Feb. 21, 1933. H. W. LINKERT ET AL 1,898,672

CARBURETOR

Filed May 26, 1930 5 Sheets-Sheet 1

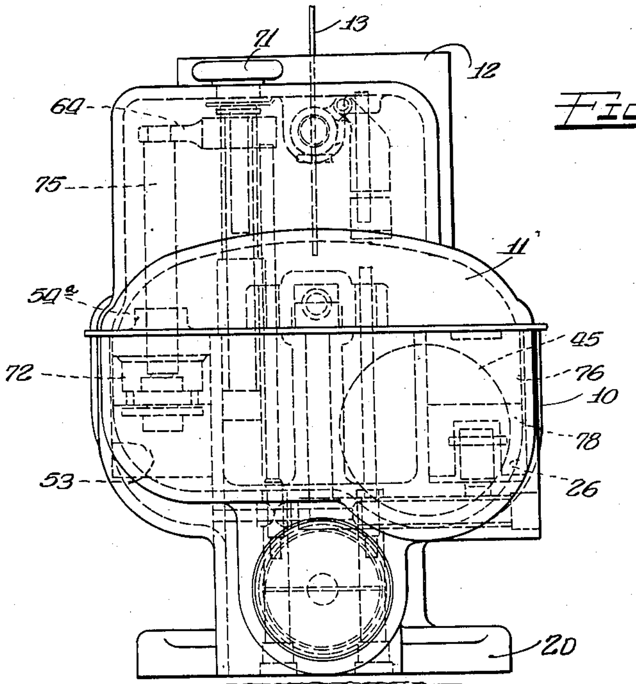


Fig-1

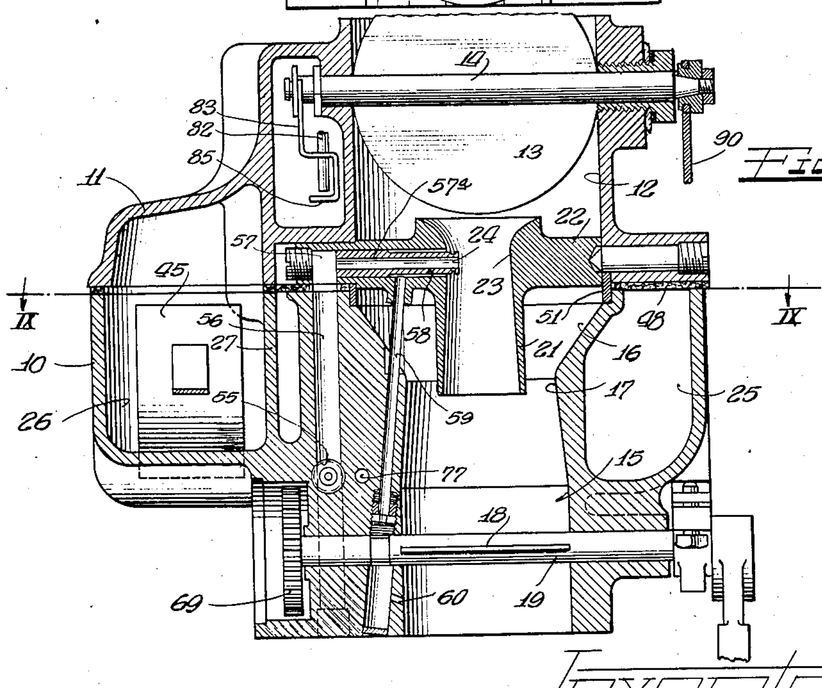


Fig-3

Inventors:
Howard W. Linkert.
Raymond M. Anderson.

by: Charles W. Hills Attys.

Feb. 21, 1933. H. W. LINKERT ET AL 1,898,672

CARBURETOR

Filed May 26, 1930 5 Sheets-Sheet 2

Fig. 2

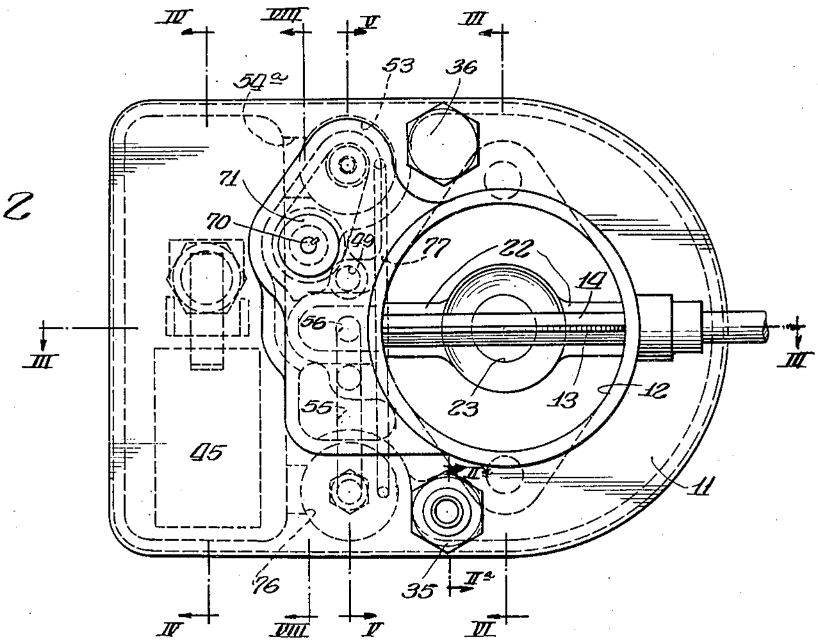


Fig. 4

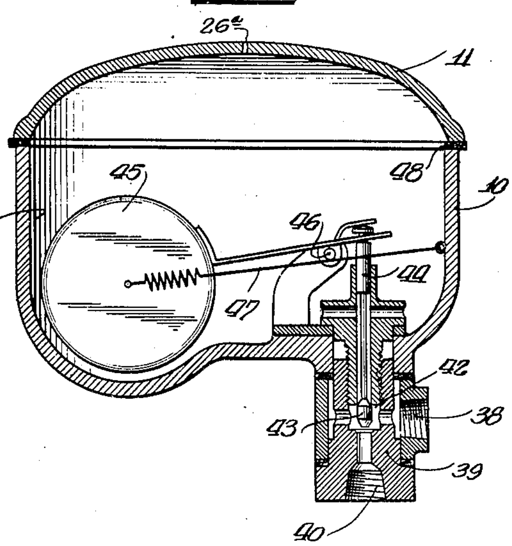
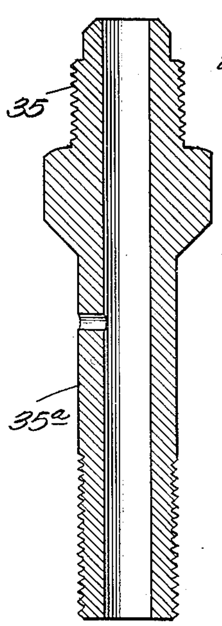


Fig. 2a



Inventors:
Howard W. Linkert.
Raymond M. Anderson.
by: Attys.

Feb. 21, 1933. H. W. LINKERT ET AL 1,898,672

CARBURETOR

Filed May 26, 1930 5 Sheets-Sheet 3

Fig. 5

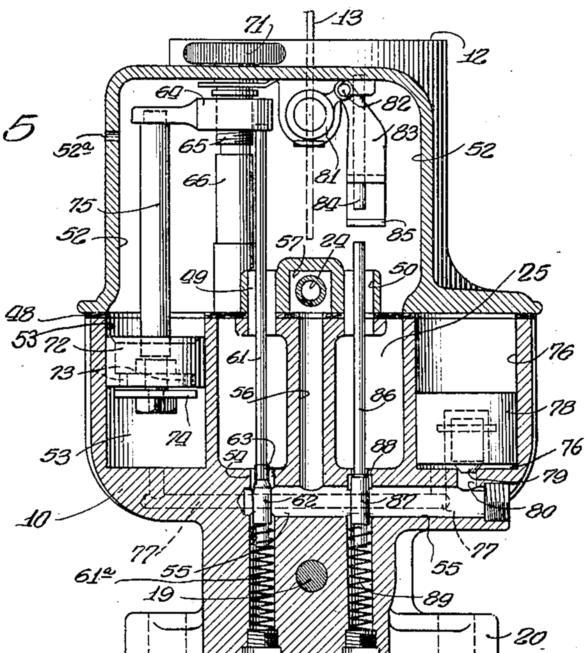
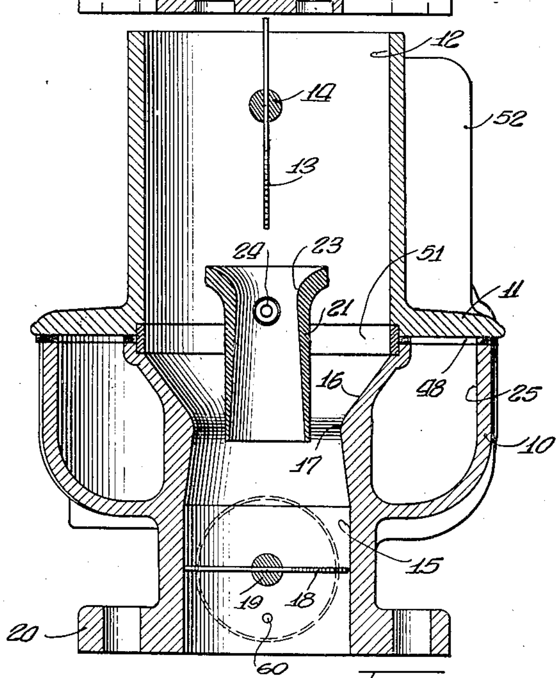


Fig. 6



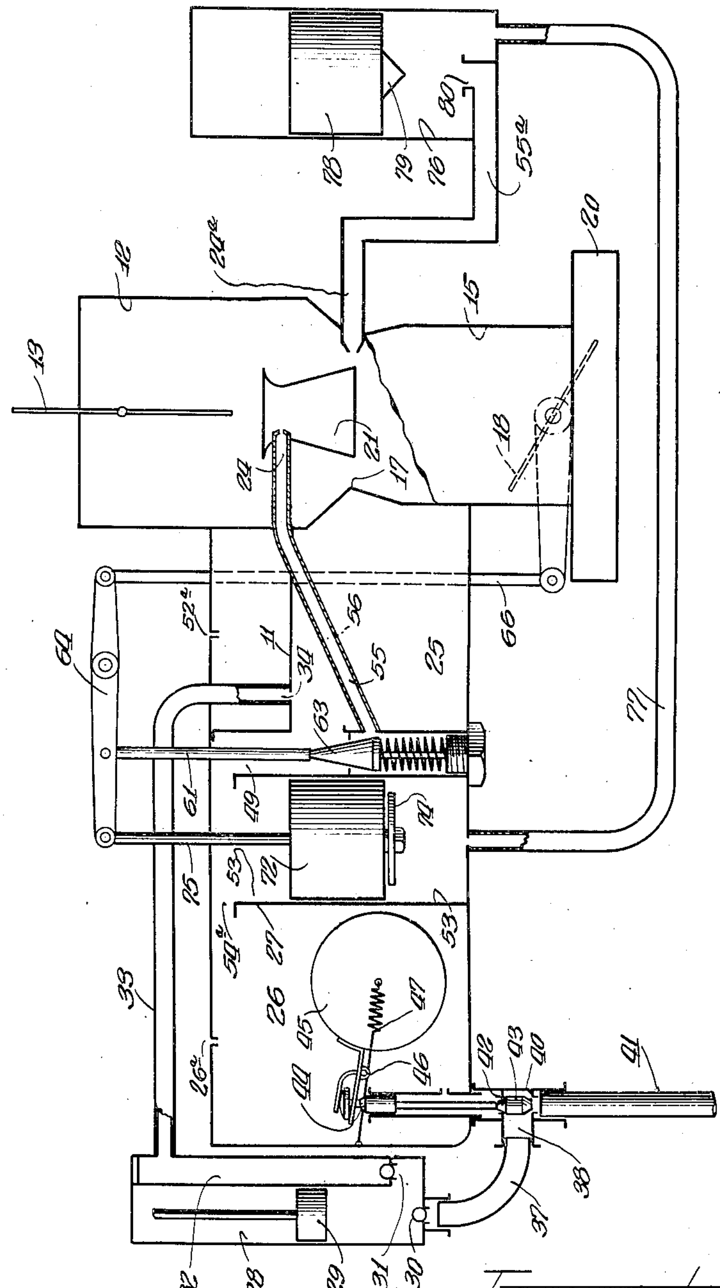
Inventors.
Howard W. Linkert.
Raymond M. Anderson.
by: Charles W. Hills Attys.

Feb. 21, 1933. H. W. LINKERT ET AL 1,898,672

CARBURETOR

Filed May 26, 1930 5 Sheets-Sheet 4

Fig. 7



Inventors:
Howard W. Linkert.
Raymond M. Anderson.
by: Charles W. Hills Attys.

Feb. 21, 1933. H. W. LINKERT ET AL 1,898,672

CARBURETOR

Filed May 26, 1930 5 Sheets-Sheet 5

FIG. 8

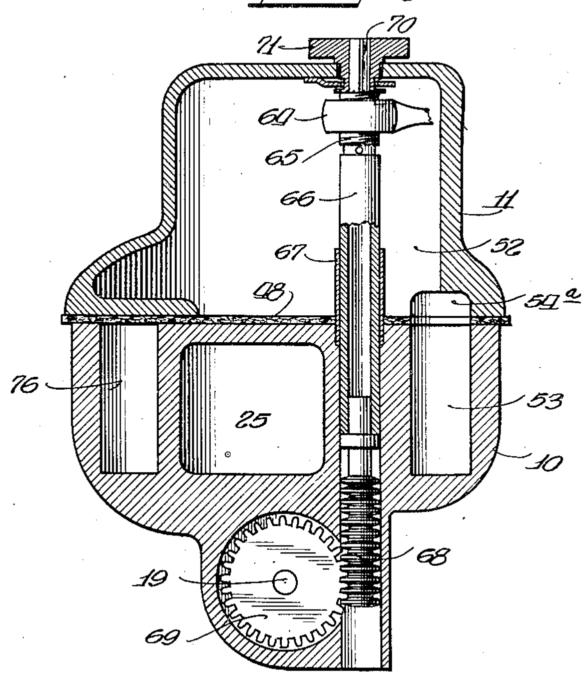
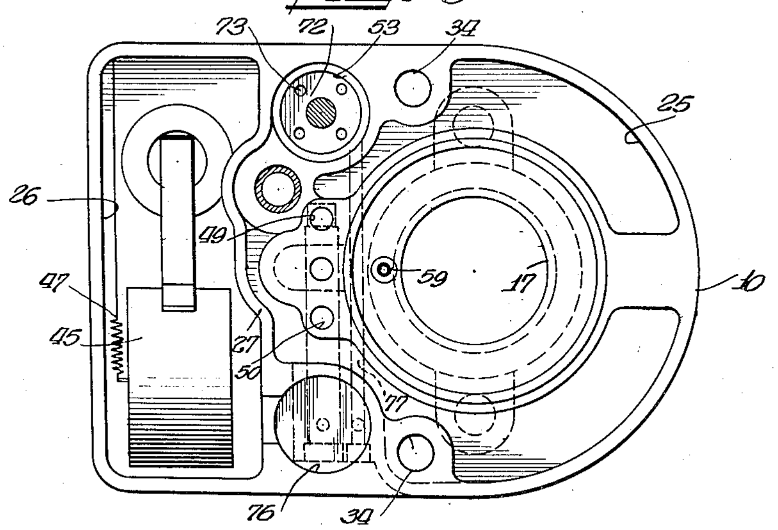


FIG. 9



Inventors:
Howard W. Linkert.
Raymond M. Anderson.
by: Charles Hills Attys.

Patented Feb. 21, 1933 **1,898,672**

UNITED STATES PATENT OFFICE

HOWARD W. LINKERT AND RAYMOND M. ANDERSON, OF INDIANAPOLIS, INDIANA, ASSIGNORS, BY MESNE ASSIGNMENTS, TO MARVEL CARBURETER COMPANY, OF FLINT, MICHIGAN, A CORPORATION OF ILLINOIS

CARBURETOR

Application filed May 26, 1930. Serial No. 455,553.

This invention relates to carburetion systems for internal combustion engines and has special reference to the provision of an improved plain tube carburetor of the down draft type.

In present types of carburetors wherein the fuel level is maintained below the nozzle outlet, so that fuel delivery is dependent upon suction within the carburetor, there are two definite limitations imposed.

With a plain tube carburetor the limitation is caused by the necessity of creating enough suction to lift the fuel to the fuel nozzle under conditions requiring small volumes, there being no air valves to enhance the suction and therefore the capacity of the carburetor at high air velocities is necessarily limited to a design of dimensions which will insure proper supply under such conditions.

In the case of expanding or air valve type carburetors, a definite limitation is imposed by the greater pressure drop at low air velocities so that the obtaining of maximum power at low engine speeds becomes difficult. Desired freedom of air flow through the carburetor at low air velocities can only be achieved at the sacrifice of stability of mixture proportions.

Down draft plain tube carburetors have failed to take care of these situations in those instances where the fuel level has been below the nozzle outlet, since in such cases we have only an inverted standard carburetor. If a head of fuel is imposed on the fuel nozzle the low volume characteristics of a large capacity plain tube carburetor will be greatly improved but with such an arrangement in a carburetor fuel would overflow when the engine is stopped thus causing loading, depletion of the fuel supply, and undue crankcase oil dilution. It is accordingly an object of this invention to provide a carburetor of the class described where fuel is supplied to the nozzle under a slight gravity head supplemented by improved means for preventing undue overflow or flooding after stoppage of the engine. By so rendering the nozzle compensation independent of suction a correct mixture ratio can be maintained at low volumes with a consequent elimination of restrictions on the design of the passages in a plain tube carburetor for maximum delivery at open throttle.

It is also an object of this invention to provide a double Venturi type of plain tube carburetor provided with an overflowing type of non-air bleed or solid fuel delivery nozzle. By using a double venturi the suction at the throat of the larger venturi is multiplied at the throat of the smaller. This increase in suction requires a proportionate decrease in nozzle area so that to maintain the same gravity flow with this reduced nozzle area at small volumes a greater head of fuel on the nozzle is required. Thus by combining this double venturi with a solid fuel or non-air bleed nozzle we are able to obtain superior compensation throughout the range of operation without air bleeding.

It is a further object of this invention to provide a plain tube carburetor in which the nozzle is supplied with fuel from a fuel chamber the level of which is maintained at a definite head above the nozzle. The excess delivery to this chamber overflows into an accelerating pump chamber and thence to a return trap chamber, the accumulation of fuel in said return trap chamber being intermittently returned to the pump for recirculation to the fuel chamber. Thus a constant head of fuel is maintained on the nozzle during operation of the engine, and the capacity of the fuel chamber above the nozzle discharge level can be greatly restricted to reduce the afterflow or drippage from the nozzle when the engine is stopped.

It is a further object of this invention to provide an accelerating pump filled by overflow from the pressure chamber the pump in turn overflowing into a return trap chamber. Thus the rate of refill of the accelerating pump is a function of time and the rate of overflow from the pressure chamber, preventing repeated pumping of full volumes of accelerating charge. If a sufficient time interval exists between operations of the accelerating pump the pump will refill and give a full discharge each time. This arrangement prevents over enrichment of the mixture during operation or flooding when the engine is not operating due to repeated actuation of the accelerator in the case of a throttle operated accelerating pump.

It is also an object of this invention to provide a carburetor of the type described incorporating an improved inertia type of throttle operated accelerating pump wherein the pump delivers to an accumulator and thence to the mixture passage of the carburetor, the accumulator providing an inertia effect supplementing the initial accelerating charge with a dwell period of continued fuel supply for maintaining the rate of acceleration until carburetting conditions become stabilized at the increased volume of flow created by opening the throttle.

It is a further object of this invention to provide in a double Venturi plain tube carburetor an idling by-pass around the throttle and so connected to the inner venturi as to create a flow of air from the throat of the inner venturi about the tip of the fuel nozzle to pick up any fuel dribbling from the nozzle to prevent it from falling onto the nearly closed throttle until a substantial velocity of flow is established through the venturi by the partial opening of the throttle. This arrangement gives quiet and smooth operation at and above the slowest idling speed.

Other and further important objects of this invention will be apparent from the disclosures in the specification and the accompanying drawings.

This invention (in a preferred form) is illustrated in the drawings and hereinafter more fully described.

On the drawings:

Figure 1 is an elevation of a carburetor embodying the features of this invention;

Figure 2 is a plan view thereof;

Figure 2—A is an enlarged sectional view showing the fuel inlet;

Figure 3 is a central longitudinal vertical section on the line III—III of Figure 2 showing the venturi and by-pass structure;

Figure 4 is a section on the line IV—IV of Figure 2 showing the return trap float valve mechanism;

Figure 5 is a section on the line V—V of Figure 2 showing the accelerating pump and fuel metering valves;

Figure 6 is a central section through the air and mixture passage taken on the line VI—VI of Figure 2;

Figure 7 is a diagrammatic layout of the carburetor showing the various fuel chambers and passages in simplified form in one plane;

Figure 8 is a section taken on the line VIII—VIII of Figure 2 showing the throttle linkage operating the accelerating pump and metering valve; and

Figure 9 is a section on the line IX—IX of Figure 3 showing the lower body in elevation.

As shown on the drawings:

The carburetor of this invention, in the specific embodiment chosen for illustrative purposes, comprises a lower body member 10 containing the various fuel chambers and passages, and a cover member 11 therefor inclosing the metering and accelerating pump operating linkages and including an air inlet passage 12 controlled by a butterfly choke valve 13 on a cross shaft 14. The lower body member 10 is provided with a mixture outlet passage 15 aligned with the air inlet and formed with a Venturi section 16 the throat of which is indicated by the numeral 17. A butterfly throttle valve 18 is mounted on a cross shaft 19 in the passage 15 adjacent the usual mounting flange 20.

An inner Venturi member 21 is mounted by means of a bridge 22 resting on the top of the lower body member. This venturi 21 is so positioned that its discharge end is substantially in the plane of the throat 17 of the large venturi 16, the throat 23 of the small venturi being somewhat above the line of the top of the lower body as this throat location determines the position of the fuel discharge nozzle 24.

Referring to Figure 9 for clearness, the lower body 10 contains fuel chamber 25 enveloping the mixture outlet passage around the venturi 17 therein, which chamber 25 is separated from a return trap chamber 26 by a wall 27. The return trap chamber 26 contains a snap-over float valve mechanism best shown in Figure 4.

The carburetor chosen for illustration is intended to operate with a fuel feed from a pump mechanically operated in step with the engine. The pump is chosen with a maximum capacity in excess of maximum continuous demand at maximum volumes. Since the pump is a separate element in practice, it is shown diagrammatically in Figure 7 as comprising a pump cylinder 28 containing a reciprocable piston 29 which draws in fuel past an inlet valve 30 on its up stroke and discharges on its down stroke through a valve 31, passage 32 and tube 33 to an inlet 34 through the cover 11 into the pressure fuel chamber 25. As shown in Figures 2, 2—A and 9 two inlets on opposite sides are provided, one having a compression tubing coupling 35 as part of a chambered stud 35a while the other is a solid cap screw 36 according to the exigencies of the individual installation.

From the chamber 25 excess fuel overflows the wall 27, in a manner to be more particularly described hereinafter, into the chamber 26 which is vented at 26a. The pump inlet 30 is connected by suitable piping 37 to a side connection 38 in a float valve body 39 having a bottom inlet 40 having a pipe

41 leading to the main fuel supply tank, not shown. The body 39 contains a top inlet 42 from the chamber 26, and the top and bottom inlets 42 and 40 respectively are alternately closed by a double acting plug 43 operated by linkage 44 from a float 45, the float being pivoted at 46 and given a snap-over action by a spring 47 so that the plug 43 always closes one or the other of the inlets. It has been found that the spring 47 may be omitted, in which case the valve 43 reaches a point of equilibrium which allows the overflow to run out continuously and not interfere with the supply from the tank.

A sealing gasket 48 is interposed between the body 10 and cover 11 in such a manner as to completely seal over the fuel chamber 25 except for overflow standpipes 49 and 50 through which the stems of the fuel metering pins project. The gasket seal may be reinforced by a centering ring 51.

The overflow standpipes 49 and 50 are of relatively small fuel capacity and extend slightly above the outlet of the fuel nozzle 24 so that the fuel in the chamber 25 is under a static head equal to the elevation of the standpipes above the nozzle inlet and the fuel is supplied therefrom to the nozzle under a positive head, rendering the nozzle supply independent of Venturi suction under idling and small volume operating conditions. Excess fuel supplied to the chamber 25 overflows through the standpipes 49 and 50 into the accelerating and metering pin chamber 52 which is vented at 52ª, in the cover 11 above the sealing gasket 48, and flows over the gasket into the open top of an accelerating pump cylinder 53. When the pump cylinder has filled it in turn overflows through a port 54ª beneath the cover into the return trap chamber 26. The normal fuel supply from the chamber 25 to the nozzle 24 is through a port 54 into a horizontal passage 55 and thence through a vertical passage 56 to a nozzle chamber 57 in one arm of the inner Venturi bridge 22. The nozzle tube proper 57ª is inserted in a horizontal aperture in the bridge arm and is so formed externally as to form an annular chamber 58 opening into the throat 23 of the inner venturi.

The annular chamber 58 forms a communicating chamber for an idling by-pass tube 59 leading past the throttle shaft 19 and having an outlet 60 on the manifold side of the throttle valve 18. When the throttle is nearly closed the high manifold suction created thereby induces a flow of air from the throat of the inner venturi into the annular chamber 58 and through the tube 59 and outlet 60. This air flow adjacent the tip of the nozzle 24 serves to snatch fuel dripping from the nozzle within the carburetor passages and delivers the mixture of fuel and air to the engine side of the throttle whenever the pressure in the channel 58 is less than in the surrounding passages. An important result of this arrangement is to prevent drippage of fuel onto the closed throttle; the atomization of the idling fuel supply producing a marked improvement in smoothness of idling at slow speeds.

The fuel flowing through the port 54 is controlled by a throttle operated metering pin 61 having certain characteristics. The largest diameter 62 is intended to shut off the fuel flow for idling adjustment. The large diameter 62 merges through a conical surface where idling adjustment is obtained into a smaller diameter 63 which increases the available port area for normal operation when the pin 61 is pushed downwardly by an opening movement of the throttle. At wide open throttle the diameter 61 affords the largest opening or power range.

The metering pin is supported by a spring 61ª and the shank 61 thereof extends upwardly through the overflow aperature 49 into engagement with an arm 64 adjustably mounted on the threaded portion 65 of a vertical tube 66 which extends downwardly through a liquid sealing guide 67 and carries a rack 68 on its lower end which rack is engaged by a gear 69 on the throttle shaft 19 as best shown in Figure 8. With this arrangement an opening movement of the throttle pulls down on the tube 66 thus depressing the metering pin to enlarge the effective area of the port 54. In order to adjust the idling position and relative point of transfer of the metering pin the upper end of the tube 66 has a stub shaft 70 pinned therein, which shaft is rotatably engaged in an externally operatable nut 71. Since the rack 68 is cut on a cylindrical surface a rotation of the nut 71 will rotate the tube 66 and rack 68 relative to the arm 64 thus raising or lowering the arm on the threaded portion 65 of the tube, while the stub shaft is freely reciprocable in the nut under operating conditions.

The accelerating pump cylinder 53 has been described as being filled by overflow from the standpipes 49 and 50. A piston 72 is reciprocable in the cylinder and is provided with ports 73 and a loose bottom disc 74 to permit the downward flow of fuel therepast, the disc 74 acting as a check valve to close the ports 73 upon the downward pumping stroke of the piston. The piston 72 is carried by a stem 75 suspended from the arm 64 so that it is pushed downwardly coincident with the like movement of the metering pin 61 due to an opening movement of the throttle.

The pumping or downward stroke of the accelerating pump acts to deliver fuel to an accumulator chamber 76 through a transfer passage 77 shown in dotted lines in Figure 5, as distinct from and back of the fuel passage 55 previously described. A relatively heavy, weighted or spring loaded free piston 78 is reciprocable in the chamber 76 and is lifted by fuel transferred to the chamber by the accelerating pump. The piston 78 carries a valve 79 which closes a delivery outlet 80 when the piston is at the bottom of its chamber. This outlet opens into the passage 55 supplying the nozzle 24 so that the valve 79 is provided to prevent the normal or higher suction ranges acting on the nozzle from drawing an additional supply of fuel from the chamber 76 and thence from the accelerating pump chamber which, as has been previously described, is continuously supplied with an excess of fuel. In the diagrammatic showing of Figure 7 a passage 55^a and a nozzle 24^a are shown as separate from the main passages 55 and 56 and the main nozzle 24, and it is to be understood that such a separate passage and nozzle would be entirely satisfactory in the illustrated embodiment of this invention.

The choke valve 13 previously mentioned is chiefly of use to assist in starting a cold engine and to some extent to maintain satisfactory operation thereof during the warming up period. Since an air choke acts to increase the internal suction in the carburetor, which increase in suction increases the fuel delivery from the discharge nozzle, it is advantageous to increase the idling fuel supply near the extreme end of the closing movement of the choke valve. To this end a collar 81 is applied to the choke shaft 14 which collar carries a pin 82 acting to reciprocate a member 83 on a guide stud 84. The lower end 85 of the member 83 is so formed as to engage the spaced end of the stem 86 of a fuel valve 87 which valve is normally held up against its seat 88 by a spring 89. The valve seat 88 forms a second fuel inlet from the chamber 25 to the passage 55, the stem thereof passing up through the second overflowing standpipe 50 previously described. Suitable alterations in the length of the valve stem 86 governs the delay in opening of the fuel valve upon movement of the choke valve, the time at which the valve 87 opens necessarily varying with different types and designs of engines. The choke valve is externally operable in any convenient manner through means engaging an operating lever 90 applied to one end of the choke shaft 14.

The operation of this carburetor may conveniently be considered as beginning with the normal stages of starting an engine. With the engine and surrounding atmosphere cold it is well known that a very rich priming mixture facilitates the delivery of a combustible mixture to the cylinders. In a down draft carburetor any fuel released at the carburetor eventually finds its way into the engine cylinders, so that an increase in the fuel supply over the normal idling mixture proportions is sufficient to meet the most adverse starting conditions without the aid of a separate priming device. As illustrated and described herein the choke valve 13 controlling the air inlet passage 12 is provided with mechanism including a valve 87 to supplement the flow of fuel to the nozzle 24 during the final portion of the closing movement of the choke valve. This added volume of fuel supplied by the opening of the valve 87 is necessary because the normal area through the port 54 is restricted for idling purposes. With the choke valve 13 in the closed position additional suction will draw a corresponding increase of fuel through 54 but this quantity alone is inadequate for starting a cold engine. After the engine starts, the opening of the choke valve will establish normal idling conditions if the throttle is left nearly closed, in which circumstances there is only a slight air flow velocity through the inner venturi insufficient to properly break up fuel delivered by the nozzle 24. The by-pass structure shown in Figure 3 serves to pick off the fuel dribbling from the nozzle and to mix it with air, the resulting mixture being bypassed to the manifold or engine side of the throttle valve 18.

Under normal and full power operating conditions the opening of the throttle valve shifts the metering pin 61 downwardly, transferring from the idling fuel feed to the economy fuel feed provided by the smaller diameter 63. Under the increased air flow conditions resulting from the throttle opening the suction acting on the outlet of the nozzle is increased to a degree to cause increased fuel flow beyond that provided by gravity flow due to the standpipes. With the double Venturi structure disclosed herein the suction at the throat of the smaller venturi is increased by the suction created at the discharge end of the smaller venturi by the Venturi form of the mixture outlet passage. The suction imposed on the nozzle therefore increases in greater proportion to the increased air flow and the compensation so produced has been found to produce a substantially correct fuel and air mixture from above the idling range to maximum power with a fixed orifice area. It is therefore practical to use a cylindrical surface at 63 on the metering pin although design idiosyncrasies of different types of engines may make a slightly tapered form desirable in individual designs.

The fuel supply to the nozzle is under a static head imposed by the height of the standpipes 49 and 50 above the fuel discharge nozzle, which places the fuel chamber 25 under slight pressure. Any surplus fuel supplied to the chamber 25 by the separate fuel pump overflows from the open tops of the standpipes into the accelerating pump cylinder 53, and when this cylinder has filled it in turn overflows through a by-pass 54ª into the return trap chamber 26 which is vented at the top to maintain atmospheric pressure therein. The level of fuel in the trap chamber fluctuates between maximum and minimum limits due to the provision of the float operated valve which forces the pump to draw from the main fuel tank when the chamber fuel level is below its maximum level. When the level in the chamber reaches its maximum the float moves into its upper position, reversing the valve 43 and causing the pump to draw fuel from the chamber 26 until the level therein falls sufficiently to cause the float to shift into its lower position.

It will thus be seen that we have invented an improved carburetor of the plain tube type wherein correct fuel ratios are provided by a gravity fuel flow regardless of dimensions thus permitting a design of unlimited capacity at small volumes at high speeds and maximum power, these two features being diametrically opposed when used with a fuel nozzle dependent for its metering characteristics upon suction and hence its dimensions for its delivery. A further feature of the carburetor of this invention is that in connection with a non-air bleed nozzle the double venturi has been found correct for a substantially fixed fuel metering orifice for fixed throttle openings. As an example, it has been found possible to increase the maximum capacity 40% over suction-feed air valve carburetors of the same nominal outlet size.

We are aware that many changes may be made and numerous details of construction may be varied through a wide range without departing from the principles of this invention, and we, therefore, do not purpose limiting the patent granted hereon otherwise than necessitated by the prior art.

We claim as follows:

1. A carburetor having an aligned air inlet and mixture outlet, a concentric double Venturi structure formed between said inlet and outlet, a non-air bleed type of fuel nozzle discharging into the throat of the inner of the concentric venturis, and means for supplying fuel to said nozzle under a static pressure head, comprising a fuel chamber having elevated overflow outlets, an accelerating pump receiving the overflow from said chamber, fuel pumping means delivering an excess of fuel to said chamber, and means for returning excess fuel from said accelerating pump to said fuel pumping means.

2. A carburetor having an air inlet and mixture outlet, a concentric double Venturi structure formed between said inlet and outlet, a non-air bleed type of fuel nozzle discharging into the throat of the inner of the venturis, means for restricting the supply of fuel to said nozzle below a predetermined throttle opening, means for supplying fuel to said nozzle under a static head above the nozzle outlet, comprising a pressure fuel chamber having an elevated overflow outlet, fuel pumping means delivering an excess of fuel to said chamber, a return trap chamber receiving the overflow from said chamber, and means in said return trap for returning excess fuel therein to said fuel pumping means.

3. A carburetor having an air inlet and mixture outlet, a concentric double Venturi structure formed between said inlet and outlet, a non-air bleed type of fuel nozzle discharging into the throat of the inner of the venturis, means for restricting the supply of fuel to said nozzle below a predetermined throttle opening, means for supplying fuel to said nozzle under a static head above the nozzle outlet, comprising a fuel chamber having an elevated overflow outlet, fuel pumping means delivering an excess of fuel to said pressure chamber, and means for returning excess fuel from said fuel chamber to said fuel pumping means.

4. In a carburetor a mixture outlet, a Venturi tube formed in said outlet, a second Venturi tube leading into said first mentioned Venturi tube, a common air inlet for both Venturi tubes, a fuel nozzle leading into said second Venturi tube and means for supplying fuel to said nozzle under a hydrostatic head independently of suction at low inlet air velocities, said means including a restricted gravity fuel feed to said nozzle, and means for reducing the restriction on the fuel fed at increased air volumes.

5. In a carburetor a mixture outlet, a Venturi tube formed in said outlet, a second Venturi tube leading into said first mentioned Venturi tube, a common air inlet for both Venturi tubes, a fuel nozzle leading into said second Venturi tube and means for supplying fuel to said nozzle under a hydrostatic head independently of suction at low inlet air volumes, and means for reducing the restriction on the fuel feed at increased air volumes.

6. A carburetor comprising an air inlet and mixture outlet passage having a Venturi-like restriction therein, an inner venturi spaced from the walls of the passage and so positioned in said passage that its discharge end is adjacent the throat of the restricted portion of the passage, whereby the air flow through said inner venturi is accelerated by the air flow in the space surrounding said venturi, a constant level fuel supply chamber, a fuel supply nozzle leading into the inner venturi and fed by said fuel supply chamber, the nozzle outlet being below the fuel level in the supply chamber whereby a hydrostatic pressure head is maintained on the fuel in said nozzle outlet in addition to the suction thereon in the venturi, and means for restricting the fuel supply to said nozzle under conditions of re-

duced volume of air flow through the carburetor passages.

7. A carburetor having an air inlet and mixture outlet and a throttle valve in said outlet, a Venturi-like restriction between said inlet and said outlet, a second venturi leading into and terminating adjacent the throat of said Venturi-like restriction, whereby to increase the suction effect in said second venturi, a fuel nozzle opening into said second venturi and having a source of fuel supply thereto under a fixed hydrostatic head, said nozzle being subjected to both hydrostatic pressure and suction within the venturi, and means for controlling the fuel flow from said nozzle independently of suction thereon at low air flow velocities through said venturi, said control means being inoperative at higher air flow velocities.

8. A carburetor having an air inlet and mixture outlet and a throttle valve in said outlet, a Venturi-like restriction between said inlet and said outlet, a second venturi leading into and terminating adjacent the throat of said Venturi-like restriction, whereby to increase the suction effect in said second venturi, a fuel nozzle opening into said second venturi and having a source of fuel supply thereto under a fixed hydrostatic head, said nozzle being subjected to both hydrostatic pressure and suction within the venturi, means for variably restricting the flow of fuel to said nozzle, and throttle operated means for controlling said last-mentioned means under idling conditions said flow restricting means being inoperative at larger throttle openings above idling.

In testimony whereof, we have hereunto subscribed our names at Indianapolis, Marion County, Indiana.

HOWARD W. LINKERT.
RAYMOND M. ANDERSON.