary mixture to the intake manifold, a main fuel distributing canal formed in the distributor block and communicating with all of said mixing chambers, a passage supplying fuel to said canal from the main fuel reservoir, an auxiliary fuel distributing canal adapted to supply fuel to all of said mixing chambers, and an auxiliary fuel reservoir formed in said distributor block and adapted to supply fuel to said auxiliary fuel distributing canal.

47. A charge forming device for multi-cylinder engines comprising, an intake manifold, throttling means, a main fuel reservoir, a fuel distributor block having a plurality of mixing chambers formed therein and adapted to supply a primary mixture to the intake manifold, a main fuel distributing canal formed in the distributor block and communicating with all of said mixing chambers, a passage supplying fuel to said canal from the main fuel reservoir during all engine operation, an auxiliary fuel distributing canal adapted to supply fuel to all of said mixing chambers, an auxiliary reservoir formed in said distributor block and adapted to supply fuel to said auxiliary fuel distributing canal, and means controlling the flow of fuel from the auxiliary reservoir to the auxiliary canal and effective to permit such flow only when the mixing chamber suction is relatively low.

48. A charge forming device for internal combustion engines comprising, an intake manifold, a throttling device, a main fuel reservoir, a fuel distributor block having a mixing chamber formed in said distributor

block and adapted to be supplied with fuel from said reservoir, an auxiliary fuel reservoir formed in said distributor block and adapted to supply fuel to said mixing chamber, a passage connecting the auxiliary fuel reservoir with said main fuel reservoir and means for rendering said passage alternately effective to supply fuel to the auxiliary reservoir and to permit flow of fuel therefrom to the mixing chamber.

49. A charge forming device for internal combustion engines comprising, a main air intake conduit adapted to communicate with the engine intake port, a restriction in said conduit adjacent said intake port and forming a mixing chamber, a fuel conduit for supplying fuel to the mixing chamber comprising an annular channel adjacent said restriction, and fuel passages adapted to supply fuel from said channel to the intake passage.

50. A charge forming device for internal combustion engines comprising, a main air intake conduit adapted to communicate with the engine intake port, a restricting element in said conduit adjacent the intake port and having a passage therethrough forming a mixing chamber, a fuel conduit for supplying fuel to the mixing chamber and comprising a fuel channel formed in the outer surface of the restricting element, and fuel supply passages adapted to connect said fuel channel with the mixing chamber.

51. A charge forming device for internal combustion engines comprising, a main air intake conduit adapted to communicate with the engine intake port, a restricting element in said conduit having a passage therethrough forming a mixing chamber, a fuel conduit for supplying fuel to the mixing chamber and comprising a fuel channel formed in the outer surface of the restricting element, fuel supply passages connecting a part of said channel with the mixing chamber and supply fuel thereto during normal engine operation, and a nozzle connecting another part of the fuel channel with the said mixing chamber and adapted to supply fuel thereto only under certain predetermined operating conditions.

52. A charge forming device for internal combustion engines comprising, a main air intake conduit adapted to communicate with the engine intake port, a restricting element in said conduit having a passage therethrough forming a mixing chamber, a fuel conduit for supplying fuel to the mixing chamber and comprising a fuel channel formed in the outer surface of the restricting element, fuel supply passages connecting a part of said fuel channel with the mixing chamber and adapted to supply fuel thereto during all engine operation, another part of said fuel channel comprising a well adapted to fill with fuel during normal engine operation, and a nozzle communicating with said well and adapted to supply additional fuel to the mixing chamber under certain predetermined operating conditions.

53. A charge forming device for internal combustion engines comprising, a main air intake conduit adapted to communicate with the engine intake port, a restricting element in said conduit having a passage therethrough forming a mixing chamber, a fuel conduit for supplying fuel to the mixing chamber and comprising a fuel channel formed in the outer surface of the restricting element, fuel supply passages connecting a part of said fuel channel with the mixing chamber and adapted to supply fuel thereto during all engine operation, another part of said fuel channel comprising a well adapted to fill with fuel during operation of the engine at speeds below a certain predetermined speed, and a nozzle communicating with said well and adapted to supply additional fuel to the mixing chamber on increase in engine speed above said predetermined speed.

54. A charge forming device for internal combustion engines comprising, a main air intake conduit adapted to communicate with the engine intake port, a restricting element in said conduit having a passage therethrough forming a mixing chamber, a fuel conduit for supplying fuel to the mixing chamber and comprising a fuel channel formed in the outer surface of the restricting element, fuel supply passages connecting a part of said fuel channel with the mixing chamber and adapted to supply fuel thereto during all engine operation, another part of said fuel channel comprising a well adapted to fill with fuel during operation of the engine when the mixing chamber suction is relatively low, and a nozzle communicating with the well and adapted to supply additional fuel to the mixing chamber on increase in the mixing chamber suction.

55. A charge forming device for internal combustion engines comprising, a main intake conduit communicating with an engine intake port, a restriction in said conduit adjacent said port and having a passage therethrough forming a mixing chamber, an air inlet for said conduit, a throttle, means for supplying fuel to said mixing chamber during normal operation, a fuel well, and a fuel passage connecting said well with said mixing chamber and effective to supply additional fuel thereto during certain predetermined operating conditions.

56. A charge forming device for internal combustion engines comprising, a main intake conduit communicating with an engine intake port, a restriction in said conduit adjacent said port and having a passage therethrough forming a mixing chamber, an air inlet for said conduit, a throttle, means for supplying fuel to said mixing chamber dur-

ing normal operation, a fuel well adapted to be filled with fuel from said fuel supply during operation at relatively low engine speed, and a fuel passage connecting said well with said mixing chamber and effective to supply additional fuel thereto on opening movements of the throttle.

57. A charge forming device for internal combustion engines comprising, a main intake conduit communicating with an engine intake port, a restriction in said conduit and having a passage therethrough forming a mixing chamber, an air inlet for said conduit, a throttle, means for supplying fuel to said mixing chamber during normal operation, a fuel well, a fuel passage connecting the well with said mixing chamber and effective to supply additional fuel thereto on increase of mixing chamber suction, and a passage admitting air to the well below the level of the fuel therein.

58. A charge forming device for internal combustion engines comprising, a main intake conduit communicating with an engine intake port, a restriction in said conduit and having a passage therethrough forming a mixing chamber, an air inlet for said conduit, a throttle, means for supplying fuel to said mixing chamber during normal operation, a fuel well, a fuel passage connecting the well with said mixing chamber and effective to supply additional fuel thereto on increase of mixing chamber suction, a passage admitting air to the well below the level of fuel therein, and a check valve effective to prevent a flow of fuel from the well into said passage, when the mixing chamber suction is insufficient to draw fuel from the well.

59. A charge forming device for internal combustion engines comprising, a main intake conduit communicating with an engine intake port, a restriction in said conduit and having a passage therethrough forming a mixing chamber, an air inlet for said conduit, a throttle between the mixing chamber and the intake port, means for supplying fuel to said mixing chamber during normal operation, a fuel well, a fuel passage connecting the well with said mixing chamber and effective to supply additional fuel thereto on increase of mixing chamber suction, a passage admitting air to the well below the level of fuel therein, and a passage connecting said air passage with the intake conduit posterior to the throttle valve.

60. A charge forming device for internal combustion engines comprising a main intake conduit communicating with an engine intake port, a restriction in said conduit and having a passage therethrough forming a mixing chamber, an air inlet for said conduit, a throttle between the mixing chamber and the intake port, means for supplying fuel to said mixing chamber during normal operation, a fuel well, a fuel passage connecting the well with said mixing chamber, and effective to supply additional fuel thereto on increase of mixing chamber suction, a passage admitting air to the well below the level of fuel therein, a check valve in said air passage, and a passage connecting said air passage with the intake conduit posterior to the throttle valve, whereby the check valve is held closed when the throttle valve approaches closed position.

61. A charge forming device for internal combustion engines comprising, a main intake conduit communicating with an engine intake port, a restriction in said conduit and having a passage therethrough forming a mixing chamber, an air inlet for said conduit, a throttle between the mixing chamber and the intake port, means for supplying fuel to said mixing chamber during normal operation, a fuel well, a fuel passage connecting the well with said mixing chamber and effective to supply additional fuel thereto on increase of mixing chamber suction, a passage admitting air to the well below the level of the fuel therein, a passage connecting said air passage with the intake conduit posterior to the throttle valve, and a check valve in said last named passage to prevent a flow of mixture therethrough from the intake passage when the throttle valve approaches open position.

62. A charge forming device for internal combustion engines comprising, a main intake passage connecting with an engine intake port, an air inlet therefor, a mixing chamber in said passage, a fuel reservoir, a fuel relay chamber receiving fuel from said reservoir, an outlet passage delivering fuel from said relay chamber to the mixing chamber and communicating with said relay chamber above the bottom thereof whereby a quantity of fuel is normally retained in said relay chamber below said outlet passage, and a supplementary outlet passage connecting the bottom of said relay chamber with the mixing chamber to supply fuel thereto.

63. A charge forming device for internal combustion engines comprising, an intake manifold having a plurality of outlet branches adapted to register with the engine intake ports and an inlet admitting air to all of said branches, and primary carbureting means for supplying a primary mixture of air and liquid fuel to the outlet branches of said manifold relatively close to the engine intake ports, said primary carbureting means being constructed to deliver equal quantities of fuel to all of said outlet branches.

64. A charge forming device for internal combustion engines having a plurality of intake ports, comprising an intake manifold having an outlet branch leading to each intake port, means admitting air to said manifold, and individual primary carbureting

means associated with each of said outlet branches and constructed to supply substantially the same quantity of a primary mixture of air and liquid fuel to each outlet branch of said air manifold relatively close to the engine intake ports.

65. A charge forming device for internal combustion engines comprising, an intake manifold having a plurality of outlet branches adapted to register with the engine intake ports and an inlet admitting air to all of said branches, and primary carbureting means for forming and delivering a primary mixture of liquid fuel and air to the outlet branches of said manifold, said primary carbureting means being constructed to deliver substantially equal quantities of fuel to all of said manifold branches.

66. A charge forming device for internal combustion engines comprising, an intake manifold having a plurality of outlet branches adapted to register with the engine intake ports and an inlet admitting air thereto, primary carbureting means for forming a cold mixture of air and liquid fuel, and for delivering said primary mixture in a cold state to the outlet branches of the manifold, said primary carbureting means being constructed to deliver substantially equal quantities of fuel to all of said manifold branches.

67. A charge forming device for internal combustion engines comprising, an intake manifold having a plurality of outlet branches adapted to register with the engine intake ports and an inlet admitting air thereto, primary carbureting means for forming a cold mixture of air and liquid fuel, and for delivering said primary mixture in a cold state to the outlet branches of the manifold relatively close to the engine intake ports, said primary carbureting means being constructed to deliver substantially equal quantities of fuel to all of said manifold branches.

68. A charge forming device for internal combustion engines comprising an intake manifold having a plurality of outlet branches adapted to register with the engine intake ports and an inlet admitting air thereto, and individual primary carbureting means for forming a cold mixture of liquid fuel and air and for delivering said mixture in a cold state to the outlet branches of the manifold, each of said primary carburetors being constructed to communicate with one of said outlet branches whereby substantially the same quantity of fuel is supplied to each branch.

69. A charge forming device for internal combustion engines comprising an intake manifold having a plurality of outlet branches adapted to register with the engine intake ports, a fuel reservoir, a fuel distributing element receiving fuel from said reservoir and adapted to separate such fuel into a plurality of equal portions, and conduits connecting said fuel distributing element with the outlet branches, each of which is adapted to deliver one of said equal portions of the fuel to one of the manifold branches, whereby substantially uniform fuel distribution is secured.

70. A charge forming device for internal combustion engines comprising an intake manifold having a plurality of outlet branches adapted to register with the engine intake ports, a fuel reservoir, a fuel distributing element receiving fuel from said reservoir and adapted to separate such fuel into a plurality of equal portions, conduits connecting said fuel distributing element with the outlet branches, each of which is adapted to deliver one of said equal portions of the fuel to one of the manifold branches, whereby substantially uniform fuel distribution is secured, and means for introducing air into the conduits to form a primary mixture with the fuel therein.

71. A charge forming device for internal combustion engines comprising, a mixing chamber, fuel and air inlets therefor, a main fuel reservoir supplying fuel to said fuel inlet, an auxiliary reservoir communicating with said main fuel reservoir, a mixing chamber, means for communicating the suction of the mixing chamber to said auxiliary fuel reservoir, to draw fuel from said main fuel reservoir into said auxiliary reservoir when the suction in the mixing chamber is high, and an accelerating well to which fuel is fed from said auxiliary reservoir on reduction of the suction in the mixing chamber.

72. A charge forming device for internal combustion engines comprising, a mixing chamber, fuel and air inlets therefor, a main fuel reservoir supplying fuel to said fuel inlet, an auxiliary reservoir communicating with said main fuel reservoir, a mixing chamber, means for communicating the suction of the mixing chamber to said auxiliary fuel reservoir, to draw fuel from said main fuel reservoir into said auxiliary reservoir when the suction in the mixing chamber is high, an accelerating well to which fuel is fed from said auxiliary reservoir on reduction of suction in the mixing chamber and means communicating the suction of the mixing chamber to the accelerating well whereby fuel is drawn from the well on increase of suction in the mixing chamber.

73. A charge forming device for internal combustion engines comprising, a mixing chamber, fuel and air inlets therefor, a main fuel reservoir supplying fuel to said fuel inlet, an auxiliary fuel reservoir communicating with said main reservoir and adapted to receive fuel therefrom, an accelerating well adapted to be supplied with fuel from said auxiliary reservoir, a fuel inlet communicating with the well and supplying ad-

ditional fuel to the mixing chamber during the acceleration period, means for communicating the suction in the mixing chamber to the well and auxiliary fuel reservoir, and means for controlling the flow of fuel to and from said auxiliary reservoir whereby the reservoir is emptied and the well filled simultaneously and vice versa.

74. A charge forming device for an internal combustion engine having a plurality of intake ports, comprising an intake manifold having a plurality of outlet branches, one of which communicates with each engine intake port, an inlet supplying air to said manifold, a plurality of separate primary mixing chambers, means for supplying fuel and air to each of said mixing chambers, and a plurality of separate primary mixture conduits, each of which connects one of said primary mixing chambers with one of said outlet branches, whereby a primary mixture of liquid fuel and air is supplied to the outlet branches and substantially the same quantity of fuel is delivered to each branch.

75. A charge forming device for an internal combustion engine having a plurality of intake ports, comprising an intake manifold having a plurality of outlet branches, one of which communicates with each engine intake port, an inlet supplying air to said manifold, a plurality of separate primary mixing chambers, a fuel inlet in each of said mixing chambers and means for supplying air to said chambers, a common fuel supply conduit supplying fuel to all of said fuel inlets, means for creating substantially the same suction in each of said mixing chambers for any given operating condition, whereby substantially the same quantity of fuel is supplied to each of said mixing chambers, and a plurality of separate primary mixture conduits, each of which connects one of said primary mixing chambers to one of said outlet branches to deliver primary mixture thereto.

76. A charge forming device for an internal combustion engine having a plurality of intake ports, comprising an intake manifold having a plurality of outlet branches, one of which communicates with each engine intake port, an inlet supplying air to said manifold, a plurality of separate primary mixing chambers, a fuel inlet in each of said mixing chambers and means for supplying air to said chambers, a common fuel supply conduit supplying fuel to all of said fuel inlets, means for creating substantially the same suction in each of said mixing chambers for any given operating condition, whereby substantially the same quantity of fuel is supplied to each of said mixing chambers, a suction operated valve controlling the admission of air to the manifold and regulating the degree of suction maintained in the primary mixing chambers, and a plurality of separate primary mixture conduits, each of which connects one of said primary mixing chambers to one of said outlet branches to deliver primary mixture thereto.

77. A charge forming device for an internal combustion engine having a plurality of intake ports, comprising, an intake manifold having a plurality of outlet branches, one of which communicates with each engine intake port, an inlet supplying air to said manifold, a plurality of separate primary mixing chambers, a fuel inlet in each of said mixing chambers and means for supplying air to said chambers, a main fuel reservoir, a fuel supply conduit conducting fuel from said reservoir to all of said fuel inlets, said conduit being substantially concentric with the fuel reservoir and symmetrical with respect to all of the fuel inlets whereby variation in the angle of inclination of the device does not effect the fuel flow, and a plurality of separate primary mixture conduits for conveying the primary mixture from said mixing chamber to the outlet branches of said manifold.

78. A charge forming device for internal combustion engines comprising, a secondary mixing chamber adapted to supply a mixture of fuel and air to the engine intake port, a primary mixing chamber connected by a primary mixture passage with the secondary mixing chamber and located relatively remote from said secondary mixing chamber, means for supplying fuel and air to the primary mixing chamber, a throttle, and means for supplying additional fuel directly to the secondary mixing chamber on opening movements of the throttle, whereby a relatively rich mixture is supplied to the secondary mixing chamber substantially immediately on opening of the throttle.

79. A charge forming device for internal combustion engines comprising, a secondary mixing chamber located adjacent the engine intake port, a primary mixing chamber connected by a primary mixture passage with the secondary mixing chamber and located relatively remote from said secondary mixing chamber, means for supplying fuel and air to the primary mixing chamber, a throttle, and means for supplying additional fuel directly to the secondary mixing chamber on opening movements of the throttle, whereby a relatively rich mixture is supplied to the engine intake port substantially immediately on opening of the throttle.

80. A charge forming device for internal combustion engines comprising, a plurality of secondary mixing chambers adapted to supply a mixture of fuel and air to a plurality of engine intake ports, a plurality of primary mixing chambers connected by individual primary mixture passages with the secondary mixing chambers and located

relatively remote from said secondary mixing chambers, means for supplying fuel and air to each of the primary mixing chambers, throttles, and means for supplying additional fuel directly to all of the secondary mixing chambers on opening movements of the throttles, whereby a relatively rich mixture is supplied to each of said secondary mixing chambers substantially immediately on opening of the throttles.

In testimony whereof I hereto affix my signature.

FRED E. ASELTINE.