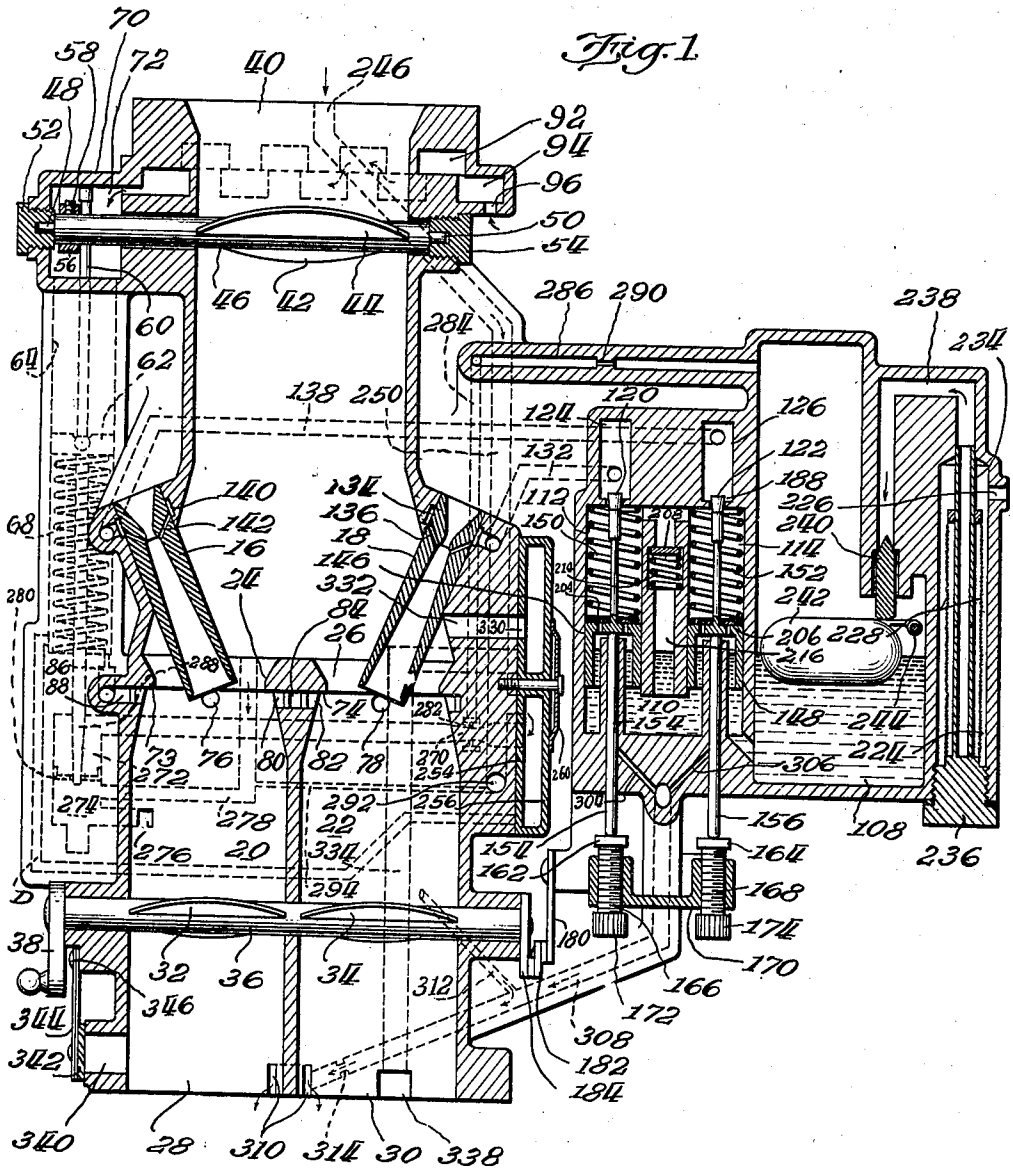
Dec. 5, 1939. R. F. BRACKE 2,182,580

CARBURETOR

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Fig. 1.



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CARBURETOR

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Fig. 2.

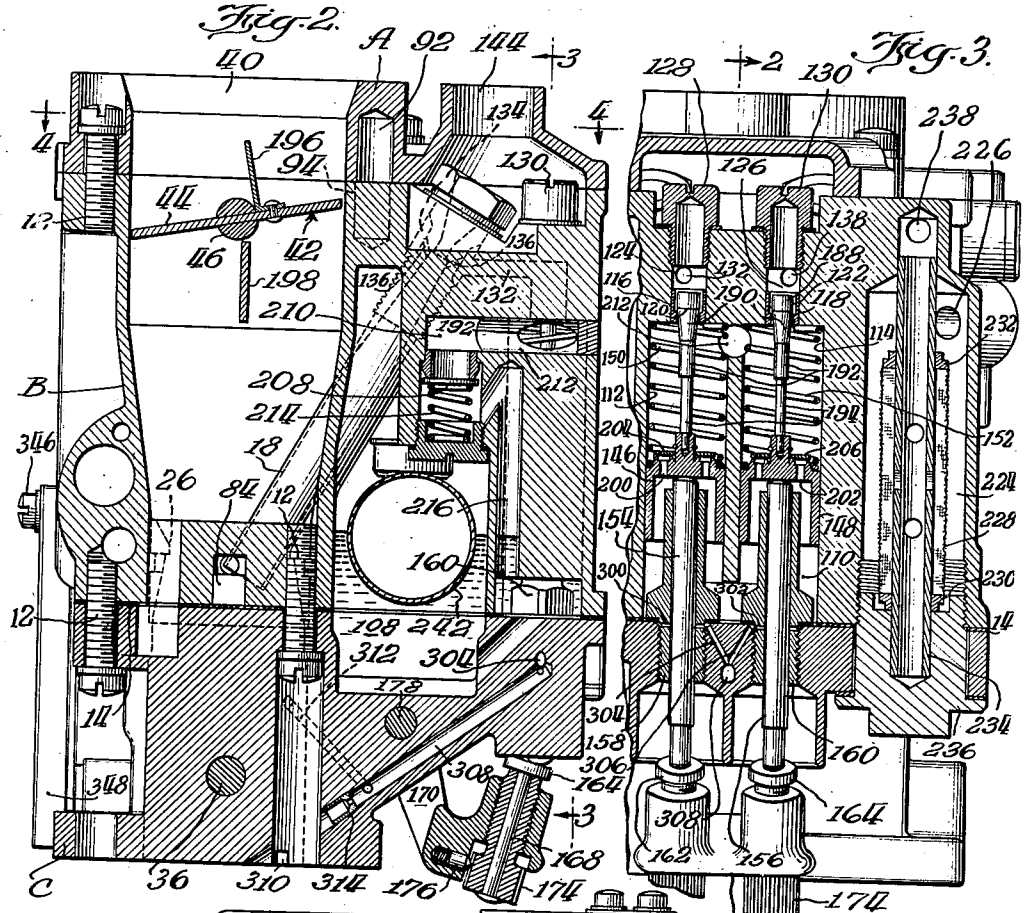
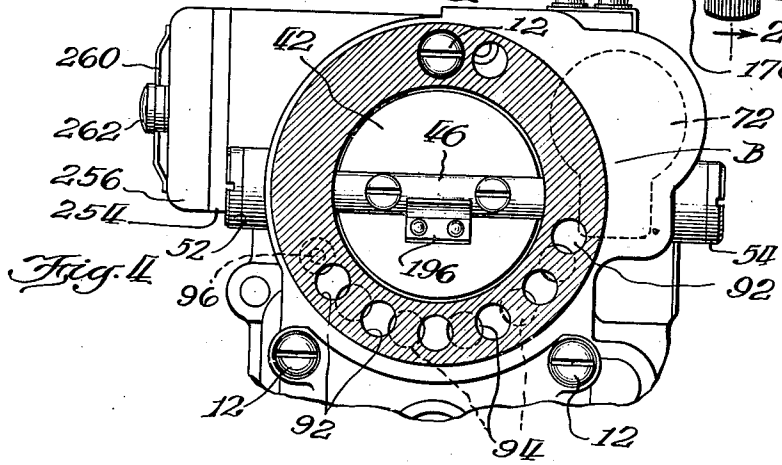


Fig. 3.

Fig. 4.



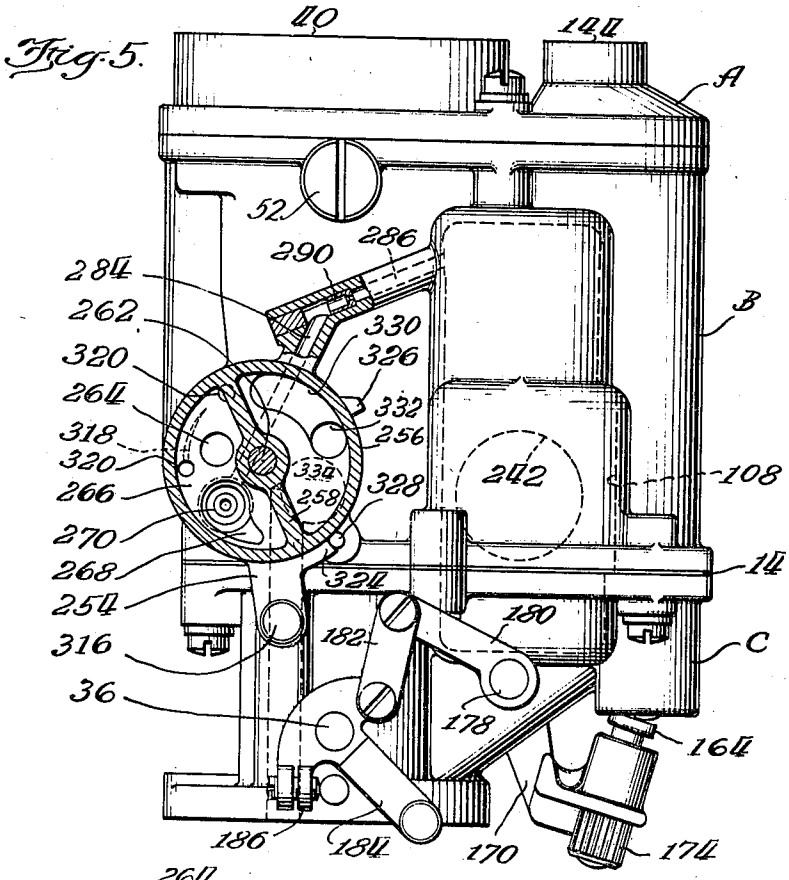
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CARBURETOR

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Fig. 5.



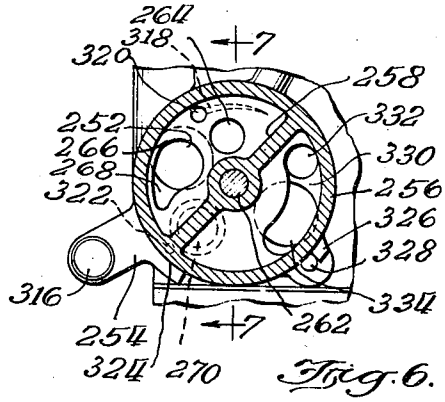
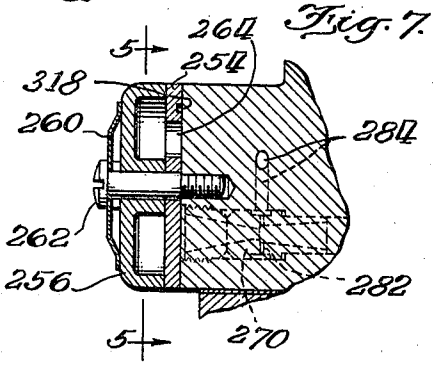


Fig. 6.

Fig. 7.



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CARBURETOR

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Fig. 8.

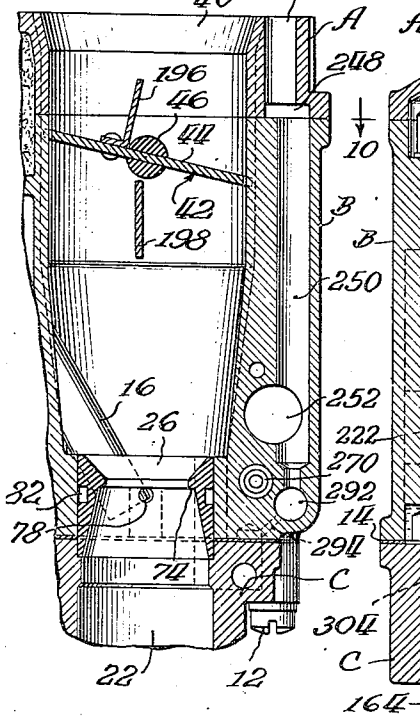


Fig. 9.

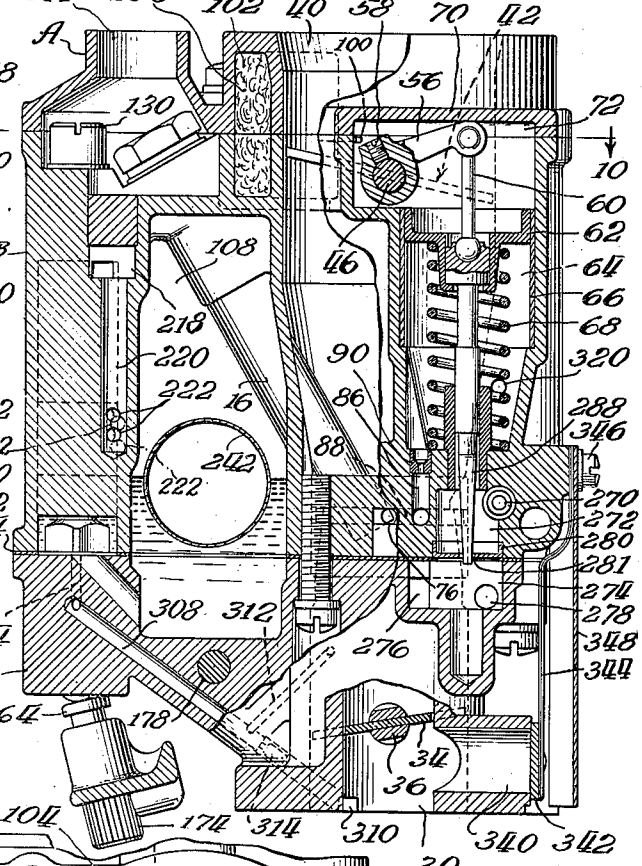
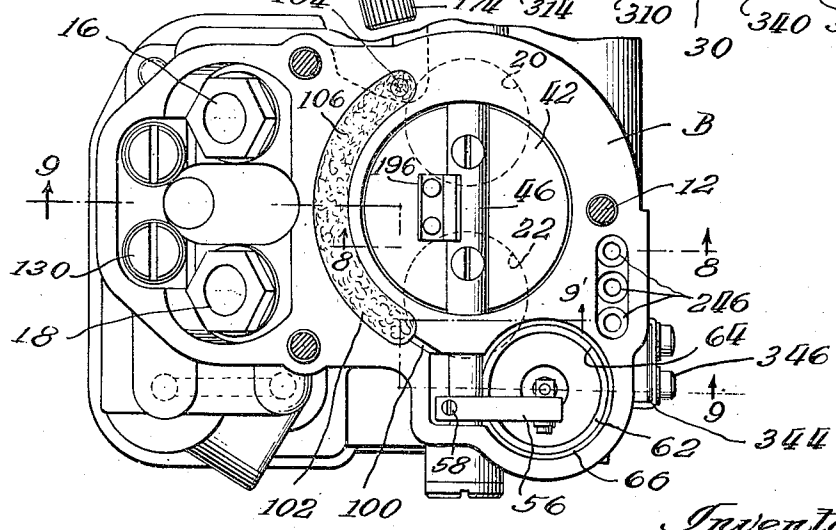


Fig. 10.



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Patented Dec. 5, 1939

2,182,580

UNITED STATES PATENT OFFICE

2,182,580

CARBURETOR

Robert F. Bracke, Chicago, Ill.

Application January 16, 1936, Serial No. 59,327

18 Claims. (Cl. 123—119)

My invention pertains to carburetors and is more particularly concerned with carburetors of the self-feeding type which are especially adapted for use on automotive vehicles.

An object of my invention is to provide an improved carburetor which affords maximum power and acceleration with economical fuel consumption.

Another object is to provide a carburetor having improved means for adjusting and controlling the richness of the combustible mixture supplied to the engine.

Another object is to provide a carburetor having an improved air valve and control therefor, whereby varying needs of the engine for different conditions of operation are satisfied more efficiently.

Another object is to provide a carburetor having improved means for facilitating starting of a cold engine.

Another object is to provide a carburetor having improved means for facilitating starting of a hot engine.

Another object is to provide a highly efficient carburetor which will be economical to manufacture and which will afford trouble-free service.

Another object is to provide a carburetor which will free itself of any oil carried into the carburetor from an air strainer and cleaner.

Another object is to provide a carburetor having an improved float for better withstanding the suction maintained in the fuel chamber.

Other objects and advantages will become apparent as the description proceeds.

In the drawings,

Figure 1 is a diagrammatic sectional view of one form of carburetor embodying my invention;

Figure 2 is a vertical section taken on the line 2—2 of Figure 3;

Figure 3 is a vertical section taken on the line 3—3 of Figure 2;

Figure 4 is a horizontal section taken on the line 4—4 of Figure 2;

Figure 5 is a side elevation showing parts of the choke mechanism cut away on the line 5—5 of Figure 7;

Figure 6 is a fragmentary view of the choke mechanism taken on the line 5—5 of Figure 7 but showing the parts in a different position from that shown in Figure 5;

Figure 7 is a section through the choke mechanism and is taken on the line 7—7 of Figure 6;

Figures 8, 9 and 10 show a modified type of carburetor in which the only differences reside in the air cleaner for the air valve control chamber and the relief means for the accelerator pump, and wherein Figure 8 is a section taken on the line 8—8 of Figure 10;

Figure 9 is a vertical section taken mainly on the line 9—9 of Figure 10 but wherein the lower part showing the throttle valve is taken on the line 9' of Figure 10; and

Figure 10 is a horizontal section taken on the line 10—10 of Figure 9.

Referring to the drawings, I have shown my carburetor as composed of three main castings, an upper casting A, a center casting B, and a lower casting C. These castings may be secured together by any suitable means such as the screws 12, and a gasket 14 is preferably interposed between the center and lower castings. In the present state of the art, carburetors used in large quantities are most economically manufactured by the die casting process of zinc base alloys and, while the castings A, B and C may be made of any suitable material and by any desired process, I have designed them so they may be easily and economically manufactured by the usual die casting process.

The carburetors shown in the drawings are of the dual jet type and are provided with a pair of nozzles or fuel-feeding Venturi tubes 16 and 18. Each nozzle discharges into a mixing chamber 20 or 22, the upper or inlet end of each mixing chamber is defined by a secondary Venturi tube 24 or 26. These secondary Venturi tubes are preferably made as separate rings which are press-fitted or otherwise secured in place, as indicated most clearly in Figure 8.

Each nozzle is in the form of a primary Venturi tube and is threadedly secured in the central casting B, as best indicated in Figure 2 of the drawings. The lower or discharge end of each nozzle is located a short distance below the throat of its corresponding secondary Venturi tube 24 or 26 so that each nozzle discharges into its mixing chamber at the point of maximum suction in that mixing chamber. This affords maximum efficiency of operation for the nozzles 16 and 18. Mixing chambers 20 and 22 communicate with throttle bores 28 and 30, respectively, and each throttle bore in turn communicates with a section of an inlet manifold. My carburetor is particularly designed for use with multi-cylinder engines wherein each section of an inlet manifold supplies combustible mixture to a plurality of cylinders.

A pair of throttle valves 32 and 34 are provided, these throttle valves comprising disks of relatively thin material mounted on a common

shaft 36 provided at one end with a lever 38 adapted to be connected in the usual manner with the hand control of an automobile or other vehicle.

Secondary air for intermixture with the relatively rich mixtures provided by the nozzles 16 and 18 is admitted through a common inlet 40 controlled by an automatic air valve 42. This air valve comprises a disk 44 of sheet material carried by a shaft 46 having reduced ends or journals 48 and 50 pivoted in bearing caps 52 and 54, respectively, which are screwed into opposite sides of the central casting B. The reduced size of the journals 48 and 50 is of great importance in reducing the frictional resistance to rotation of the air valve 42 and results in an air valve which is extremely sensitive and which accurately apportions the secondary air according to the varying needs of the engine.

The means for opening and closing the air valve 42 is shown diagrammatically in Figure 1 and in detail in Figure 9. This means comprises an arm 56 which is attached to the air valve shaft 46 by means of a set screw 58. The other end of the arm 56 is drilled to receive the bent-over upper end of a piston rod 60 whose lower end is connected by means of a universal connection to a piston 62. The piston 62 reciprocates in a cylinder 64 provided by a sleeve 66 of brass or other suitable material which is press-fitted into the central die casting B in order to reduce the frictional resistance to movement of the piston 62. The piston 62 is urged upwardly by a spring 68, and the upper position of the piston 62 is determined by the engagement of the end of the lever 56 with the upper wall 70 of a chamber 72 located above the cylinder 64.

The parts are so constructed and arranged that when the arm 56 engages the wall 70 the secondary air valve 42 is slightly open, that is, the right and left-hand edges of the valve, as viewed in Figure 8, do not engage the wall of the passage in which the valve is located. This is important as it facilitates ease of operation of the valve and prevents the wedging action which would occur between the edges of the valve and the wall of its passage if the valve were permitted to close completely. This feature, in combination with the small bearings on which the valve pivots, produces an extremely sensitive and efficient valve.

The cylinder 64 is in communication with the throats of secondary Venturi tubes 24 and 26 in the manner hereinafter described, and the suction created in the throats of these Venturi tubes extends to the cylinder 64 and tends to draw the piston 62 downwardly, thereby opening the valve 42. The degree of suction created in the throats of the secondary Venturi tubes is proportional to the secondary air requirements of the engine so that the valve 42 is automatically opened or closed, in accordance with the needs of the engine.

I shall now describe the manner in which communication is established between the cylinder 64 and the throats of the secondary Venturi tubes 24 and 26. As shown most clearly in Figures 1 and 8, these secondary Venturi tubes have their throats provided with steps 72 and 74, respectively, and below these steps are the series of radial openings 76 and 78, each series communicating with an annular groove 80 or 82.

As shown most clearly in Figure 8, these secondary Venturi tubes are formed as separate sleeves which are press-fitted into the central and lower castings of the carburetor. A slot 84 (Figures 1 and 2), formed in the wall of the central casting, establishes communication between the annular grooves 80 and 82 of the two secondary Venturi tubes.

The cylinder 64 communicates with these annular grooves through vertical duct 86 and horizontal duct 88. A plug 90 is press-fitted into the vertical duct 86 and carries a metering orifice for accurately controlling the communication between the cylinder 64 and the throats of the secondary Venturi tubes.

It is necessary that the chamber 72, located above the piston 62, be in communication with atmosphere, but it is also important that no dirt be permitted to enter this chamber and interfere with the operation of the piston 62. I accordingly provide means to filter any air which is admitted to the chamber 72, and in the drawings I have illustrated two forms of filtering means.

In the embodiment of Figures 1 to 7, inclusive, I have shown the chamber 72 as being in communication with one end bore of a series of spaced bores 92 formed in the upper casting A. These bores 92 overlap a complementary series of bores 94 formed in the upper end of the central casting B. The end bore of the lower series 94, which is remote from the chamber 72, communicates with atmosphere through an opening 96.

The purpose of this structure is to provide a relatively long pathway for the air entering the chamber 72, this pathway being provided with a series of sharp turns for separating the air from any dust contained therein. This winding pathway also provides a series of pockets in which the dirt removed from the air may collect. This form of air cleaner has proved to be very efficient in service.

In the embodiment shown in Figures 8 to 10, inclusive, the chamber 72 receives its air supply through a filtering chamber in which may be located any suitable and conventional filler for removing the dirt from the air. More specifically, the chamber 72 is in communication with one end of a passage 100 leading to an arcuate chamber 102 formed partly in the upper casting and partly in the central casting. The other end of this chamber 102 communicates with atmosphere through an opening 104. In the chamber 102 I place any suitable air filtering media 106, such as a mass of metal shavings, textile fibers, etc. I have found that when the engine is operating with wide open throttle, it is desirable to provide some means in addition to the piston 62 and cylinder 64 for holding the air valve 42 in fully open position. I accordingly mount a vane 196 on the upper side of the air valve 42 and in such position that as the air valve opens the inrushing air impinges upon this vane and tends to increase the opening of the air valve. This vane is made of such size that it has no appreciable effect upon the opening of the valve 42 except when the engine is operating under substantially full throttle and at substantially top speed.

Just below the shaft 46 of the air valve 42 I provide a vertical baffle 198 which eliminates the eddy currents which might otherwise be formed by the inrushing air in the space immediately beneath this air valve.

I shall now describe the means for supplying fuel to the nozzles 16 and 18 from the carburetor float chamber 108. The bottom of the float chamber 108 communicates with a space 110 located below a pair of accelerator pump cylinders 112 and 114. At the upper ends of these cylinders are plugs 116 and 118 press-fitted into the

central casting B. These plugs carry accurately metered orifices in which are located economizer pins 120 and 122, respectively. Above these plugs 116 and 118 are chambers 124 and 126 closed at their upper ends by removable caps 128 and 130.

The chamber 124 communicates with the nozzle 18 by way of passage 132, annular groove 134, and diagonal passages 136 which open into the throat of the nozzle 18 just below the step therein. Chamber 126 similarly communicates with nozzle 16 by way of passage 138, annular groove 140, and diagonal passages 142 which open into the throat of the nozzle 16 just below the step therein.

The fuel thus supplied to the nozzles 16 and 18 mixes with the air flowing through these nozzles, and the mixtures thus formed are discharged into the respective mixing chambers with which the nozzles are associated. Each nozzle receives its supply of air through an inlet 144 provided by the upper casting A. I utilize the economizer pins 120 and 122 to regulate the richness of mixtures supplied by the nozzles 16 and 18 in a manner which I shall now describe.

The economizer pins 120 and 122 are carried, respectively, by pistons 146 and 148. These pistons are urged downwardly by springs 150 and 152 and are raised by piston rods 154 and 156. It is to be noted, as shown most clearly in Figure 3, that the pistons reciprocate in cylinders provided by the central casting B, whereas the piston rods 154 and 156 reciprocate in guides 158 and 160 which are threadedly engaged in the lower casting C. It is undesirable to increase manufacturing costs by requiring accurate alignment between the guides 158 and 160 and the cylinders 112 and 114 and, in order to make such accurate alignment unnecessary, the upper ends of the piston rods 154 and 156 are slightly rounded and engage flat surfaces on the lower sides of the pistons 146 and 148.

The lower ends of the piston rods 154 and 156 rest upon case-hardened steel disks 162 and 164 which are riveted, respectively, to brass sleeves 166 and 168 adjustably threaded in one end of a common lever arm 170. The sleeves 166 and 168 have heads 172 and 174 provided with longitudinal grooves for engagement by spring-pressed detents 176 to hold them in adjusted position.

The arm 170 is mounted on a shaft 178 pivoted in the lower casting C and carrying a second arm 180 attached by means of link 182 to the lever 184 which oscillates the throttle valve shaft 36. The lever 184 is provided with the usual adjustable stop 186 and is adapted to be connected to the foot throttle control mechanisms of the conventional automobile.

Through this linkage the economizer pins 120 and 122 assume different positions corresponding to the different positions assumed by the throttle valves 32 and 34. Each economizer pin has an enlarged head 188 which is larger than the orifice in its respective metering plug 116 or 118. Immediately below this head is a tapered portion 190 and below this in turn is a cylindrical portion 192 of materially less diameter than the head. The economizer pins may be individually adjusted by means of the brass sleeves 166 and 168.

In the idling position of the throttle valve the adjustment of the economizer pins is such that the tapered portions 190 are located in the orifices of the plugs 116 and 118 to greatly restrict the flow of fuel to the nozzles 16 and 18. As the throttle valves are opened, the economizer pins move upwardly through the orifices in the plugs 116 and 118 so that a small opening of the throttle valves will bring the cylindrical portions 192 of the economizer pins in the metering orifices. The cylindrical portions 192 are of such length that they remain in these orifices until the throttle valves are well open. These cylindrical portions 192 are of such size as to afford appreciable restriction to the flow of fuel to the nozzles.

When the throttle valves are wide open or nearly so, the small stems 194 of the economizer pins are located in the metering orifices of the plugs 116 and 118 and afford no appreciable restriction to the flow of fuel to the nozzles 16 and 18. In this manner the carburetor is permitted to develop full engine power while the mixture supplied by the nozzles 16 and 18 is graduated in accordance with the needs of the engine to afford maximum economy of operation.

The pistons 146 and 148 and cylinders 112 and 114 comprise parts of accelerator pumps for supplying additional fuel to the nozzles 16 and 18 during periods of acceleration. The pistons 146 and 148 are provided with ports 200 and 202 through which the fuel normally passes to the nozzles 16 and 18. Above these ports are valve disks 204 and 206 which are raised from their seats by suction to permit fuel to flow through the ports 200 and 202 during normal engine operation. Each of these valve disks 204 and 206 may be provided with a small orifice capable of supplying sufficient fuel when the engine is idling so that during idling operation these valves may remain upon their seats.

When the throttle valves are suddenly opened through a wide range, the accelerator pumps would supply too much fuel to the nozzles 16 and 18 unless some relief means were provided. In Figures 1 and 2, this relief means takes the form of a spring-pressed relief valve 208 controlling the outlet of a chamber 210 which communicates through port 212 with the upper ends of both of the accelerator pump cylinders 112 and 114. When the throttle valve is suddenly opened through a wide range, the pressure developed on the fuel by the accelerator pump pistons causes the valve 208 to open against the tension of its spring 214 which permits fuel to return to the bottom of the fuel chamber by way of the passage 216.

In the embodiment of Figures 8, 9 and 10, a different means is provided to prevent oversupply of fuel to the nozzles by the accelerator pumps. In this embodiment the chamber 218 corresponds to the valve chamber 210 of the previous embodiment. This chamber 218 communicates with a vertical return passage 220 and at the lower end of this return passage there are two pairs of bores 222, each pair leading back into one of the accelerator pump cylinders. The two sets of bores 222 are staggered, as indicated in Figure 9, and are so located with respect to the accelerator pump cylinders that when the accelerator pump pistons are in their lower or normal positions these pistons close the outlet ends of these bores. As the pistons rise during the opening movement of the throttle valves, they successively uncover the discharge ends of the bores 222 to permit increasingly free return flow of fuel from the upper ends of the accelerator pump cylinders to the fuel chamber.

The float chamber 108 is supplied with fuel from the main fuel supply tank. Interposed between the float chamber 108 and the main fuel tank is a strainer chamber 224 having an inlet

226 connected by piping to the main fuel supply tank. The fuel entering the inlet 226 passes into the chamber 224 on the outside of a screen 228 attached to rings 230 and 232 surrounding a central tube 234 carried by a removable head 236. By removing the head 236, the entire assembly, including the tube 234, rings 230 and 232, and screen 228, may be removed as a unit to facilitate inspection and cleaning of the screen 228. The fuel passing through the screen 228 flows through the openings in the tube 234 and upwardly through this tube and into passageway 238 leading to the float chamber 108.

The inlet valve 240 controls the admission of fuel to the float chamber 108 from this passage 238. This valve is opened by gravity and is closed by the float 242. This float is a hollow metal shell of cylindrical shape having rounded ends, as I have found this particular shape to provide the greatest strength to resist the suction created in the float chamber 108. This float 242 is pivoted on a pin 244.

In automotive practice it is usual to mount the engine at the forward end of the vehicle and the main fuel tank at the rear of the vehicle and at an elevation below that of the engine carburetor. Some means must therefore be provided to raise the fuel from the main fuel tank to the engine carburetor. This means will next be described.

The upper casting is shown in Figure 10 as being provided with three bores 246 leading to a manifold 248 communicating with the upper end of a passage 250 (Figure 8). The lower end of the passage 250 communicates with a horizontal duct 252 which terminates at a choke plate 254. As shown most clearly in Figures 5, 6 and 7, this choke plate carries a hollow cap 256 which is divided into two chambers by a central partition 258. The cap 256 is pressed against the plate 254 by a spring 260 beneath the head of a bolt 262 which secures the plate 254 and cap 256 to a laterally extending boss of the central casting.

Plate 254 has a port 264 (Figure 5) which normally registers with the end of the passage 252 to admit air to the chamber 266 of the cap 256. The choke plate 254 has a second and generally pear-shaped opening 268 which normally connects the chamber 266 with the inlet end of a booster Venturi tube 270. In the position of the parts shown in Figure 5, air is admitted to the inlet end of the booster 270 and passes through this booster to discharge into a space 272 (Figure 9). This space connects with a chamber 274 which communicates with one of the mixing chambers through a port 276. The chamber 274 also communicates with the air inlet immediately above the secondary Venturi tubes through a passage 278.

Between the space 272 and chamber 274 is a metal disk 280 carrying a metered orifice 281 through which passes the tapered lower end of a pin 282 attached to the air valve piston 62.

The suction existing in the mixing chamber 20 is communicated in lessened degree through passage 276, chamber 274, orifice 281 and space 272, to the booster 270 to cause air flow therethrough.

The throat of the booster 70 has a slight step just beyond which are radial passages 282 communicating with bores 284 and 286 leading to the top of the float chamber 108 for the purpose of creating sufficient suction therein to lift fuel from the main fuel supply tank to this chamber. As the fuel needs of the engine increase with the opening of the throttle valves, greater quantities of fuel must be drawn from the main fuel tank to the float chamber, and it is desirable under these conditions to permit the degree of suction existing in the float chamber to increase somewhat with the opening of the throttle valve. However, unless some means were provided to regulate this increase, the arrangement so far described would provide more increase in fuel chamber suction than is desirable.

The means for regulating the fuel chamber suction for different conditions of engine operation comprises the tapered lower end of the pin 288 which is located in the metered orifice 281. This pin is carried by the piston 62 in such manner that as the secondary air valve opens the tapered end of the pin 288 moves downwardly in the orifice 281 and increasingly reduces the effective size thereof. It will, of course, be appreciated that the tapered end of this pin can be shaped to give any desired rate of increase of fuel chamber suction.

The greater degree of suction in the fuel chamber, the less the head available to raise fuel from the float chamber to the nozzles 16 and 18. In order, therefore, to improve the accelerating characteristics of the engine, I find it desirable to retard the increase in float chamber suction during the accelerating period. This I accomplish by interposing a restriction 290 in the passage 280 which connects the throat of the booster 270 with the float chamber 108. This restriction is in the form of a separate piece having a metered orifice, this separate piece being press-fitted into the passageway 286.

My carburetor is designed for use with air cleaners and silencers of the types now commonly used, and I contemplate that the upper part of my carburetor will be attached to an air cleaner and silencer in such a manner that all of the air entering the carburetor through the openings 40, 144 and 246 will have been cleaned of dirt by such means before reaching the carburetor. Some of these cleaners contain quantities of oil, and I have found it desirable to provide special means for preventing this oil from interfering with the operation of the carburetor. The booster and the air valve control mechanism are the only parts of the carburetor which might be undesirably affected by the presence of this oil in any air supplied thereto. I have already described the means for cleansing the air supplied to the chamber 72 of the air valve control mechanism, and I shall now describe the means for preventing this oil from interfering with the operation of the booster.

The vertical passage 250, which supplies the booster 270 through the cross passage 252, continues downwardly below this cross passage and opens into a conduit 292 which communicates with the chamber 274 through a diagonal duct 294. Any oil which may be contained in the air admitted through the booster inlets 246 will continue downwardly past the passage 252 leading to the booster and will be discharged into the mixing chamber 20 through passageways 292 and 294, chamber 274, and passageway 276, where it will mix with the combustible mixture supplied to the engine.

I have found it desirable to provide means for preventing any leakage of air into the float chamber around the piston rods 154 and 156. To accomplish this I provide the guides 158 and 160 with radial bores 300 and 302 connecting with diagonal ducts 304 and 306 leading to a conduit 308 which empties into both throttle

bores 28 and 30 through an interconnecting opening 310. The conduit 308 has a branch 312 leading to the mixing chamber 22 above the throttle valve 34, and a plug 314 is press-fitted into the lower end of the conduit 308 to restrict flow therethrough. In this manner intermediate portions of the piston rods 154 and 156 are exposed to a combination of the different degrees of suction existing on opposite sides of the throttle valves, while at the same time the amount of bypassing around these throttle valves is limited by the restriction 314.

I have provided special means associated with the choke plate 254 for facilitating starting of the engine when cold. This choke plate 254 has an arm terminating in a knob 316 adapted to be connected to the usual hand choke control on the instrument board of an automobile, whereby this choke plate 254 may be shifted from the running position, shown in Figure 5, to the fully choked position, shown in Figure 6, or to any intermediate position.

As the choke plate 254 is moved from the position of Figure 5, toward the position of Figure 6, the pear-shaped orifice 268 restricts the flow of air into the booster 270, thereby reducing the degree of suction which this booster maintains in the float chamber 108 and thus permitting the nozzles 16 and 18 to draw more fuel from this float chamber and provide richer mixtures. When the choke plate 254 is moved to fully choked position, the air supply to the booster 270 is entirely cut off, as shown in Figure 6.

As the choke plate 254 is moved to choked position, a comet-shaped opening 318 registers with one end of a passage 320 opening into the air valve control cylinder 64, thereby reducing the degree of suction created therein and which is available for opening the air valve 42. When the choke plate 254 is in fully choked position, free communication for air is established between the air inlet 246 and the cylinder 64, whereby substantially atmospheric pressure is maintained in this cylinder and the secondary air valve 42 remains closed.

It will be understood that the cap 256 rotates with the choke plate 254, the plate being provided with a pin 322 extending into a hole provided in the cap to insure this relationship. Movements of the choke plate 254 are limited by the engagement of stops 324 and 326 with a stationary pin 328.

As the choke plate 254 and cap 256 are moved toward choked position, an arcuate slot 330 in the plate 254 establishes communication between a bore 332 opening into the space beneath the air valve 42 and a bypass passage 334 communicating with the throttle bore 30 at 338. The opening of this bypass between the space beneath the air valve 42 and the throttle bore 30 has substantially the same effect as opening the throttle valve slightly and thus facilitates starting of the engine.

It is frequently difficult to start a hot engine due to the fact that the mixture supplied to the engine under these conditions is richer than necessary. A feature of my invention lies in the provision of means to overcome this difficulty and to make the starting of an engine which is extremely hot as easy to accomplish as the starting of an engine at normal operating temperature.

The means for carrying out this feature of my invention is best shown in Figures 1 and 9 of the drawings. In these figures I have shown the throttle bore 28 as provided with an opening 340 which is shown as closed by a valve 342 carried on the lower end of a bimetallic strip 344 having its upper end bent outwardly and attached to the central casting by a bolt 346 which also carries a protecting shield 348. The parts are so constructed and arranged that when the engine is stopped while it is extremely hot the heat of the engine causes the bimetallic thermostatic strip 344 to flex in such a way as to move the valve 342 away from the end of the opening 340, the outward movement of this valve being limited by the shield 348. If an attempt is made to start the engine while still in this extremely hot condition, air will be drawn through opening 340 into throttle bore 28, thereby reducing the richness of the mixture supplied to the cylinders connected with that section of the manifold connected to the throttle bore 28.

My carburetor has been used in connection with a V type eight-cylinder engine wherein each manifold section supplies four cylinders, and this hot starting feature of my carburetor has proved to be very effective in this installation. It will be noted that the throttle bore 30 and section of the manifold connected therewith is not appreciably affected by the opening of the valve 342 so that the cylinders supplied from the throttle bore 30 receive the normal starting mixture which will be available for starting the engine in the event that too lean a mixture is created in the throttle bore 28 by opening of the valve 342. As soon as the engine starts, the suction created in the throttle bore 28 is sufficient to close the valve 342 against the resistance of the bimetallic strip 344. This means that, no matter how hot the engine may become while it is operating, the valve 342 will always remain closed until the engine stops.

The operation of my invention is as follows: When the engine is operating with the throttle valves 32 and 34 partly open, air is admitted to the nozzles 16 and 18 through inlet 144, and the air passing through the restricted throats of these nozzles draws fuel from the float chamber 108. The mixture thus formed is delivered into the mixing chambers 20 and 22 at substantially the points of maximum suction therein, and mixes with air admitted through the inlet 40 and past the partially opened secondary air valve 42. The suction created in the throats of the secondary Venturi tubes 24 and 26 is exerted on the air valve control piston 62 and pulls this piston downwardly against the tension of the spring 78 to maintain the air valve 42 in partially open position.

Air is also admitted through inlets 246 and passes through booster 270 and is discharged into mixing chamber 20. The flow of this air through the throat of the booster 270 creates suction therein which is communicated to the upper end of the float chamber 108 and is effective to draw fuel from the main supply tank to this float chamber through the filter screen 228.

When the throttle valves are opened to accelerate the engine, the accelerator pump pistons 146 and 148 are raised in their respective cylinders and the valves associated with the tops of these pistons are closed, thereby forcing fuel to the inlets 16 and 18. If the throttle valves are opened through a wide range the pressure produced by the pistons 146 and 148 will result in opening of the relief valve 208 which permits part of the fuel supplied by the accelerator pumps to

return to the fuel chamber through bypass conduit 216.

As the fuel needs of the engine change with different positions of the throttle valves, the economizer pins 120 and 122 shift their positions with respect to the orifices in the plugs 116 and 118 to regulate economically the degree of richness of the mixture supplied by the nozzles 16 and 18. The increased suction created in the throats of the secondary Venturi tubes 24 and 26, as a result of increased opening of the throttle valves, is communicated to the secondary air valve control cylinder 64 and moves the piston 62 downwardly therein to further open the secondary air valve 42. This downward movement of the piston 62 lowers the tapered end of the pin 288 further into the orifice 281 to prevent undue increase in flow through the booster 270. The small amount of increased flow which occurs through the booster, as a result of opening of the throttle valves, is prevented by the restriction 290 from immediately affecting the float chamber suction, and in this manner the acceleration of the engine is further improved.

When the throttle valves are substantially wide open and the engine is operating at substantially its maximum speed, the flow of air past the secondary air valve 42 impinges on the vane 196 and assists in the complete opening of this valve. During the periods when the engine is operating at or near full throttle, the economizer pins 120 and 122 offer no restriction to the flow of fuel to the nozzles 16 and 18.

In starting a cold engine, the choke plate 254 is shifted to restrict or entirely cut off the flow of air through the booster 270, thus reducing the degree of suction existing in the float chamber 108 and permitting the nozzles 16 and 18 to draw more fuel therefrom and to supply richer mixtures. At the same time air is admitted to the secondary air valve control cylinder 64 to prevent the creation of any suction therein, with the result that the secondary air valve remains closed. This movement of the choke plate also creates a bypass around the throttle valves to increase the supply of combustible mixture to the engine cylinders.

If the engine is stopped while it is extremely hot, the bimetallic strip 344 opens the valve 342 to establish communication between one throttle bore and atmosphere. If the engine is started while in this extremely hot condition, air is drawn in through the opening 340 and the richness of the mixture supplied to one-half of the engine cylinders is reduced. This greatly improves the starting characteristics of these cylinders under these conditions. As soon as the engine starts, the valve 342 is drawn shut by the suction created in the associated throttle bore, and this valve remains shut during engine operation, regardless of engine temperature.

It is to be understood that my invention is not limited to the specific details shown in the drawings and described in the specification, but that my invention may assume various forms and that the scope of my invention is to be limited solely by the following claims.

I claim:

1. In a carburetor of the class described, the combination of a pair of fuel feeding nozzles, a separate mixing chamber for each nozzle, a secondary Venturi tube defining the inlet to each mixing chamber, a common inlet for secondary air, a valve controlling said last-named inlet, and means for shifting the position of said valve in accordance with the mean of the variations in suction occurring at the throats of said secondary Venturi tubes.

2. In a carburetor of the class described, the combination of a fuel feeding nozzle, a mixing chamber into which said nozzle delivers, a secondary Venturi tube through which secondary air is admitted to said mixing chamber, a valve for controlling the admission of secondary air to said mixing chamber, suction operated means connected with the throat of said secondary Venturi tube for controlling the position of said valve, and other, air-flow operated, means for aiding said valve in reaching fully open position during maximum speed operation of an engine to which said carburetor is attached.

3. In a carbuetor of the class described, the combination of a fuel feeding nozzle, a mixing chamber into which said nozzle discharges, a balanced valve for controlling admission of secondary air to said mixing chamber, suction operated means for shifting the position of said valve in accordance with suction variations in a part of said carburetor, and a vane carried by said valve and adapted to be impinged upon by air passing therethrough for assisting said suction actuated means in holding said valve in fully open position during maximum speed of operation of an engine to which said carburetor is attached.

4. In a carburetor of the class described, the combination of a fuel feeding nozzle, a fuel chamber from which said nozzle is supplied, a booster Venturi tube for creating a suction in said fuel chamber, means for varying flow through said booster to vary the suction created thereby, and means for delaying the effect on said fuel chamber of variations in suction produced by said booster.

5. In a carburetor of the class described, the combination of a fuel feeding nozzle, a fuel chamber from which said nozzle is supplied with fuel, a booster for creating suction in said fuel chamber, an accelerator pump for supplying additional fuel to said nozzle, a piston rod for operating said pump, a throttle valve, a connection between said throttle valve and piston rod, said connection including an adjustable brass sleeve carrying a case-hardened disk engaging said piston rod, guide means for said piston rod, a suction connection between an intermediate portion of said guide means and opposite sides of said throttle valve, and a restriction in said connection limiting bypassing of said throttle valve therethrough.

6. In a carburetor of the class described, the combination of a pair of fuel feeding nozzles, a pair of accelerator pumps for supplying additional fuel to said nozzles during acceleration, and common relief means for both of said pumps.

7. In a carburetor of the class described, the combination of a pair of fuel feeding nozzles, a pair of accelerator pumps for supplying additional fuel to said nozzles during acceleration, each pump comprising a cylinder having a piston reciprocable therein, relief means including a bypass passageway, and openings leading from said passageway into said cylinders arranged to be successively uncovered by said pistons to permit relief flow of fuel therethrough.

8. In a carburetor of the class described, the combination of a fuel feeding nozzle, a source of fuel supply for said nozzle, a conduit leading from said nozzle to an intake manifold of an engine, an atmospheric opening for said conduit, a valve for closing said opening, and thermostatic means for opening said valve when said engine is extremely hot and is not operating, said means being unable to maintain said valve in open posi-

tion against the closing force of suction created in said conduit when the engine is operating.

9. In a carburetor of the class described, the combination of a fuel feeding nozzle, a mixing chamber into which said nozzle discharges, a throttle valve, a throttle bore leading to the intake manifold of an engine, an atmospheric opening in said bore, a valve for closing said opening, a bimetallic strip tending to open said valve when said engine is extremely hot, the opening force of said strip being insufficient to overcome suction created in said throttle bore during engine operation, and means for limiting the opening movement of said valve.

10. In a carburetor of the class described, the combination of fuel feeding means, a pair of throttle bores, each throttle bore communicating with a part of an intake manifold of an engine, an atmospheric opening in one bore only, and a thermostatic valve controlling said opening to admit air therethrough only when the engine is hot and not operating.

11. In a carburetor of the class described, the combination of a fuel feeding nozzle, a float chamber from which said nozzle is supplied with fuel, a booster for creating suction in said float chamber, an air inlet conduit for said booster, said inlet conduit being adapted for connection to an air cleaner containing oil, and means for preventing oil from being carried into said booster by air entering through said inlet conduit, said means comprising an extension of said air inlet conduit to a point below said booster, and a connection between the lower end of said conduit and a part of said carburetor subject to suction.

12. In a carburetor of the class described, the combination of a fuel feeding nozzle, a mixing chamber into which said nozzle delivers, a fuel chamber from which said nozzle is supplied with fuel, a booster for creating suction in said fuel chamber, a secondary air valve for controlling admission of air to said mixing chamber, a vacuum cylinder regulating said air valve, a throttle valve between said mixing chamber and an inlet manifold of an engine, and means for facilitating starting of a cold engine, said means including a movable cup having a pair of chambers, one chamber being shiftable to reduce the suction created by said booster and to reduce the effectiveness of said vacuum cylinder, and the other chamber being shiftable to bypass said throttle, and means for shifting said cup.

13. In a carburetor of the class described, the combination of a nozzle feeding a mixture of fuel and air, a mixing chamber into which said nozzle discharges, a secondary air inlet for said mixing chamber, a valve automatically controlling said inlet, manually operated means to facilitate starting a cold engine by increasing the richness and quantity of mixtures delivered by said nozzle and maintaining said valve in closed position, and automatically operated means to facilitate starting a hot engine by reducing the richness of mixtures delivered by said nozzle.

14. In a carbureator of the class described, the combination of a pair of nozzles feeding mixtures of fuel and air, a throttle valve interposed between each nozzle and a section of an inlet manifold of an engine, means to facilitate starting a cold engine by increasing the richness and quantity of mixture delivered by both of said nozzles, and means to facilitate starting a hot engine by reducing the quantity of mixture delivered by one of said nozzles only.

15. In a carburetor of the class described, the combination of a die cast body, a nozzle feeding a mixture of fuel and air, a mixing chamber into which said nozzle delivers, an air valve for admitting secondary air to said mixing chamber, said air valve comprising a disk of thin material, a central pivot for said disk whereby said valve is balanced with respect to air admitted therepast, a suction cylinder comprising a brass sleeve carried in said body, a piston reciprocable in said sleeve, a connection between said piston and said valve, a spring for moving said piston in a direction to close said valve, means for admitting suction to said cylinder to move said piston in the opposite direction, a stop for preventing complete closing of said valve, substantially frictionless bearings for said valve, a vane carried by said valve to increase the opening in said valve under certain conditions of engine operation, and a baffle located beneath said valve to prevent the formation of whirling currents in the air passing said valve.

16. In a carburetor of the class described, the combination of a pair of fuel feeding nozzles, a float chamber from which said nozzles are supplied with fuel, a mixing chamber into which each nozzle delivers, a secondary Venturi tube at the inlet of each mixing chamber, each nozzle having its discharge end terminating below the throat of its associated secondary Venturi tube and at a point of maximum suction in its mixing chamber for substantially all conditions of engine operation, an air valve for controlling admission of air to said mixing chambers, piston and cylinder means for opening said valve, a connection between said cylinder and the throats of said secondary Venturi tubes whereby said air valve is opened by the mean of the suctions existing in said mixing chambers at low engine speed and by the mean of the increased suctions produced by the multiplying action of said secondary Venturi tubes at high engine speeds, and spring means for closing said valve.

17. In a carburetor of the class described, the combination of a body providing a mixing chamber, an air inlet therefor and a cylinder, a nozzle discharging into said mixing chamber, a valve for said air inlet, a piston in said cylinder connected to said valve, means for operating said piston and air valve, and an air inlet for said cylinder formed in that part of the body surrounding said first-named inlet and comprising two series of alternately overlapping bores providing a tortuous channel for air admitted to said cylinder.

18. In a carburetor of the class described, the combination of a body providing a mixing chamber, an air inlet therefor and a cylinder, a nozzle discharging into said mixing chamber, a valve for said air inlet, a piston in said cylinder connected to said valve, means for operating said piston and air valve, and an air inlet for said cylinder formed in that part of the body surrounding said first-named inlet and comprising an arcuate chamber adapted to have an air cleaning medium confined therein.

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