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Chicago, Ill.
 Continuation of application Ser. No.
 636,966, May 8, 1967, now abandoned.

[54] **DIAPHRAGM CARBURETOR HAVING FUEL CHANNEL SYSTEM FOR ENGINE IDLING AND ACCELERATION**
 4 Claims, 11 Drawing Figs.

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 [51] Int. Cl. F02m 3/02,
 F02m 17/04, F02m 7/06
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 69.1, 41.4, 41, DIG. 68; 123/73

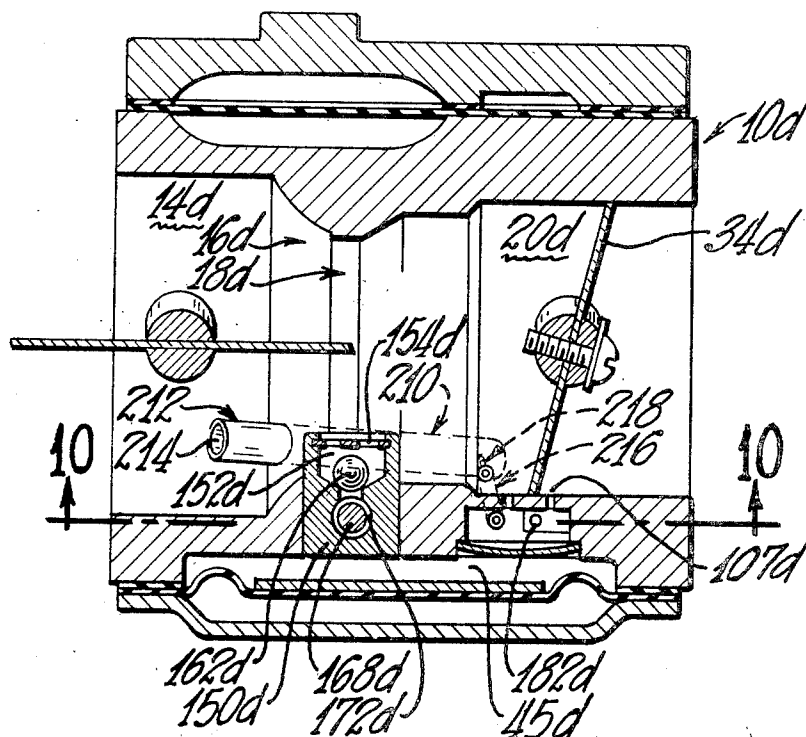
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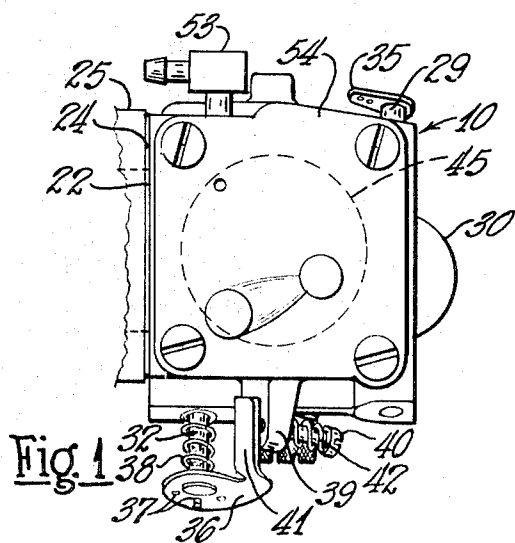
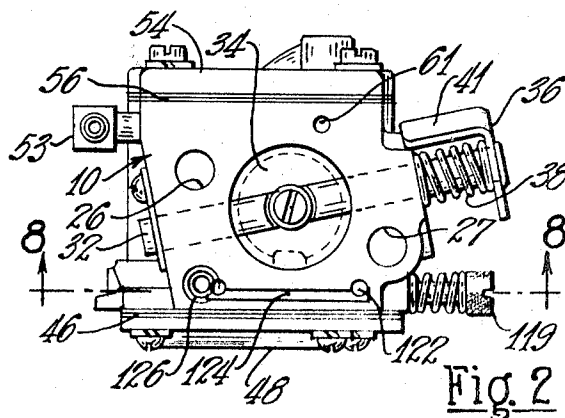
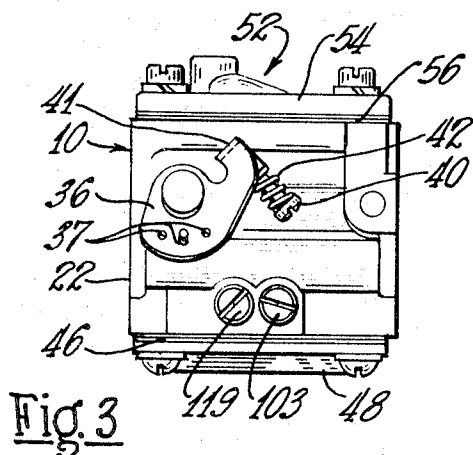
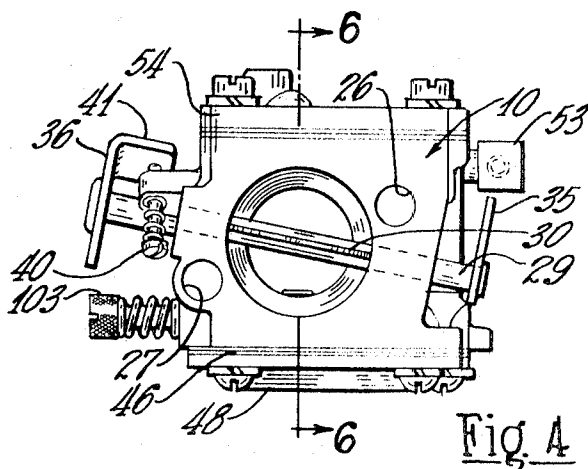
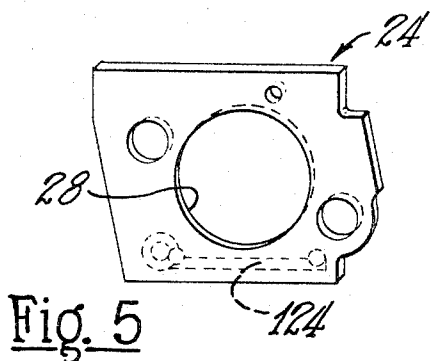
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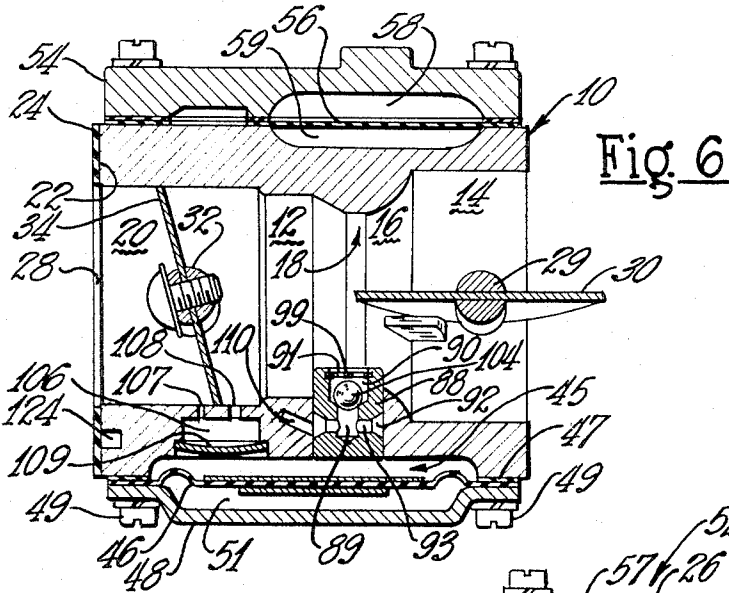
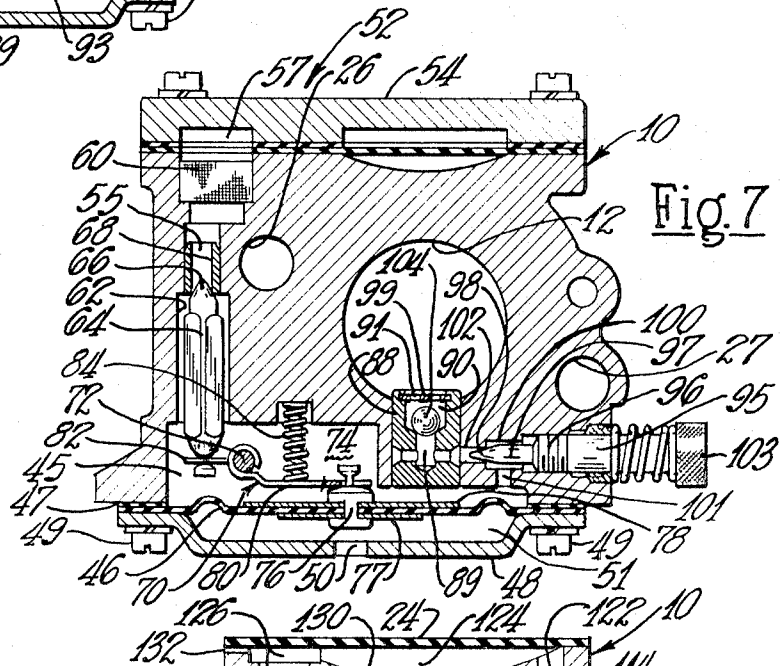
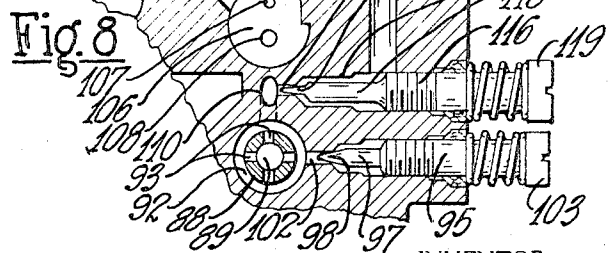
ABSTRACT: An aspirated type of diaphragm carburetor embodying a channel system accommodating fuel for delivery into the mixing passage for engine-idling purposes and for en-

gine acceleration wherein upon closing of the throttle valve to engine-idling position, delivery of fuel for engine-idling purposes is delayed whereby the engine operates for a short period of time on residual fuel in the crankcase before the idling system delivers fuel for engine idling, and upon opening of the throttle valve, the fuel in the idling channel system is delivered into the mixing passage through a main orifice for accelerating engine operation. The carburetor includes an unvented fuel chamber with a flexible diaphragm forming a wall of the fuel chamber. The chamber includes a valved fuel inlet with a lever transmitting movement of the diaphragm to the inlet valve. A fuel passage is disposed between the fuel chamber and the region of the main orifice. A fitting is disposed in an opening of the carburetor adjacent the mixing passage. A transverse passage is positioned in the fitting and a restricted passage between the transverse passage and the fuel chamber. An adjustable valve member having a portion projecting through the passage in the fitting and a needle valve portion cooperates with the restricted passage to regulate fuel flow from the chamber into the fitting and main orifice. A counter bore in the fitting has communication with the transverse passage. The counter bore opens into the mixing passage and provides the main fuel delivery orifice. A fuel channel conveys fuel from the transverse passage to an engine-idling orifice. A vent admits air directly into the fuel channel for delaying delivery of fuel from the fuel channel through the engine-idling orifice upon movement of the throttle valve to engine-idling position. The vent is effective upon opening movement of the throttle valve to promote rapid delivery of fuel from the fuel channel through the main orifice for engine acceleration. A supplemental chamber is located in the carburetor adjacent the idling orifice. The fuel channel includes a bore and an elongated channel is disposed normal to the bore. The elongated channel comprises a recess in an exterior surface region of the carburetor. A gasket covers the recess forming a wall of the elongated channel. One end region of the elongated channel opens into the bore. An angularly arranged channel connects the elongated channel and the supplemental chamber. The air vent admits air to the angularly arranged channel to delay delivery of fuel through the idling orifice upon movement of the throttle valve to engine-idling position.





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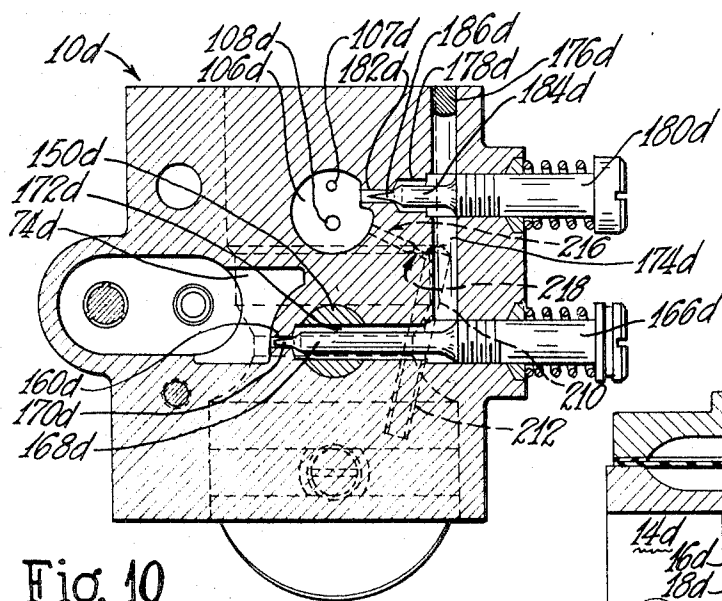


Fig. 10

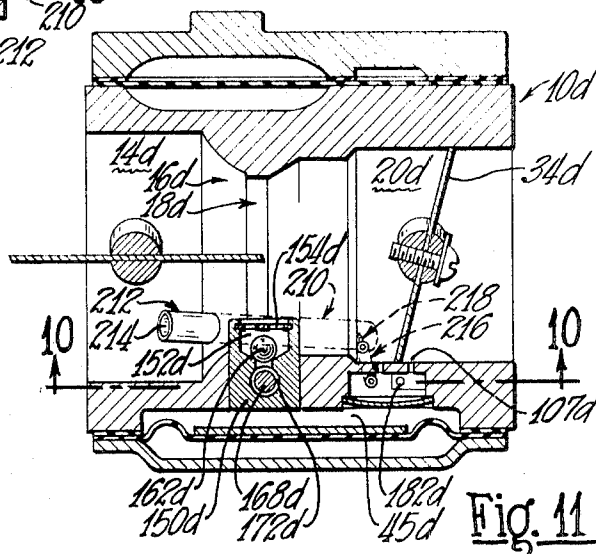


Fig. 11

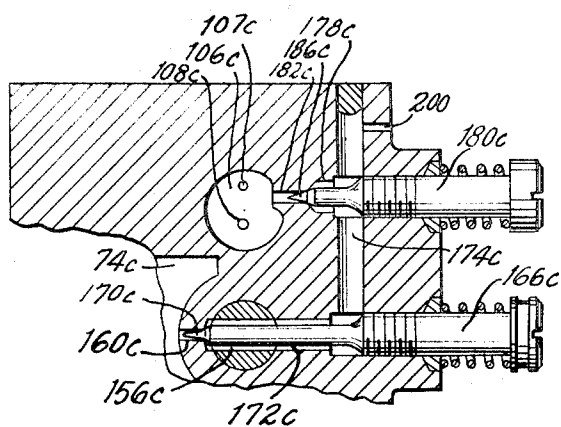


Fig. 9

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DIAPHRAGM CARBURETOR HAVING FUEL CHANNEL SYSTEM FOR ENGINE IDLING AND ACCELERATION

This application is a continuation of Ser. No. 636,966, filed May 8, 1967 and now abandoned.

Diaphragm carburetors of the aspirated type of a character for supplying combustible fuel and air mixture for a two-cycle engine wherein the mixture is delivered into the crankcase of an engine have come into extensive use for powering lawn mowers, outboard marine engines and the like and have embodied channel systems for conveying fluid from a fuel chamber in the carburetor to an engine-idling fuel delivery orifice wherein the fuel moves through a small channel a comparatively short distance from the fuel chamber to the engine-idling delivery orifice.

One of the characteristics of a two-cycle engine wherein fuel and air mixture is delivered into the engine crankcase for subsequent transfer into the engine cylinder is that some wet fuel tends to accumulate on the crankcase walls during normal engine operation. Upon closing the throttle valve to engine-idling position, reduced pressure in the crankcase is greatly increased by obstructing airflow through the mixing passage by the throttle valve and this increased suction or reduced pressure tends to volatilize the residual wet fuel in the crankcase, which, with the restricted amount of air in the engine crankcase, provides a combustible idling mixture sufficient to operate or run the engine for a short period of time. In the conventional type of aspirated diaphragm carburetor, upon closing the throttle valve, the engine suction or reduced pressure increases and fuel for engine idling is instantly delivered into the mixing passage of the carburetor to an extent under certain conditions as to provide sufficient excess fuel in the engine crankcase to cause the engine to stall by reason of an overrich mixture. This condition varies with different types and sizes of engines, but under most engine-idling operating conditions there is a tendency toward over enrichment of engine-idling mixture which, while it may not be a serious impairment to engine-idling operation with an engine having a comparatively "dry" crankcase as to cause stalling, there is sufficient overenrichment to cause rough idling of the engine.

By reason of this condition it has heretofore been a usual practice to reduce the volume of fuel in the engine-idling fuel channel system to a minimum by reducing the size and the lengths of the engine-idling fuel-conveying channels in endeavoring to minimize the tendency toward overenrichment at engine-idling position of the throttle and yet supply sufficient fuel for sustained engine idling after the wet fuel in the crankcase is volatilized by the high suction existent in the crankcase during engine-idling operation.

Another object of the invention resides in a carburetor or charge-forming apparatus of the aspirated diaphragm type embodying an arrangement of fuel passages or channels conveying fuel for engine-idling purposes wherein the passages or channels are arranged to effect a temporary delay or retarding of delivery of fuel into a mixing passage for engine-idling purposes upon movement of the throttle to engine-idling position to prevent overenrichment of fuel in the engine crankcase to secure improved engine-idling characteristics and minimize tendency for the engine to stall.

Another object of the invention resides in a carburetor or charge-forming apparatus of the aspirated diaphragm type embodying an arrangement of vented interconnected fuel passages or channels for conveying fuel for engine-idling purposes wherein the passages or channels are arranged to effect a temporary delay or retarding of delivery of fuel into a mixing passage for engine-idling purposes upon movement of the throttle to engine-idling position to prevent overenrichment of fuel in the engine crankcase to secure improved engine-idling characteristics and minimizing tendency for the engine to stall, the fuel in the engine-idling fuel passages or channels being delivered through a main orifice into the mixing passage for engine-accelerating purposes when the throttle valve is moved to open position.

Further objects and advantages are within the scope of this invention such as relate to the arrangement, operation and function of the related elements of the structure, to various details of construction and to combinations of parts, elements per se, and to economies of manufacture and numerous other features as will be apparent from a consideration of the specification and drawing of a form of the invention, which may be preferred, in which:

FIG. 1 is a top plan view of a combined diaphragm carburetor and diaphragm fuel pump construction embodying the invention;

FIG. 2 is an elevational view of the mixture outlet end of the carburetor construction shown in FIG. 1;

FIG. 3 is a side elevational view of the construction shown in FIG. 1;

FIG. 4 is an elevational view of the air inlet end of the carburetor construction shown in FIG. 1;

FIG. 5 is an isometric view of a gasket for the mixture outlet end of the carburetor;

FIG. 6 is a longitudinal sectional view through the carburetor, the section being taken substantially on the line 6-6 of FIG. 4;

FIG. 7 is a transverse sectional view through the carburetor;

FIG. 8 is a fragmentary sectional view taken substantially on the line 8-8 of FIG. 2;

FIG. 9 illustrates modified arrangement of air vent for the fuel system for engine-idling operation;

FIG. 10 is a sectional view illustrating a modified form of air vent means for the engine-idling fuel system, the view being taken substantially on the line 10-10 of FIG. 11;

FIG. 11 is a longitudinal sectional view similar to FIG. 6 illustrating the air vent means of FIG. 10.

The invention is illustrated as embodied in a diaphragm carburetor and diaphragm fuel pump construction, but as the fuel pump construction forms no part of the present invention, it has not been illustrated in detail. The diaphragm carburetor is of the aspirated type particularly usable with two-cycle engines of the character employed for powering chain saws, lawn mowers, portable drills and the like where a compact lightweight carburetor and fuel pump construction is desired.

FIGS. 1 through 5 of the drawings illustrate the carburetor and fuel pump construction enlarged to approximately 1½ actual size and the other FIGS. 6 through 18 show the construction enlarged to approximately twice actual size.

One form of the invention is illustrated in FIGS. 1 through 8. With particular reference to FIGS. 1 through 8 of the drawings, the charge-forming apparatus or carburetor construction illustrated is inclusive of a body or body member 10, which may be of cast metal or molded of resinous plastic material. The body 10 is fashioned with a fuel and air mixing passage 12, as particularly shown in FIG. 6, having an air inlet region 14, a venturi 16 having a choke band or restricted region 18 and a mixture outlet 20.

The end of the carburetor body 10 at the mixture outlet is fashioned with a planar surface 22 to accommodate a gasket 24 which is engaged with a planar surface of a boss portion 25 of the crankcase of an engine (not shown) of the two-cycle type. The body 10 is fashioned with two cylindrical bores or passages 26 and 27 extending through the body to accommodate bolts (not shown) for securing the carburetor to the boss 25 of the engine crankcase. The mixture outlet 20 registers with an opening 28 in the gasket 24 which registers with an opening in the crankcase boss 25.

A conventional reed valve construction (not shown) employed with a two-cycle engine is disposed in the mixture entrance of the engine crankcase. It is desirable that the air for entry into the mixing passage be filtered, and the carburetor and fuel pump construction is preferably contained within an enclosure (not shown) provided with an air entrance equipped with a suitable filter so as to assure that clean air is delivered into the mixing passage. A shaft 29, journaled in bores in the body 10 at the inlet region of the mixing region of the mixing passage, supports a choke valve 30 of the circular disc type.

A second shaft 32 is journaled in bores adjacent the mixture outlet region, the shaft supporting a circular-disc-type throttle valve 34. The shafts 29 and 32 are angularly arranged with respect to a horizontal plane through the axis of the mixing passage, as shown in figs. 2 and 4, an arrangement which enables fuel passages and channels to be formed in the body 10 without interference with the shafts. The shaft 29 is equipped with an arm 35 for manipulating the choke valve. The throttle valve shaft 32 is equipped with a manipulating arm 36, the arm having openings 37 for accommodating an operating cable or wire (not shown) which may be selectively engaged in one of the openings for manipulating the throttle valve.

A coil spring 38 surrounds the throttle shaft 32, the spring being arranged to bias the throttle valve toward near closed or engine-idling position, this position being shown in FIG. 6. The carburetor body is fashioned with a lug 39 having a threaded opening to accommodate an abutment screw 40, the abutment screw adapted to be engaged by a projection 41 of the arm 36 for determining the engine-idling position of the throttle valve 34. A coil spring 42 surrounds the screw 40 and provides friction for holding the screw 40 in adjusted position.

The carburetor body 10 is fashioned with a generally circular shallow recess providing a shallow fuel chamber 45 in the carburetor, a flexible membrane or diaphragm 46 extending across the recess forming a flexible wall of the fuel chamber 45.

An annular gasket 47 is disposed between the peripheral region of the diaphragm and the portion of the carburetor body defining the perimeter of the fuel chamber 45 to form a fluid-tight seal. A cover member 48 has a depressed central portion to accommodate flexing movement of the diaphragm 46.

A plurality of screws 49 extend through registering openings in the periphery of the cover member 48, the diaphragm 46 and gasket 47 and into threaded openings in the carburetor body to secure these components in assembled relation. The cover member 48 is provided with a vent opening 50 for venting the chamber or space 51 at the dry side of the diaphragm 46. The diaphragm is actuated or flexed by aspiration or reduced pressure in the mixing passage 12 established by engine operation for controlling or metering delivery of liquid fuel from a fuel supply or fuel pump into the fuel chamber 45, the latter being unvented except through a fuel delivery orifice opening into the mixing passage.

Threaded into the carburetor body is an L-shaped member or elbow fitting 53 adapted to be connected by a flexible tube (not shown) with a fuel supply tank or other fuel supply. As shown in FIG. 7, the body 10 is fashioned with a fuel inlet duct 55 in communication with a passage 57 of a fuel pump construction 52, the passage 57 registering with a bore in the carburetor body in which is disposed a fuel filter or screen 60 through which fuel flows to the inlet 55. The nipple 53 registers with passage means in the carburetor body for conveying fuel to the fuel pump construction 52.

The pump construction is of the character shown and described in Phillips Patent U.S. Pat. No. 3,275,306 and is not described herein in detail. The pump 52 includes a plate 54, a pumping diaphragm 56, a pumping or pulsing chamber 58 and a fuel-receiving chamber 59, the pulse chamber being connected with the engine crankcase through a pulse passage 61, the latter being shown in FIG. 2. The varying fluid pressure in the engine crankcase actuates or pulsates the pump diaphragm 56 to establish pumping action.

Formed in the carburetor body 10 in axial alignment with the fuel inlet 55 is a bore 62 in which is slidably mounted an inlet valve body or member 64 having a cone-shaped valve portion 66 adapted to seat against a ledge provided by the end of a bushing 68 for closing the fuel inlet 55. The valve body 64 is polygonally shaped or square in cross section to accommodate flow of liquid fuel along the valve body into the fuel chamber 45. If desired, an annular nonmetallic member (not shown) may be provided in the upper end of the bore 62 forming a seat of yieldable material for the valve portion 66.

Means is provided for transmitting movements of the diaphragm 46 to the inlet valve 64. In the embodiment illustrated, a motion-multiplying means is utilized such as a lever 70 fulcrumed upon a pin 72, the lever being disposed in a recess 74 in the roof of the fuel chamber 45. The central region of the diaphragm is equipped with a member 76 of rivet-like configuration having a shank portion extending through openings in reinforcing discs 77 and 78.

The long arm 80 of the lever is preferably articulately connected with the member 76, and the short arm 82 of the lever preferably articulately connected with the lower end of the inlet valve member 64.

An expansive coil spring 84, nested in a socket in the carburetor body, engages the arm 80 of the lever adjacent the fulcrum and provides resilient means normally biasing the inlet valve 64 toward closed position. The lever arrangement is of the character shown and described in Phillips patent U.S. Pat. No. 3,275,306. When the diaphragm 46 is moved toward the mixing passage by aspiration in the mixing passage, the lever 70 swings in a counterclockwise direction, as viewed in FIG. 7, to open the inlet valve 64 and valve in fuel into the fuel chamber 45.

The carburetor is inclusive of a main orifice means for delivering fuel into the mixing passage for engine idling and low speed operation. As particularly shown in FIGS. 6 and 7, the carburetor is provided with a bore in which is press fitted a cylindrically shaped fitting or member 88 fashioned with a central passage or bore 89 in communication with a counterbore 90, the outlet 91 of the counterbore providing a main fuel delivery orifice. The fitting 88 is fashioned with a peripheral recess 92 in communication with the passage 89 by transverse bores 93.

The carburetor body is fashioned with a bore to receive a valve body 95 having a threaded portion 96 engaged with a threaded portion of the bore. The valve body 95 has a tenon portion 97 terminating in a needle valve 98. The tenon portion 97 is disposed in a bore 100 of larger diameter than the tenon 97, the bore receiving fuel from a chamber 45 through a passage 101. The needle valve portion 98 extends into and cooperates with a restricted passage 102 which is in communication with the circumferential recess 92 for supplying fuel for delivery through the main orifice 91.

The valve body 95 is provided with a knurled head 103 for manually adjusting the position of the needle valve 98. The counterbore 90 accommodates a relatively movable ball valve 104 for preventing back bleeding through the main or primary orifice into the engine-idling fuel system when the idling or secondary orifice means is delivering fuel into the mixing passage for engine idling. The ball valve 104 is loosely confined by a perforated grid 99 in the upper end of the fitting 88.

The arrangement is inclusive of an engine-idling fuel flow or channel system for delivering fuel into the mixture outlet region 20 of the mixing passage when the throttle is in near closed or engine-idling position. As shown in FIGS. 6 and 8, the carburetor body is fashioned with a supplemental chamber 106 in communication with the mixture outlet region of the mixing passage by an engine-idling orifice or outlet 107 and a low speed outlet or orifice 108. The lower wall of the chamber is closed by a welsh plug 109.

The engine-idling and low speed fuel channel system includes the following: With reference to FIG. 6, a comparatively short passage 110 is drilled into the carburetor body and is in communication with the peripheral recess 92 of the fitting 88 and receives fuel from the passage 102 through the recess 92. The passage 110 is in communication with a bore 112 through a restricted passage 114. The body 10 is provided with a bore forming an extension of the bore 112 in which is disposed a valve body or member 116 having a threaded portion cooperating with a threaded portion of the bore.

The valve body 116 is fashioned with a tenon 118 of lesser diameter than the bore 112, the tenon 118 being provided with a needle valve portion 120 cooperating with the restricted passage 114. The valve body 116 is provided with a

head 119 for manipulating the valve. The bore 112 is in communication with a bore or channel 122 disposed normal to the bore 112, the bore 122 opening at the surface 22 at the mixture outlet end of the carburetor. The outlet end of the carburetor is fashioned with a milled groove or channel 124, shown in FIGS. 2 and 8.

The surface region 22 of the carburetor body is fashioned with counterbores 126. As shown in FIG. 8, the recess or channel 124 is in communication with the end region of the channel 122 and the counterbores 126. A channel 130 establishes communication between the counterbores 126 and the supplemental chamber 106 at the region of the engine idle and low speed orifices 107 and 108.

Air vent means is provided for the engine-idling fuel channel system. As shown in FIG. 8, a vent opening 132 in communication with one of the counterbores 126 is open to the atmosphere. The vent opening 132 should be of comparatively small size as, for example, an opening of 0.028 inches in diameter but may be of larger size depending upon the amount of air to be mixed with the fuel in the chamber 106 and the desired period of delay of delivery of fuel through the engine-idling orifice as hereinafter explained.

With particular reference to FIG. 8, the fuel for the secondary orifice system, that is, for delivery through the engine-idling orifice 107 and the low speed orifice 108 is derived from fuel in the peripheral recess 92 in the fitting 88. The needle valve 98 meters or regulates fuel flow from the fuel chamber 45 for delivery through the main orifice 91 and from the secondary and low speed orifices 107 and 108. This arrangement is usually referred to as a dependent idling system as fuel for the secondary or engine-idling orifice is metered by the high-speed adjustable needle valve 98.

When the engine is in operation with the throttle valve 34 in engine-idling position as shown in FIG. 6, fuel flow through the engine-idling fuel channel system is as follows: Fuel from the recess 92 in the fitting 88 flows through passage 110, shown in FIGS. 6 and 8, through the restricted channel 114, thence through connecting channels or bores 112 and 122, through the recess 124 and counterbores 126 and passage 130 into the supplemental chamber 106 for delivery through the engine-idling orifice 107.

A small amount of air is bled into the fuel flowing through this channel system from the air vent means 132 so as to provide a fuel emulsion for delivery through the engine-idling orifice 107 or through the low speed orifice 108. It should be noted that the engine-idling fuel channel system comprises interconnecting channels or passages and the recess 124 of substantial size or capacity to accommodate or contain a substantial amount of fuel when the engine-idling system is in operation delivering fuel through the orifice 107.

The gasket 24 forms a wall of the recess 124 in the carburetor body so that the recess provides a fuel channel connecting the channel 122 with the counterbore 126. With the throttle valve 34 in engine-idling position, engine aspiration on the idling orifice 107 is comparatively high so that fuel is readily aspirated through the circuitous fuel channel system to fill the system including the supplemental chamber 106. During fuel delivery through the engine-idling orifice 107, the light weight check valve or ball valve 104 is seated upon the ledge at the base of the counterbore 90 and prevents back bleeding of air from the mixing passage into fuel in the engine-idling fuel channel system.

The fuel filling the engine-idling fuel channel system by aspiration during engine-idling operation is available to promote acceleration of the engine when the throttle 34 is moved to a partially open or full open position. This action is as follows:

When the throttle is moved to open position, suction or aspiration on the engine-idling orifice 107 and the low speed orifice 108 is reduced and the suction greatly increased on the main orifice 91 by the high velocity of air moving through the venturi 16.

The main orifice 91 normally derives fuel from the chamber 45 through the metered restricted passage 102. However, immediately upon opening the throttle valve 34, the suction on the main orifice 91 is effective to cause reverse flow of fuel in the engine-idling fuel channel system so that the fuel contained in the chamber 106, passage 130, counterbores 126, channels 124, 122, 112, 114 and 110 flows into the peripheral recess 92 in the fitting 88 and into the central passage 89 in the fitting and is delivered into the mixing passage through the main orifice 91.

Thus, through the delivery into the mixing passage of the additional fuel contained in the engine-idling fuel channel system, the engine is effectively accelerated and the engine-idling fuel channel system drained or scavenged of fuel, the fuel being replaced by air entering the vent passage 132. The engine-idling fuel channel system being filled with air during normal engine operation provides for retarding or delaying delivery of fuel from the engine-idling orifice 107 when the throttle is again moved to near closed or engine-idling position.

By modifying the size of the bore 122 or the recess 124, or both, the fuel capacity of the engine-idling system may be varied to thereby control to a substantial extent the period of delay of delivery of fuel through the engine-idling orifice 107.

During this period of delayed delivery of fuel for engine idling, which period is usually not more than about 3 seconds, the liquid fuel wetting the crankcase walls is volatilized under the high suction and conveyed into the engine cylinder and provides for engine-idling operation until fuel is delivered through orifice 107 thus avoiding an overenrichened mixture condition which may occur if fuel is delivered instantaneously through the engine-idling orifice 107 when the throttle is moved to engine-idling position.

The high suction on the idling orifice 107 with the throttle in closed position is effective to bleed the air from the engine-idling fuel channel system which is replaced by fuel from circular recess 92 in the fitting 88. Thus, the interconnected passages 110, 114, 112, 122 and 124 are again filled with liquid fuel and counterbores 126, passage 130 and chamber 106 filled with liquid fuel mixed with air from the vent 132 as an emulsion for delivery through the engine-idling orifice 107. As it requires a short period of time for the fuel channel system to become substantially filled with fuel and fuel and air mixture delivered through the engine-idling orifice 107, the residual fuel in the engine crankcase maintains idling operation of the engine during this period.

Through this action there is no liability of an excess of fuel being superimposed on the residual fuel in the crankcase which would cause the engine to stall, but fuel is delivered after a short period of time through the orifice 107 to effect continued engine-idling operation. During each engine-idling operation, the fuel channel system is again replenished with fuel from the circular recess 92 in the fitting 88 which is available for delivery through the main orifice upon opening the throttle valve 34 as additional fuel for accelerating the engine.

All of the fuel for delivery through both the main or primary orifice 91 and the engine-idling and low speed orifices 107 and 108 is metered or regulated by the high-speed needle valve 98 and the fuel for the orifices 107 and 108 secondarily regulated by the metering needle valve 120. Thus the method and arrangement of the invention provides for delayed or retarded delivery of fuel from an engine-idling fuel channel system to prevent an overrich mixture condition which may cause the engine to stall, and wherein fuel in the fuel channel system is available whenever the throttle valve 34 is opened to effect reverse flow of fuel in the fuel channel system for delivery through the main orifice 91 for engine acceleration.

In the form of the invention shown in FIG. 9 a different form of venting means is provided for the fuel channel system. In this form fuel for delivery through both the main orifice and the secondary orifices flows from the recess 74c through the restricted passage 160c past the metering needle valve 170c

into the bore 156c and is delivered through the main orifice construction. The engine-idling fuel system derives its fuel from the bore 156c and flows through the annular passage 172c, interconnecting passages 174c and 178c past the metering needle valve 186c through the restricted passage 182c into the supplemental chamber for delivery through the engine-idling orifice 107c or through the low speed orifice 108c, the latter delivering fuel when the throttle is moved only a slight distance from engine-idling position. In this form of the invention, an air vent passage or means opens into the channel 174c. The vent 200 is in communication with the fuel channel 174c and is open to the atmosphere. The vent passage 200 should be of comparatively small size to admit a small amount of air for mixing with the fuel in the chamber 106c so that an emulsion is delivered from the engine-idling orifice 107c or from the low speed orifice 108c. It is to be understood that the air vent 200 may be placed in other positions. For example, the air vent may open into the bore 178c, or the air vent may open into the channel 174c at other positions, or may open into the channel 172c. However, it will be obvious that the closer the position of the air vent to the main orifice, the less the amount of fuel delivered to the main orifice for acceleration because the fuel channels will contain a mixture of fuel and air instead of liquid fuel and engine acceleration proportionately reduced.

The arrangement shown in FIG. 9 functions to delay delivery of fuel for engine-idling operation and to supply additional fuel to the main orifice for acceleration. The valve body 166c, is equipped with the needle valve portion 170c, and the valve body 180c equipped with the needle valve portion 186c. The valve body 170c is manually adjustable to regulate fuel flow for both the main and secondary fuel systems through the restriction 160c, and the valve body 180c is adjustable for metering fuel flow for engine-idling and low speed operation.

FIGS. 10 and 11 illustrate an engine-idling fuel channel system with a modification of air vent means for the system. In this form the carburetor body 10d is substantially the same as the carburetor body in the other forms of the invention. The fuel chamber 45d and fuel chamber recess 74d, the fitting or member 150d, the supplemental chamber 106d, engine-idling orifice 107d and low speed orifice 108d are the same as illustrated in FIG. 10. The fuel passages 160d, 172d, 174d, 178d, 182d with the chamber 106d, comprise the engine-idling fuel channel system.

The end of the channel 174d is closed by a plug 176d. The adjustable valve body or member 166d has a tenon portion 168d terminating in a needle valve 170d which cooperates with the restricted passage 160d for metering fuel flow to the main orifice 154d and for the engine-idling and low speed orifices 107d and 108d.

A lightweight check ball or ball valve 162d is loosely contained in the bore 152d and functions to prevent back bleeding of air into the engine-idling fuel channel system when the latter is delivering fuel to the chamber 106d and the engine-idling orifice 107d.

The adjustable valve body 180d has a tenon portion 184d terminating in a needle valve 186d which meters or controls fuel flow into the supplemental chamber 106d for delivery through the engine-idling and low speed orifices. In this form of the invention, an air vent means is arranged to admit air from the air inlet region 14d of the carburetor as air entering the inlet 14d is filtered or screened air as the air flows through a filter associated with an enclosure (not shown) for the carburetor as hereinbefore mentioned in reference to the form of the invention illustrated in FIGS. 1 through 8.

Fashioned in the carburetor body 10d is a bore 210 in which is press fitted a tube or tubular member 212, the entrance 214 of the tube providing an air vent opening into the air inlet region 14d. The bore 210 is in communication with a passage 216 through a restriction or restricted passage 218, the passage 216 opening into the supplemental chamber 106d. It will be seen that this arrangement provides an internal air vent means for admitting a restricted amount of filtered air to the

fuel for engine-idling and low speed purposes through the tube 212 and the interconnecting passages 210, 216 and 218 fashioned in the carburetor body.

The purpose of the tube 212 is to position the air inlet 214 of the air vent means substantially in advance of the choke band or restricted region 18d of the venturi 16d so as to obtain an air vent effect closely approaching atmospheric pressure, the entrance of the tube being spaced from the venturi so as not to be appreciably affected by the velocity airstream moving through the venturi in the missing passage.

By reason of the air vent means, the fuel in channels or passages 172d, 174d, 186d, 182d and the supplemental chamber 106d is exhausted through the main orifice 154d under normal or high-speed engine operation. When the throttle valve 34d is moved to near closed or engine-idling position, as shown in FIG. 11, the high engine suction or aspiration effective on the orifice 107d draws fuel from the channel 172d through channels 174d, 178d and 182d to fill these channels and the supplemental chamber 106d. When this channel system is filled with fuel, then fuel for engine idling is delivered through the engine-idling orifice 107d.

As previously mentioned in connection with the other forms of the invention, the filling of the channels with fuel requires a short period of time, usually not exceeding 3 seconds. By delaying fuel delivery through the orifice 107d, liquid fuel on the walls of the engine crankcase may be volatilized to operate the engine-idling speed until the orifice 107d delivers an emulsion of fuel and air for engine idling to the mixture outlet region 20d of the mixing passage. This method and arrangement avoids the promotion of an overrich mixture in the crankcase at engine-idling speed, a condition which may cause the engine to stall.

When the throttle valve 34d is moved to a substantially open position, the suction or aspiration at the idling orifice 107d is greatly reduced and aspiration or suction on the main orifice or nozzle 154d greatly increased. This increase in aspiration on the main orifice quickly withdraws or scavenges the fuel from the chamber 106d and passages 172d, 174d, 178d and 182d which is delivered through the main orifice 154d providing an immediate increased amount of fuel to promote engine acceleration. The air bleed means, provided by the tube 212 and passages 210, 216 and 218, opening into the supplemental chamber 106d enables the rapid withdrawal of the fuel from the idling fuel channel system for engine acceleration.

The air moving through the vent passages is the only air mixed with fuel and this occurs in the chamber 106e. Thus, air is not mixed with fuel in the idling fuel channel system until the fuel is delivered from the restricted channel 182e into the chamber 106e.

The invention provides an arrangement whereby delivery of fuel for engine idling is delayed for a short period of time after the throttle valve is moved to engine-idling position, and the fuel in the engine-idling fuel channel system is available for delivery through the main orifice and is delivered therethrough for accelerating the engine when the throttle is moved to open position.

However, the amount of fuel and rapidity of delivery of fuel from the fuel channel system through the main orifice for engine acceleration may be varied. For example, 174d, shown in FIG. 10 the larger the diameter of the channel, the longer period of time required to fill the channel when the throttle is suddenly opened to engine-idling position. By increasing the diameter of this channel, the fuel capacity of the channel is increased and, hence, there will be a greater volume of fuel discharged when the throttle is suddenly moved from engine-idling position to open throttle position.

In reference to the form shown in FIG. 10, when the throttle is suddenly opened from engine-idling position, the fuel in the channel 174d will not be discharged through the main orifice as rapidly as in the form of construction shown in FIG. 9 with the air bleed 200. In the arrangement shown in FIG. 10, the needle valve 182d presents a restriction to airflow and furthermore, until the chamber 106d is exhausted of fuel, the liquid

fuel in the minute annular restriction between the needle valve 186d and the wall of the adjacent passage presents surface tension which, in a measure, retards the reverse flow of liquid fuel in the fuel channel system toward the main orifice.

In the arrangement shown in FIG. 9, the liquid fuel in the chamber 174c may be delivered through the main orifice for engine acceleration at a rate, controlled in a measure, by the size of the air vent 200. Thus, if extremely rapid delivery of fuel for engine acceleration is desired, the air vent 200 in the form shown in FIG. 9, may be increased in size to secure the desired rate of delivery of fuel to the main orifice for engine acceleration.

It is apparent that, within the scope of the invention, modifications and different arrangements may be made other than as herein disclosed, and the present disclosure is illustrative merely, the invention comprehending all variations thereof.

I claim:

1. In combination, a carburetor having a mixing passage and an unvented fuel chamber, a throttle valve in the mixing passage, a flexible diaphragm forming a wall of the fuel chamber, a fuel inlet, a valve for said inlet, means transmitting movement of the diaphragm to the inlet valve, main and secondary fuel delivery outlets opening into the mixing passage, fuel passage means between the fuel chamber and the region of the main outlet, means for regulating fuel flow through said passage means, a supplemental chamber in the carburetor adjacent the secondary outlet, fuel channel means in the carburetor in communication with the region of the main outlet and the supplemental chamber, said fuel channel means including a bore, an elongated channel disposed normal to the bore, said elongated channel comprising a recess in an exterior surface region of the carburetor, gasket means covering the recess forming a wall of the elongated channel, one end region of the elongated channel opening into said bore, an angularly arranged channel connecting the elongated channel and the supplemental chamber, and air vent means for admitting air to the angularly arranged to delay delivery of fuel through the secondary outlet upon movement of the throttle valve to engine-idling position.

2. In combination, a carburetor having a mixing passage and an unvented fuel chamber, a throttle valve in the mixing passage, a flexible diaphragm forming a wall of the fuel chamber, a fuel inlet, a valve for said inlet, means transmitting

movement of the diaphragm to the inlet valve, a fitting disposed in an opening in the carburetor adjacent the mixing passage, a transverse passage in the fitting, a restricted passage between the transverse passage and the fuel chamber, an adjustable valve member having a portion projecting through the passage in the fitting and a needle valve portion cooperating with the restricted passage to regulate fuel flow from the chamber into the fitting, a counterbore in the fitting having communication with the transverse passage, the counterbore opening into the mixing passage providing a main fuel delivery outlet, a secondary outlet opening into the mixing passage, fuel channel means for conveying fuel from the transverse passage to the secondary outlet, and vent means admitting air directly into the fuel channel means for delaying delivery of fuel from the fuel channel means through the secondary outlet upon movement of the throttle valve to engine-idling position, said vent means being effective upon opening movement of the throttle valve to promote rapid delivery of fuel from the fuel channel means through the main outlet for engine acceleration.

3. In combination, a carburetor having a mixing passage and an unvented fuel chamber, a throttle valve in the mixing passage, a flexible diaphragm forming a wall of the fuel chamber, a fuel inlet, a valve for said inlet, means transmitting movement of the diaphragm to the inlet valve, a fitting disposed in an opening in the carburetor adjacent the mixing passage, a transverse passage in the fitting, a restricted passage between the transverse passage and the fuel chamber, and adjustable valve member having a portion projecting through the passage in the fitting and a needle valve portion cooperating with the restricted passage to regulate fuel flow from the chamber into the fitting, a counterbore in the fitting having communication with the transverse passage, the counterbore opening into the mixing passage providing a main fuel delivery outlet, a secondary outlet opening into the mixing passage, fuel channel means for conveying fuel from the transverse passage to the secondary outlet, and vent means admitting air to the fuel channel means for delaying delivery of fuel from the fuel channel means through the secondary outlet upon movement of the throttle valve to engine-idling position.

4. The combination according to claim 3 wherein the vent means includes a tubular member projecting into the air inlet region of the mixing passage.