Dec. 3, 1940. D. FIRTH 2,223,987

CARBURETOR

Filed May 17, 1934 3 Sheets-Sheet 1

Fig. 1.

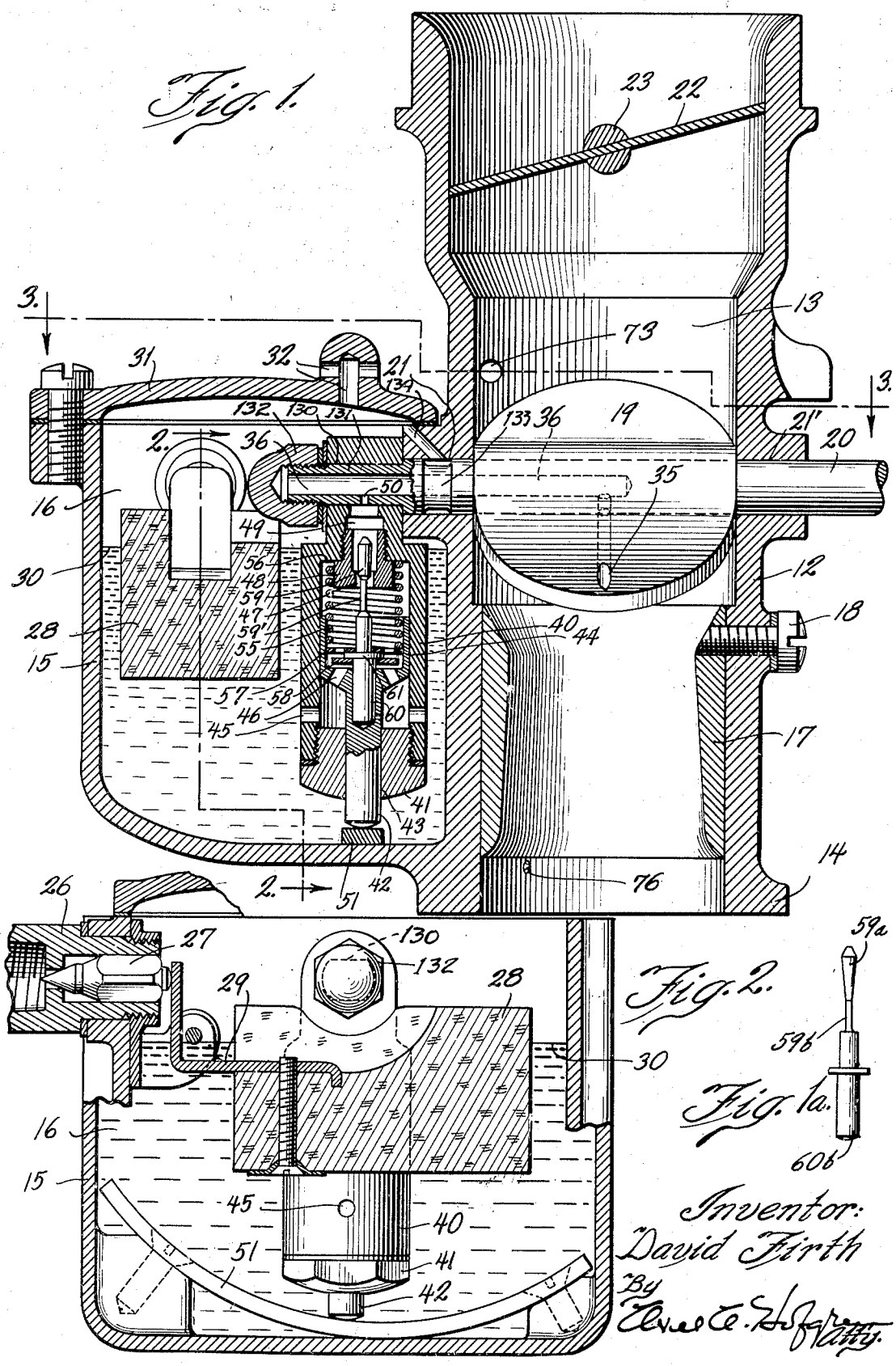


Fig. 2.

Fig. 1a.

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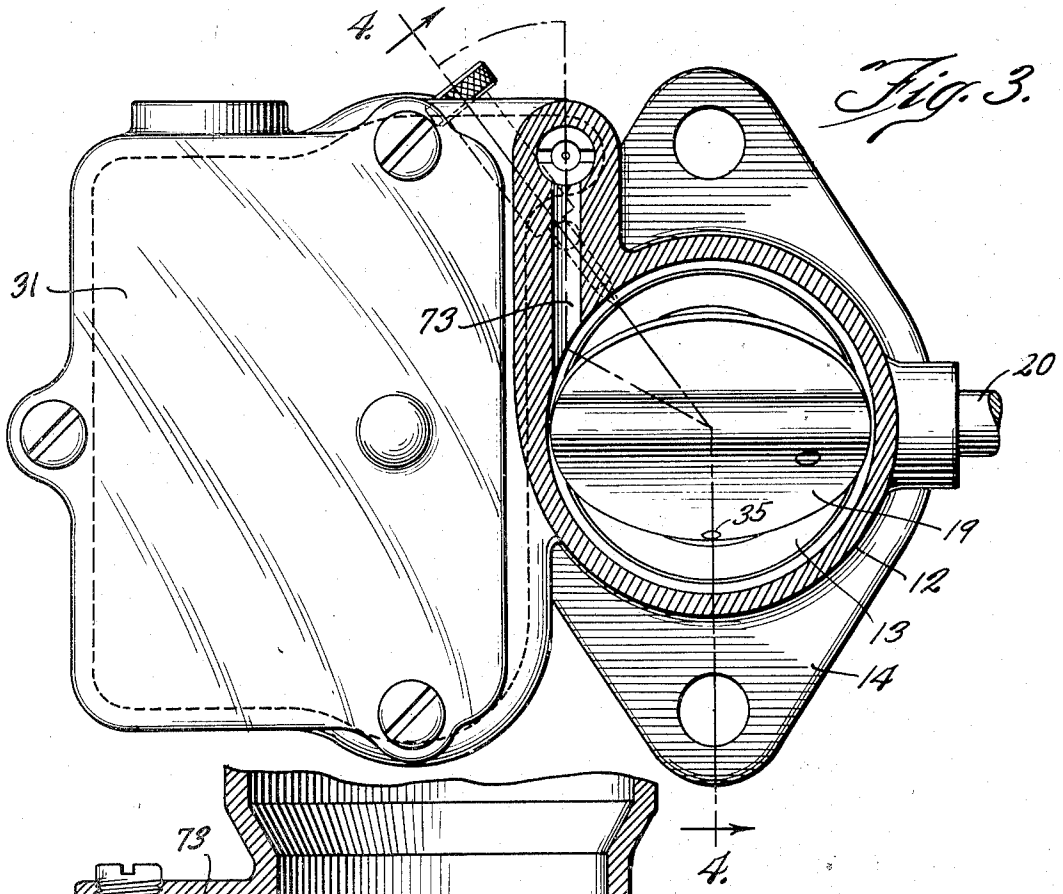


Fig. 3.

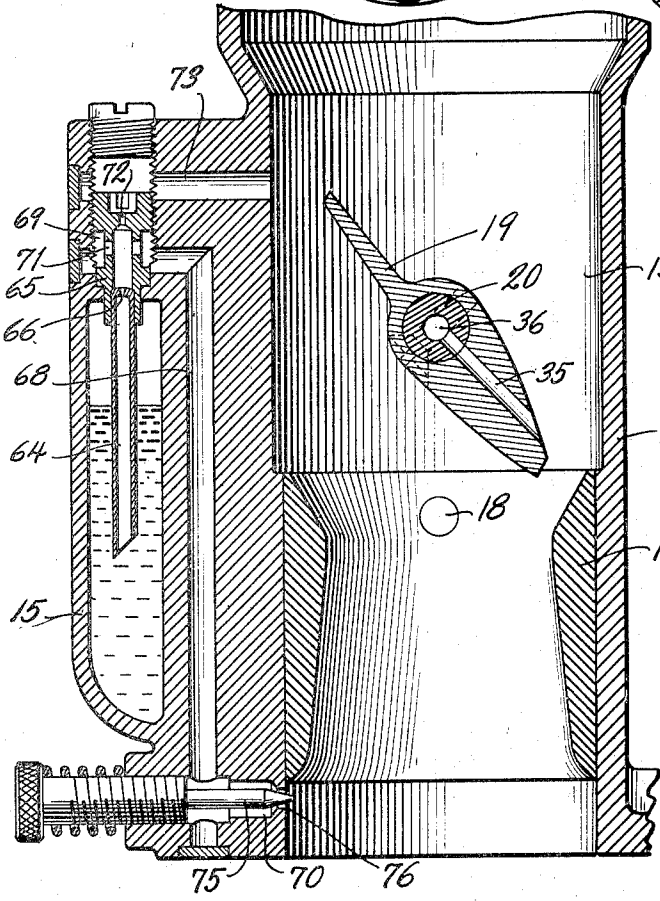


Fig. 4.

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Fig. 5.

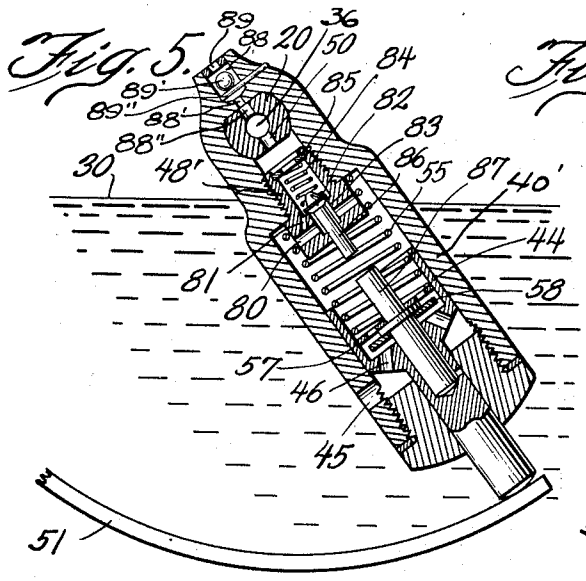


Fig. 6.

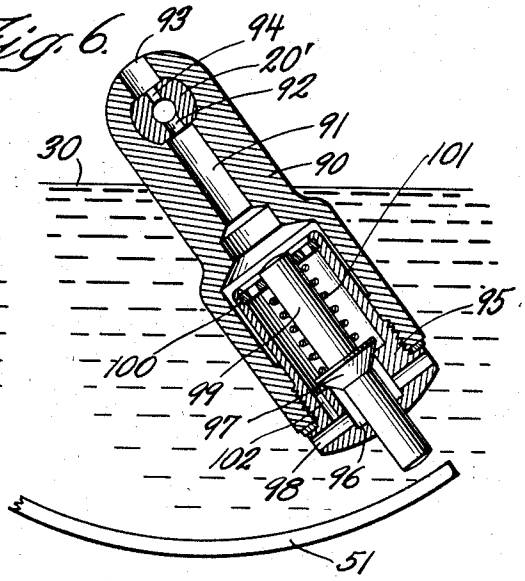


Fig. 7.

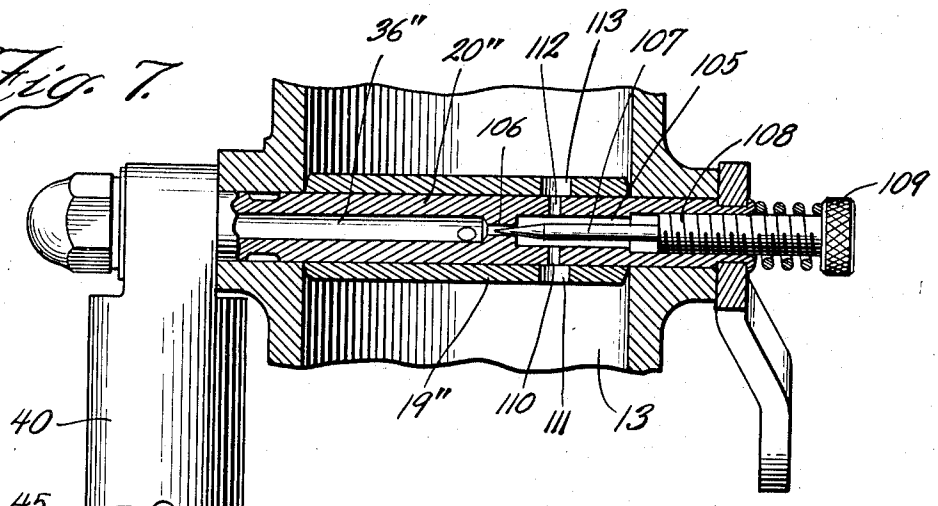
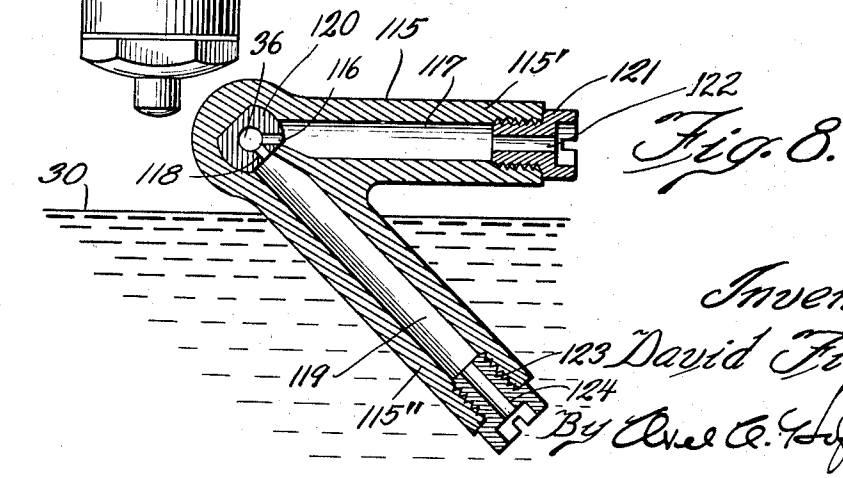


Fig. 8.



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Patented Dec. 3, 1940 2,223,987

UNITED STATES PATENT OFFICE

2,223,987

CARBURETOR

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Application May 17, 1934, Serial No. 726,059

11 Claims. (Cl. 261—34)

The invention relates generally to carburetors for internal combustion engines, and more particularly to a downdraft carburetor.

Carburetors generally may be divided into two general classes so far as the position of the throttle relatively to the fuel discharge nozzle and intake manifold is concerned, i. e., a posterior throttle carburetor wherein the throttle is positioned behind the nozzle (between the nozzle and intake manifold), so that the nozzle is on the low suction side of the throttle, and an anterior throttle carburetor wherein the throttle is in front of the nozzle (the nozzle is positioned intermediate the throttle and intake manifold), so that the nozzle or fuel discharge device is on the high suction side of the throttle. Each of the two types of carburetors has certain advantages, and each has certain disadvantages. For example, the posterior throttle carburetor is advantageous inasmuch as the metering of the fuel is accomplished on the low suction side of the throttle, thereby making it fairly easy to calibrate the fuel discharge means for part throttle mixtures. A disadvantage of the posterior throttle carburetor, however, is due to the fact that the throttle, being positioned between the fuel discharge device and the intake manifold, interferes with the flow of fuel particularly for wide-open or full-power throttle position, thus causing poor distribution of the fuel mixture to the cylinders. For this reason the anterior throttle carburetor is more advantageous so far as wide-open or full-power throttle position is concerned, since the throttle does not interfere with the flow of fuel mixture. However, because of the location of the fuel discharge device in the high suction zone of an anterior throttle carburetor, minute changes in the orifices or jets of the fuel discharge devices causes considerable change in the mixture ratio.

It is an object of the present invention to provide a new and improved carburetor embodying certain advantages of both the posterior and the anterior throttle type carburetor, and at the same time eliminate disadvantageous features of each which were heretofore pointed out.

Another object is to provide a new and improved downdraft carburetor embodying a fuel discharge means movably mounted in the air passage and arranged so that as the throttle is opened the fuel discharge orifice is lowered towards or below the normal fuel level, thus varying the fuel head and, if desired, providing a syphoning action.

Another object is to provide a new and improved downdraft carburetor having a pivoted throttle valve in the main passage and a fuel supply means including a fuel discharge port in the throttle terminating in an orifice on the upper side of the throttle adjacent the periphery thereof, so that as the throttle is moved from its idling to its open position the orifice moves downwardly with the incoming air so as to give a quick response to the demand for additional fuel.

Another object is to provide a downdraft carburetor embodying a movably mounted throttle having a main fuel discharge port therein terminating in an orifice adjacent the edge of the throttle, and means forming a fuel supply passage including a duct through the throttle shaft, and a hollow member secured to and swingable with the shaft and extending into the fuel in the float chamber.

Another object is to provide a new and improved downdraft carburetor consisting of a relatively small number of parts which may be manufactured economically.

Another object is to provide a carburetor embodying an accelerating pump device positioned in the float chamber and having its fuel intake continuously submerged in the fuel.

Further objects will become readily apparent from the following detailed description taken in connection with the accompanying drawings, wherein:

Figure 1 is a vertical central section through a preferred form of the invention showing the throttle in a partly open position.

Fig. 1a is a detail view of a modified form of fuel metering pin.

Fig. 2 is a fragmentary section, approximately along the line 2—2 of Fig. 1.

Fig. 3 is a plan view, partly in section, along the line 3—3 of Fig. 1.

Fig. 4 is a section approximately along the line 4—4 of Fig. 3.

Fig. 5 is a section through a modified form of accelerating pump construction.

Fig. 6 is a similar section through a modified form of the invention wherein the accelerating pump has been omitted.

Fig. 7 is a fragmentary section through a modified form of throttle shaft.

Fig. 8 is a fragmentary section through a modified form of fuel feeding device.

While the invention is susceptible of embodiment in many different forms, there is shown in the drawings and shall herein be described in detail, a preferred embodiment, together with

various modifications thereof, with the understanding that the present disclosure is to be considered as an exemplification of the principles of the invention and is not intended to limit the invention to the embodiment illustrated. The scope of the invention will be pointed out in the appended claims.

Referring to the drawings, and more particularly to Figs. 1 to 4, a downdraft carburetor is illustrated comprising a body casting or member 12 having a main passage 13 therethrough, a flange 14 at the lower end adapted for connection to an intake manifold, and a fuel reservoir or float bowl 15 providing a fuel chamber 16. A tubular Venturi member 17 is secured in the lower portion of the passage 13 by means of a screw device 18. A disk-like throttle 19 is movably supported in the passage 13 on a throttle shaft 20 which is rotatably mounted in suitable bearings 21, 21' formed in the body member on the opposite sides of the passage 13. A choke valve 22 is carried on a shaft 23 extending across the upper or intake end of the body member, and may be operated in any preferred or well known manner, for starting purposes.

Fuel is adapted to be supplied to the float bowl 15 by means of a suitable conduit (not shown) which may be connected to a bushing 26 secured to the wall of the float bowl as illustrated most clearly in Fig. 2. The usual valve 27 is operated by means of a float 28 secured to a pivotally mounted lever 29 so as to maintain the fuel in the chamber 16 at approximately the level indicated by the line 30. Preferably the float bowl is provided with a detachable cover 31 having an air vent 32.

In the preferred form of the invention, the fuel discharge means comprises a fuel duct or port 35 formed in the throttle 19, the port 35 communicating at its inner end with an axially extending passage 36 in the throttle shaft 20. The passage in the throttle shaft extends into a portion of the shaft which projects into the upper end of the fuel chamber 16 as shown in Fig. 1. Various means may be provided for supplying fuel from the lower portion of the fuel chamber to the port 35, although preferably such means assumes the form of a fuel feeding member 40 secured to the throttle shaft 20 so as to swing therewith, the member 40 having a passage therethrough connecting at one end with the passage 36 and at the other end with the surface of said member below the fuel level in the chamber 16 as hereinafter more fully described, to form an inlet.

In the form illustrated in Figs. 1 to 4, a tubular fuel feeding member 40 is secured at one end to the shaft 20 and extends radially therefrom down into the fuel in the bowl 15. The lower end of the member 40 is closed by means of an apertured plug 41, a pin or rod 42, slidably mounted in the aperture 43 of the plug 41 carrying a piston 44 which is slidable in the cylinder formed by the member 40. An inlet fuel passage includes a plurality of ports 45 in the member 40, ports 46 through the piston 44, a metering port 47 in a bushing 48 at the upper end of the cylinder, an opening 49 in the upper end of the member 40, and a port 50 in the shaft 20. The piston 44 cooperates with the cylinder formed by the member 40 to form an accelerating pump, the piston being moved upwardly during opening movements of the throttle 19 by means of an arcuate cam member 51 mounted in the lower portion of the fuel bowl. The piston rod 42 rides on the cam member 51 so that during swinging movement of the throttle 19 in its shaft 20 (in a clockwise direction as shown in Fig. 2) the piston is moved upwardly or toward the axis of the shaft 20. In the idle position of the throttle valve 19 the piston is withdrawn to the lower portion of the member 40. A coiled spring 55 positioned between a shoulder 56 within the member 40 and an apertured washer 57 in the piston 44 serve to move the piston downwardly and maintain the rod 42 in contact with the cam 51.

In order to prevent return flow of fuel from the accelerating pump cylinder, a disk-type check valve 58 is positioned in the lower portion of the hollow piston 44 so as to be adapted to close the ports 46 during upward movement of the piston. This check valve is of sufficiently light weight so as to be normally raised by incoming fuel and held in the position shown in Fig. 1. Preferably a metering pin 59 is also carried by the piston 44, the metering pin having a stem 60 secured to the piston and being provided with a reduced portion 59'. As illustrated in Fig. 1, the stem 60 forms a guide for the check valve 58 and a flange 61 on the stem serves to locate the apertured washer 57. It will be readily apparent that when the throttle 19 is moved to its wide-open or full-power position the reduced portion 59' of the metering pin will be positioned in the port 47 so as to enlarge the area of the port and pass increased quantities of fuel. The metering pin may assume various forms depending upon the characteristics desired. Thus, for example, instead of the two-diameter form of pin illustrated in Fig. 1, a tapered form such as illustrated in Fig. 1^a may be used. In this form the upper end 59^a is tapered inwardly and downwardly so as to merge with the reduced portion 59^b, a stem 60^b being provided for securing the pin to the accelerating pump piston.

As illustrated in Figs. 1 to 4, a separate fuel feeding means is provided for supplying fuel for idling purposes. This means comprises an idle tube 64 extending down into the fuel bowl 15 and below the normal fuel level therein, the upper end of the idle tube being secured to a bushing 65 and provided with a metering orifice 66. A passage 68 in the body member 12 communicates at its upper end (Fig. 4) with an annular chamber 69 surrounding the bushing 65, and at its lower end with a horizontal passage 70 communicating with the main carburetor passage 13. The bushing 65 has a plurality of radially extending ports 71 through which fuel passes to the passage 68, and preferably has a port 72 in its upper end through which air may be bled from a horizontally extending passage 73, the inner end of which communicates with the passage 13. In order to adjust the amount of fuel and air mixture supplied through the passage 68, a needle valve 75 is adjustably mounted in the lower portion of the body member 12 and is adapted to control a discharge orifice 76 for the passage 70.

In the form of fuel feeding means illustrated in Fig. 5, an orifice 50 in the throttle valve shaft 20 is preferably a metering orifice, and fuel is normally fed to said orifice through ports 45 and 46, the apertured washer 57, a transverse, diametrically extending port 80 in a bushing 48', and a metering orifice 81 in said bushing. A valve 82 normally closes an auxiliary supply port 83 in the bushing 48' and is held in its closed position by means of a coiled spring 84 positioned between the valve 82 and an apertured washer 85. The valve 82 is provided with a downwardly extending stem 86. In this form of the invention, as the accelerating piston 44 is moved upwardly a pin 87

extending therefrom engages the valve stem 86 to unseat the valve in the wide-open or full power position of the throttle valve. When the valve 82 is open, the fuel is metered by the orifice 50. This form of the invention also provides an air bleed so as to feed an emulsion to the port 35. A passage 88 in the member 40 has a reduced portion 88' communicating with a port 88'' in the shaft 20, the port 88'' connecting with the passage 36. The outer end of the passage 88 is partly closed by a washer having an opening 89, and a ball check valve 89' positioned between said washer and a pin 89'' functions to prevent fuel from flowing out through the air bleed passage when the accelerating pump operates. Thus during normal operation the check valve 89' is unseated as shown, and air is admitted through the opening 89, passage 88 and port 88''.

As illustrated in Fig. 6 the accelerating pump is omitted. A fuel feeding member 90 is substituted, said member having a passage 91 communicating at its upper end with a radially extending port 92 in the throttle shaft 20', and also having an air bleed passage 93 communicating with a radial port 94 in the shaft 20'. In this form of the invention a plug 95 screw threaded into the lower end of the member 90 has an axial bore 96 normally closed by means of a conical valve 97, radially extending ports 98 supplying fuel to the bore 96. The valve 97 is carried on a stem 99 slidably mounted in the plug 95 and an apertured washer 100, and is normally urged downwardly by means of a coiled spring 101. In this form of the invention fuel is fed through a port 102 in the plug 95 until the throttle valve has been swung sufficiently to engage the lower end of the stem 99 and the cam 51, after which further opening movements of the throttle valve unseat the valve 97 and supply added quantities of fuel through the bore 96.

In Fig. 7 there is illustrated a modified form of idling mechanism. In this form of the invention a chamber 105 is formed in the right-hand end of the throttle shaft 20'' and is connected to the main fuel supply passage 36'' by means of an axial port 106. A needle valve 107 is adjustably mounted in the shaft 20'' by means of a threaded stem 108 and may be operated by means of a thumb nut 109. With the throttle in substantially horizontal closed position for idling, the port 35 is on the upper, low suction side of the throttle and thus ineffective to feed fuel. However, in that position of the throttle fuel is drawn into the chamber 105 through the port 106 and discharged into the main carburetor passage 13 through radially extending ports 110 and 111 in the shaft 20'' and throttle 19'', respectively, on the lower, high suction side of the throttle. Preferably connecting air bleed ports 112 and 113 are provided in the intake side of the throttle shaft and throttle, respectively, the port 112 being suitably calibrated.

For certain installations, a fuel feeding member 115 of the type illustrated in Fig. 8 may be employed. In this form the member has two branches 115' and 115'', the branch 115' extending somewhat horizontally from the throttle shaft 120 so as to be above the fuel level 30 in the idle position of the throttle, the branch 115'' extending in an inclined position downwardly into the fuel. The throttle shaft is provided with a horizontally extending radial port 116 alined with a passage 117 in the branch 115', and also has a port 118 alined with a passage 119 in the branch 115''. A bushing 121 is secured to the outer end of the branch 115' and is provided with a calibrated opening 122, and a bushing 123 secured to the outer end of the branch 115'' and is provided with a calibrated opening 124. In this form of the invention, fuel is normally fed through the calibrated opening 124, passage 119 and port 118 to the throttle shaft passage 36, air being bled into the same passage 36 through the calibrated opening 122, passage 117 and port 116. As the throttle is opened, the fuel feeding member 115 is rotated in a clockwise direction (Fig. 8), the calibrated opening 122 being immersed in the fuel at a predetermined point so as to form an auxiliary fuel feed which adds to the primary fuel feed through the calibrated opening 24 and provides the necessary additional fuel for the more open and full power positions of the throttle.

In the various forms illustrated herein the fuel feeding member 40 is provided with an irregular opening 130 through which the reduced and flattened end 131 of the throttle shaft extends. A cap nut 132 is threaded onto the end of the shaft 20 so as to clamp the fuel feeding member against a shoulder on the shaft formed by the reduced portion 131. Thus rotary movement of the fuel feeding member with the shaft is insured. Preferably, as illustrated in Fig. 1, a groove 133 is formed in the shaft intermediate the ends of the bearing 21 and a vent 134 is provided in the body member so as to prevent any syphoning of fuel through the bearing should leakage occur.

It is believed readily apparent that the invention provides an extremely simple carburetor having a relatively small number of parts. By providing a fuel discharge orifice which moves downwardly in the body passage as the throttle is opened, the fuel head on the orifice may be varied, and if desired the orifice may be moved from a position above the normal fuel level in the fuel chamber to a position below the normal fuel level. By locating the discharge orifice in the throttle a simple construction is obtained, and as the throttle is opened the fuel discharge orifice moves downwardly with the incoming air so as to provide a prompt response to the demand for fuel. By securing the fuel feeding member to the throttle shaft so that it swings therewith, there are no movable joints in the entire fuel supply passage where detrimental leakage could occur. Furthermore the fuel supply passage is effectively protected from the heat of the engine, the portion in the throttle shaft and throttle being cooled by the incoming air, and the portion within the fuel chamber by the fuel.

As illustrated in the drawings, the accelerating pump actuating cam 51 is shown with an arcuate form positioned eccentrically of the axis of the throttle shaft, but it will be readily evident that the form of the member 51 may be selected so as to provide for any desired movements of accelerating pump piston and metering pin.

If desired, the venturi 17 may be omitted and the carburetor will operate satisfactorily. This is due to the fact that with the movably mounted nozzle the device has, in effect, an overflow nozzle in the wide-open position of the throttle.

I claim as my invention:

1. A carburetor having, in combination, a body member forming a main fuel and air passage and a fuel supply chamber adjacent said passage, a throttle, a shaft rotatably mounted in

said body member carrying said throttle and having one end thereof extending into said fuel chamber, means for supplying fuel to said main passage comprising a passageway in said shaft, and a tubular member forming an accelerating pump cylinder carried on said shaft in said fuel chamber and extending downwardly into the fuel, a piston in said cylinder, means in said fuel chamber effective to actuate said piston during swinging movement of said cylinder with said shaft, means including a check-valve-controlled passage for supplying fuel to said cylinder, and means comprising a check-valve-controlled passage for normally bleeding air to the passageway in said shaft, and a check valve in said air bleed passage to prevent discharge of fuel therethrough by the accelerating pump.

2. A carburetor having, in combination, a body member forming a main fuel and air pasage and a fuel supply chamber adjacent said passage, a throttle, a shaft rotatably mounted in said body member carrying said throttle and having one end thereof extending into said fuel chamber, means for supplying fuel to said main passage comprising a passageway in said shaft, and a tubular member forming an accelerating pump cylinder carried on said shaft in said fuel chamber adapted to swing therewith and extending downwardly into the fuel, a piston in said cylinder, means in said fuel chamber effective to actuate said piston during swinging movement of said cylinder with said shaft, means including a check valve controlled passage for supplying fuel to said cylinder, means providing a metering orifice intermediate the cylinder and shaft passageway for limiting the flow of fuel to said passageway, means forming a supplemental outlet from said cylinder to said passageway, a valve normally closing said supplemental outlet, and means on said piston for opening said valve when the throttle reaches a predetermined point in its opening movement.

3. A carburetor having, in combination, a body member forming a main fuel and air passage and a fuel supply chamber adjacent said passage, a throttle, a shaft rotatably mounted in said body member carrying said throttle and having one end thereof extending into said fuel chamber, means for supplying fuel to said main passage comprising a passageway in said shaft, and a tubular member forming an accelerating pump cylinder carried on said shaft in said fuel chamber adapted to swing therewith and extending downwardly into the fuel, a piston in said cylinder, means in said fuel chamber effective to actuate said piston during swinging movement of said cylinder with said shaft, and means including a check valve controlled passage for supplying fuel to said cylinder.

4. A carburetor having, in combination, a body member forming a main fuel and air passage and a fuel supply chamber adjacent said passage, a throttle, a part rotatably mounted in said body member carrying said throttle and having one end thereof extending into said fuel chamber, means for supplying fuel to said main passage comprising a passageway in said part, and a member forming an accelerating pump cylinder carried on said part in said fuel chamber adapted to swing therewith and extending downwardly into the fuel, a piston in said cylinder, means in said fuel chamber effective to actuate said piston during swinging movement of said cylinder with said part, means including a check valve controlled passage through said piston for supplying fuel to said cylinder, means providing a metering orifice intermediate the cylinder and said passageway for limiting the flow of fuel to said passageway, and a metering pin carried on said piston for controlling said orifice.

5. A carburetor having, in combination, a body member forming a main passage for fuel and air and a chamber adjacent said passage for liquid fuel, a throttle in said passage, a part movably supporting said throttle and having a portion extending into said chamber, and means for feeding liquid fuel to said passage comprising a fuel feeding member secured to said part within the fuel chamber and extending downwardly into the fuel and a second member extending radially from said part and having a passage therethrough terminating in an inlet at the outer end thereof, said inlet being above the normal fuel level in said chamber to form an air bleed when the throttle is in its low speed position and being swung down into the fuel as the throttle is moved toward its high-speed position to form a supplemental fuel feeding member.

6. A carburetor comprising, in combination, a body member having a main passage therethrough, a throttle pivotally mounted in said passage and having a main fuel discharge passage therein terminating in an orifice in the anterior face of the throttle adjacent the periphery thereof, said orifice being exposed to low suction only when said throttle is in closed position for idling; means for supplying fuel to said fuel discharge passage, means for supplying a mixture of fuel and air to said main passage posterior to said throttle for idling purposes comprising a fuel discharge port communicating with said main passage posterior to said throttle and an air bleed passage communicating with said discharge port and with said main passage anterior to said throttle, and a venturi in said main passage intermediate said throttle and said fuel discharge port.

7. A carburetor comprising, in combination, a body member having a main passage therethrough and a fuel chamber, a throttle in said passage having a fuel passage therein terminating in a discharge orifice, a shaft for said throttle having one end projecting into said fuel chamber, a tubular member secured to the end of the throttle shaft within the fuel chamber to swing with the throttle, a plunger within said tubular member mounted for reciprocable motion, and cam means engaging said plunger to reciprocate the same upon swinging movement of said throttle.

8. A carburetor comprising, in combination, a body member having a main passage therethrough and a fuel chamber, a throttle in said passage having a fuel passage therein terminating in a discharge orifice, a throttle shaft having one end projecting into said fuel chamber and having a passage therein communicating with the passage in the throttle, a tubular member disposed within the fuel chamber communicating with the fuel chamber and the passage in said throttle shaft, a plunger mounted for reciprocable movement within said tubular member, and a cam member engaged by said plunger, one of said members being rigid with the end of the throttle shaft to swing with said throttle, and the other of said members being fixed so as to actuate said plunger by relative movement of the members.

9. A carburetor comprising, in combination, a body member having a main passage therethrough and a fuel chamber, a throttle in said passage having a fuel passage therein terminating in a discharge orifice, a throttle shaft having one end projecting into said fuel chamber and having a passage in that end communicating with the passage in the throttle, a tubular member rigid with the end of the throttle shaft projecting into the fuel chamber providing communication between the fuel chamber and the passage in said shaft, a plunger mounted in said tubular member for reciprocable movement, an arcuate cam fixed in said fuel chamber and engaged by said plunger to reciprocate the same upon movement of said throttle, and means carried by said plunger varying the character of the passage through said tubular member upon opening movement of the throttle.

10. A carburetor comprising, in combination, a body member having a main passage therethrough, a fuel chamber, a throttle in said passage having a fuel passage therein terminating in a discharge orifice, and means for supplying fuel to the passage in said throttle including an accelerating pump disposed in said fuel chamber and comprising a piston and cylinder device mounted to swing with said throttle, and means to actuate said pump to supply fuel at a rate proportional to the rate at which said throttle is opened.

11. A carburetor comprising, in combination, a body member having a main passage therethrough and a fuel chamber, a throttle in said main passage having a fuel passage therein terminating in a discharge orifice, and means for supplying fuel to the passage in said throttle including a piston and cylinder means forming an accelerating pump disposed in said fuel chamber and mounted to swing with said throttle, and means for actuating said pump to discharge fuel when the throttle is swung toward open position.

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