Feb. 10, 1970 W. D. NUTTEN 3,494,343

PRIMING DEVICE FOR INTERNAL COMBUSTION ENGINES

Filed March 15, 1968 3 Sheets-Sheet 1

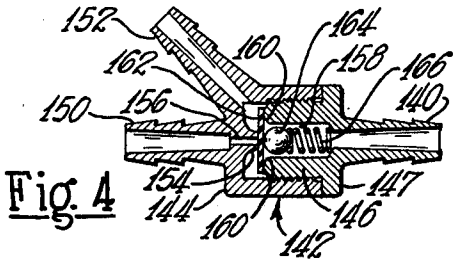



Fig. 4

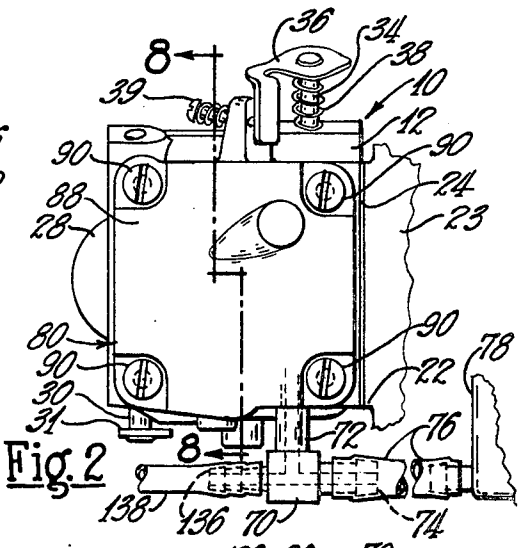



Fig. 2

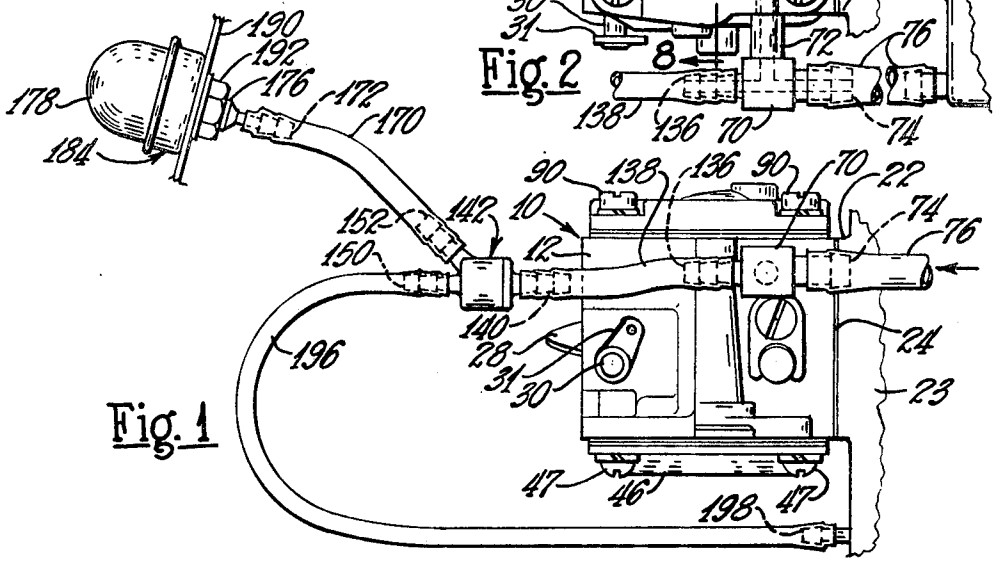



Fig. 1

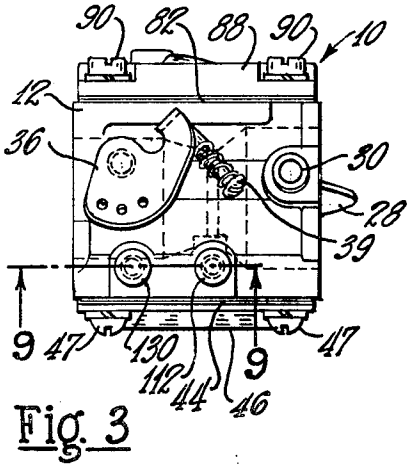



Fig. 3

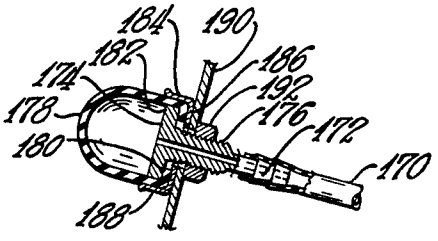



Fig. 5

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PRIMING DEVICE FOR INTERNAL COMBUSTION ENGINES

Filed March 15, 1968 3 Sheets-Sheet 2

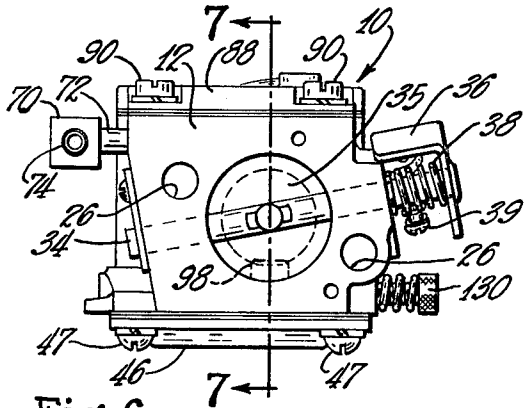



Fig. 6

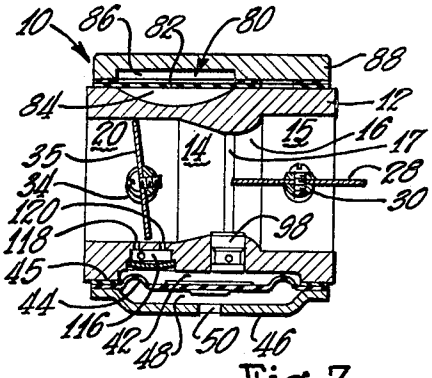



Fig. 7

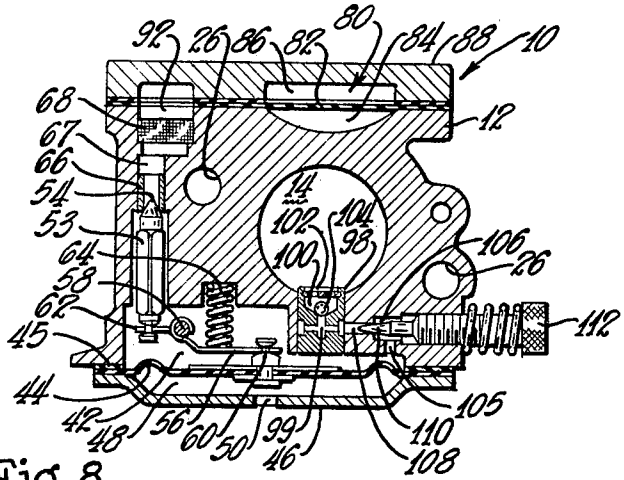



Fig. 8

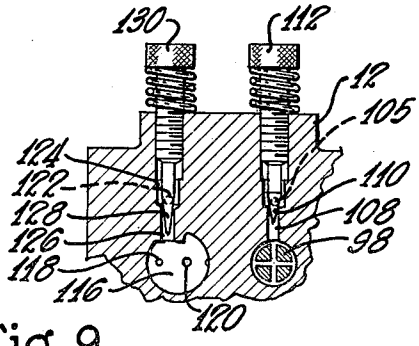



Fig. 9

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PRIMING DEVICE FOR INTERNAL COMBUSTION ENGINES

Filed March 15, 1968 3 Sheets-Sheet 3

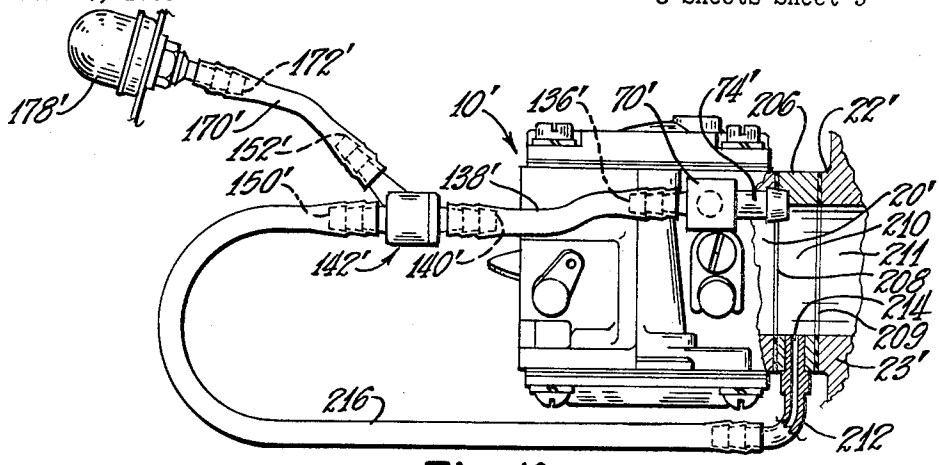



Fig. 10

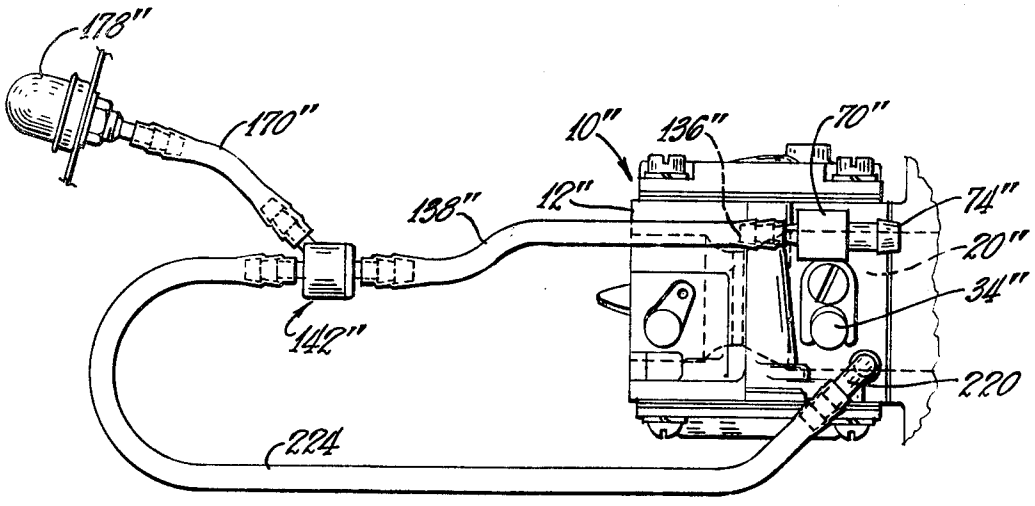



Fig. 11

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Patented Feb. 10, 1970



3,494,343

# PRIMING DEVICE FOR INTERNAL COMBUSTION ENGINES

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Int. Cl. F02m 1/16; F02b 33/04; F04b 39/10
U.S. Cl. 123—187.5 12 Claims

## ABSTRACT OF THE DISCLOSURE

A priming device for injecting fuel by manually actuable means from a fuel supply into the mixing passage of a carburetor or at any other region of the induction system of an internal combustion engine for engine starting purposes.

This invention relates to a priming device for delivering liquid fuel from a supply by manually actuable means into the fuel and air induction system of an internal combustion engine of the reciprocating piston type, which priming device may be advantageously associated with a fuel feed and charge forming apparatus for facilitating easy starting of the engine. In the use of a conventional type of aspirated diaphragm carburetor of the character particularly adapted for use with internal combustion engines of the two cycle type for operating chain saws, power mowers, portable engines, snow vehicles and the like, it is a usual practice to employ a manually operated choke valve for restricting air flow through a mixing passage in order to effect the starting of the engine particularly when the engine is cold and when the same is used in a low temperature environment.

As engines of the above-mentioned character are usually started by manual means, it becomes a laborious task for an operator to rotate the engine by manual means and simultaneously manipulate the choke valve in endeavoring to start the engine. Engine starting operations are particularly aggravated when the ambient temperatures are 0° F. or lower as are usually encountered in the use of snow vehicles and in regions where chain saws are operated in felling and trimming trees. In starting a chain saw engine with the choke valve of a diaphragm type carburetor in closed position, the delivery of fuel into the mixing passage thence into the engine crankcase, is dependent upon manual rotation of the engine at a speed sufficient to effect delivery of fuel by engine aspiration into the carburetor mixing passage in starting an engine. In starting an engine equipped with a diaphragm type carburetor, manual cranking of the engine must develop sufficient reduced pressure to act upon the carburetor diaphragm to admit fuel into the fuel chamber for delivery into the mixing passage in sufficient quantity to start the engine. In very cold ambient temperatures, it usually requires many cranking revolutions of the engine by manual means to start the engine.

The present invention embraces a method of and means for delivering fuel into the induction system of an engine independently of the operation of the charge forming apparatus or carburetor whereby to facilitate easy starting of the engine without reliance upon engine aspiration to deliver fuel into the induction system.

Another object of the invention resides in a priming fuel system effective independently of the operation of the charge forming apparatus or carburetor for delivering liquid fuel from a supply into the induction system of an engine by manually operable means effective to exert pressure upon the priming fuel to assure its delivery into



the induction system prior to or concomitantly with the manually cranking of the engine in an engine starting operation.

Another object of the invention resides in the provision of a manually actuable priming device intercalated in a fuel supply system for an engine for positively injecting fuel into the induction system to promote easy starting of an engine.

Another object of the invention resides in a valve construction for interconnection in a fuel supply system for a carburetor wherein a manually collapsible envelope or bulb is associated with the valve construction whereby the operator is enabled to inject fuel for engine starting purposes into the mixing passage of the carburetor, or into the crankcase of a two cycle engine or into any other region of the induction system of a two cycle or four cycle engine with or without manipulating the conventional choke valve in the carburetor in order to start an engine.

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:

FIGURE 1 is a side elevational view of a form of diaphragm carburetor or charge forming apparatus illustrating the priming arrangement of the invention associated therewith;

FIGURE 2 is a top plan view of the carburetor illustrated in FIGURE 1;

FIGURE 3 is an elevational view of the opposite side of the carburetor shown in FIGURE 1;

FIGURE 4 is an enlarged sectional view of a valve construction forming a component of the priming system;

FIGURE 5 is a sectional view of a squeeze bulb construction forming a component of the priming system;

FIGURE 6 is an end view of the carburetor shown in FIGURES 1 and 2;

FIGURE 7 is a longitudinal sectional view through the carburetor, the view being taken substantially on the line 7—7 of FIGURE 6;

FIGURE 8 is an enlarged transverse sectional view taken substantially on the line 8—8 of FIGURE 2;

FIGURE 9 is an enlarged detail sectional view taken substantially on the line 9—9 of FIGURE 3;

FIGURE 10 is an elevational view of a carburetor and priming system of the invention wherein priming fuel is delivered into the induction system intermediate the carburetor and the engine crankcase or intake manifold, and

FIGURE 11 illustrates the priming system wherein the priming fuel is delivered into the mixing passage in the carburetor.

The priming system or device of the invention receives liquid fuel from a conventional supply or fuel tank and is of a character wherein by manual actuation of a variable volume member, squeeze bulb or the like, fuel for priming an internal combustion engine of the reciprocating piston type may be delivered at any convenient region in the induction system such as the mixing passage of the carburetor, the crankcase of a two cycle engine or the induction system manifold of a two cycle or four cycle engine to promote easy starting of the engine.

Referring to the drawings in detail and initially to the arrangement shown in FIGURES 1 through 5, a combined diaphragm carburetor and diaphragm fuel pump is illustrated in association with a form of priming system of the invention. The combined carburetor and fuel pump **10** is

of the general character shown in my Patent 3,275,305, the carburetor or charge forming apparatus being of the aspirated diaphragm type adapted for use in all positions including inverted position.

The carburetor or charge forming apparatus includes a body **12** of cast metal fashioned with an air and fuel mixing passage **14** having an air inlet region **15**, a Venturi **16** with a restricted region or choke band **17** and a mixture outlet region **20**, as shown in FIGURE 7.

The mixture outlet end of the carburetor has a uniplanar surface which mates with a boss portion **22** of an engine crankcase **23**, a gasket **24** being interposed between the carburetor and the boss **22**. The carburetor is secured to the engine crankcase **23** by bolts (not shown) which project through openings **26** extending through the carburetor, the openings being shown in FIGURES 6 and 8.

The mixture outlet **20** of the mixing passage of the carburetor registers with an opening in the boss **22** on the crankcase **23** of a two cycle engine, there being the conventional reed valve construction (not shown) adjacent the gasket **24** for controlling delivery of mixture into the crankcase. With particular reference to FIGURE 7, a disc-type choke valve **28** may be supported upon a shaft **30** which is journaled in bores in the carburetor body **12**. A portion of the shaft **30** exteriorly of the body is equipped with a manipulating arm **31** in the event it is desired to use or adjust the conventional choke valve **28**.

Journaled in bores in the carburetor body is a throttle shaft **34** mounting a conventional disc-type throttle valve **35**, an exterior portion of the shaft **34** being equipped with a manipulating arm **36** for operating the throttle valve. A spring **38** normally biases the throttle valve toward closed or engine idling position, this position being shown in FIGURE 7. An adjusting screw **39** cooperates with the arm **36** to regulate the engine idling position of the throttle.

As shown in FIGURES 7 and 8, the carburetor body **12** is formed with a generally-circular shallow chamber or recess **42** providing a fuel chamber. A flexible impervious metering diaphragm **44** extends across the recess and forms a flexible wall of the fuel chamber **42**, a sealing gasket **45** being disposed between the diaphragm and the carburetor body at the peripheral region of the diaphragm. A cover member **46** is secured to the body by screws **47** threaded into openings in the body and extending through registering openings in the diaphragm **44** in gasket **45** for securing these components in assembled relation.

The space **48** beneath the diaphragm **44** is vented through an opening **50** in the cover **46**. The diaphragm **44** is flexed by pressure variations in the mixing passage **14** caused by engine aspiration, the pressures being transmitted to the fuel chamber **42** for controlling or regulating fuel flow past an inlet valve **54**. The diaphragm **44** controls the position of the inlet valve **54** through the medium of a lever **56** fulcrumed on a pin **58**.

One end of the lever is operatively connected with a button-like member **60** mounted on the diaphragm, the short arm **62** of the lever being operatively connected with a valve body **53** having a cone-shaped valve portion **54**. An expansive coil spring **64** normally biases the valve **54** toward closed position in engagement with a valve seat provided by the end of an annular member **66** in a fuel inlet passage **67** in the carburetor. A fuel filter **68** is disposed in advance of the fuel inlet passage **67**.

When the engine is not in operation, the spring **64**, acting on the lever **56**, biases the valve **54** closed to prevent ingress of fuel into the fuel chamber **42** until the engine is in operation. As shown in FIGURES 1, 2 and 6, a T-shaped fitting **70** has one tubular nipple or branch **72** pressed into an opening in the carburetor body **12**. A second tubular branch **74** of the T-shaped fitting **70** is connected by a flexible fuel conveying tube **76** with a fuel supply such as a fuel tank **78** of conventional character.

The branch **72** of the fitting **70**, extending into an opening in the carburetor body, is in communication with a diaphragm fuel pump construction **80** of a character shown and described in my Patent 3,275,305. The fuel pump construction is of the pulse-operated diaphragm type embodying a diaphragm **82** which extends across cavities **84** and **86** providing a pumping chamber **86** and a fuel chamber **84**. In the embodiment illustrated the fuel chamber is provided by the cavity **84** in the body **12** and the pumping chamber **86** provided by the cavity **86** in a plate **88**, the latter being secured to the carburetor body by screws **90**.

The diaphragm is provided with integral inlet and outlet flap valves (not shown) which cooperate with fuel inlet and outlet ports (not shown) for the fuel chamber **84** whereby the vibrations or pulsations of the pumping diaphragm **82** pumps fuel from the tank **78** through the T-shaped fitting **70** and into the fuel chamber **84** of the fuel pump construction.

Fuel from the fuel chamber **84** flows through an outlet port past an outlet flap valve into a passage or chamber **92** which is in communication with the fuel inlet **67** in the carburetor body adjacent the fuel inlet valve **54**.

During operation of the engine, the diaphragm pump delivers fuel under comparatively low pressure to the fuel inlet **67**. Fuel flows past the inlet valve **54** whenever the engine aspiration or reduced pressure in the mixing passage flexes the metering diaphragm **44** upwardly and opens the inlet valve.

The fuel conveying channel system in the carburetor body includes a primary fuel delivery orifice and a secondary or engine idling and low speed system. With particular reference to FIGURES 7 and 8, the carburetor is fashioned with a bore in which is snugly disposed a fitting **98** having a central fuel passage **99**, a counterbore **100**, the exit of which provides a main fuel delivery orifice **102**. A ball valve **104** is disposed in the counterbore **100** and closes the passage **99** whenever the secondary system is in operation to prevent back bleeding of air into the liquid fuel in the secondary system.

Fuel is conveyed from the fuel chamber **42** to the interior of the fitting **98** through a passage **105** in communication with a bore **106** which is connected by a restricted passage **108** with fuel passages in the fitting **98** in communication with the central passage **99**.

A manually adjustable needle valve **110** fashioned on a valve body **112** is threadedly adjustable for metering fuel flowing through the restriction **108** for delivery through the main orifice **102** into the mixing passage **14**. As shown in FIGURE 7 the main orifice of the fitting **98** opens into the choke band region **17** of the Venturi **16**.

The secondary or engine idling and low speed system includes a supplemental chamber **116** which is in communication with the mixture outlet region of the mixing passage through an engine idling orifice **118** and a low speed orifice **120**. As shown in FIGURE 9, the supplemental chamber **116** receives fuel from the fuel chamber **42** through a passage **122** which opens into a bore **124**, the latter being in communication with the chamber **116** through a restricted passage **126**.

A manually adjustable needle valve **128**, provided on a valve body **130**, cooperates with the restriction **126** to regulate fuel flow into the supplemental chamber **116** for delivery through one or both of the orifices **118** and **120**. When fuel is being delivered from the secondary system into the mixing passage, the check ball **104** closes the passage **99** to prevent air bleeding from the mixing passage **14** into the secondary fuel delivery system.

FIGURES 1 through 4 illustrate the priming arrangement or system associated with the carburetor and fuel pump construction **10** hereinbefore described. The T-shaped fitting **70**, which conveys fuel from the tank **78** to the fuel pump construction **80**, has a third tubular branch or nipple **136** connected by a flexible tube **138** with a tubular nipple portion **140** of a housing means **142** enclosing a check valve construction.

The valve housing means includes a housing portion **144** which has a threaded bore accommodating a threaded member **146** which is integral with the tubular nipple **140**. A flange **147** on member **146** engages an end region of the housing **144** in the manner shown in FIGURE 4.

The housing **144** is fashioned with a tubular nipple **150** and with a second tubular nipple **152** angularly disposed with respect to the axis of the nipple **150**. The central interior region of the housing **144** is fashioned with a raised boss **154** in which is fashioned a passage **156** in communication with the interior of the tubular nipple **150**. As shown in FIGURE 4, the interior of housing portion **146** is fashioned with a bore **158**, the upper annular end region of portion **146** being of curved or arcuate shape **160**, the circular crown or ridge formed thereby providing a seat for a flexible disc-like valve member or diaphragm **162** of synthetic rubber, plastic or the like. The flexible valve member **162** may be of a thickness of about .015" and preferably made of fabric impregnated with synthetic rubber.

Disposed in the bore **158** in the portion **146** is a ball or member **164**, an expansive coil spring **166** biasing the ball **164** into engagement with the flexible valve member **162** to normally hold the latter against the seat provided by the raised boss portion **154** and thereby close the passage **156**. The valve construction in the housing **142** is in operative association with a manually actuable member such as a squeeze bulb for effecting fuel flow from the fuel tank **78** to the engine induction system. A flexible tube **170** is connected with the nipple **152** of the valve housing means **142**, the other end of tube **170** being connected with a nipple **172** as shown in FIGURES 1 and 5.

One form of squeeze bulb construction is shown in detail in FIGURE 5 which includes a base member **174** provided with a threaded shank portion **176** which terminates in the nipple portion **172**. A squeeze bulb or collapsible member **178** is of hollow construction and is fashioned of flexible synthetic rubber or rubber-like material not effected by hydrocarbon fuel. The bulb **178** has an inwardly extending circular flange **180** which seats over a circumferential flange **182** formed on member **174**. A thimble-shaped collar **184** has an opening in the planar portion **186** thereof accommodating the threaded shank portion **176**, a peripheral wall portion **188** of the collar **184** extending upwardly contiguously with the adjacent portion of the squeeze bulb member **178**.

The squeeze bulb assembly is preferably mounted upon a sheet metal member **190** which may be a portion of a housing enclosing the carburetor although it may be mounted on any other suitable support. The components are assembled in the manner shown in FIGURE 5 with the flange **182** compressing the flange **180** of the squeeze bulb in close engagement with the collar **184**, a nut **192**, threaded onto the shank portion **176**, is drawn into snug engagement with the mounting member **190** to secure the components of the squeeze bulb construction together and provide an effective seal.

The nipple portion **150** of the valve construction **142** is connected by a tubular member **196** with a tube or nipple **198** extending through an opening in the wall of the engine crankcase **23** for the conveyance of fuel into the crankcase to provide priming fuel for starting the engine.

The method of operation in starting an engine equipped with the carburetor hereinbefore described and the priming system of the invention is as follows: The throttle valve **35**, in the mixture outlet passage **20** of the carburetor, may be set to partially open or near open position to admit air into the engine crankcase during an engine starting operation. When the system is being used for the first time, the operator manually squeezes or collapses the flexible squeeze bulb member **178**. This forces the air out of the squeeze bulb against the left-hand side of the flexible valve member or diaphragm **162**, as viewed in FIGURE 3.

The pressure of the air on the valve member flexes the central region of the valve member away from the boss **154** opening the passage **156**, the pressure compressing the spring **166**. The air flows through the passage **156**, nipple **150** and tube **196** into the crankcase **23** of the engine. The operator releases pressure on the squeeze bulb whereby it returns under its inherent stress to its expanded or uncollapsed position, as shown in FIGURES 1 and 5, and the pressure of the spring **166** causes the valve **162** to close the port or passage **154**.

As the squeeze bulb expands to its normal position, the reduced pressure set up in the bulb transmitted through tube **170** and nipple **152** to the annular chamber adjacent the flexible valve **162** flexes or moves the peripheral region of the valve **162** away from the circular ridge or seat **160** and fuel from the fuel tank or supply **78** flows through tube **76**, fitting **70**, tube **138** through the nipple **140** and bore **158** past the peripheral region of the valve **162** through the nipple **152**, tube **170** and into the expanding squeeze bulb **178**, thereby filling the squeeze bulb **178** and tube **170** with liquid fuel from the supply.

The operator then squeezes and collapses the bulb **178** which is filled with fuel, the pressure on the bulb forces the fuel to flex the central region of valve **162** away from its seat **154** opening the passage **156** whereby the fuel flows through the nipple **150** and tube **196** into the crankcase of the two cycle engine which is a component of the induction system of this type of engine. The engine is then manually cranked by the operator and the priming fuel delivered into the engine crankcase is therein mixed with air flowing past the throttle valve **35** in the carburetor.

The engine is thus easily started by reason of the rich mixture formed by delivering the priming fuel directly into the crankcase or induction system without reliance upon engine aspiration in the mixing passage of the carburetor elevating fuel from the fuel chamber **42** into the mixing passage. It is found that the priming system of the invention is very effective in facilitating easy starting of an engine, particularly engines powering snow vehicles and especially chain saw engines where the ambient temperatures may be many degrees below zero in the areas where timber is cut in the winter season.

If further priming is necessary, the operator repeats the operation of squeezing the bulb **178** which has again been filled with fuel when the operator released pressure on it at the completion of the previous priming operation. The squeeze bulb **178** provides a variable volume member or chamber and stores fuel from the supply whenever the squeeze bulb returns to its normal expanded condition following release of pressure upon it.

Thus through this method priming fuel is projected under pressure through the passage **156** to the induction system of the engine. When the bulb **178** is permitted to return to its full volume or expanded condition, fuel is admitted from the supply into the squeeze bulb and tube **170** and stored therein for use in the next succeeding engine priming operation.

Another major advantage of the priming system for engine starting is that actuation of the primer bulb **178** lifts fuel through the fitting **70** to the inlet of the fuel pump on the carburetor so that it requires only a small amount of cranking of the engine to cause the fuel pump to deliver fuel to the carburetor inlet passage **67** and past the fuel inlet control valve **54** into the fuel chamber **42** of the carburetor. This also facilitates starting of the engine because fuel is lifted by the actuation of the squeeze bulb rather than by engine aspiration of an engine cranking operation.

While the arrangement shown in FIGURE 1 provides a common fuel supply tube **76** from the fuel tank **78** to the carburetor and to the squeeze bulb through the T-shaped fitting **70**, it is to be understood that the valve housing means **142** and the squeeze bulb arrangement **178** may be directly connected with the fuel tank **78** by a tubular means independent of the tube **76**.

FIGURE 10 illustrates a modification of arrangement for delivering fuel for engine priming purposes into the induction system of a reciprocating piston type of internal combustion engine.

The combined carburetor and fuel pump construction **10'** is of the same construction hereinbefore described and shown in FIGURES 1, 2, 3 and 6 through 9. In this arrangement a member or spacer **206** is disposed between the mixture outlet or mounting end of the carburetor body **12'** and the mounting boss **22'** of the engine crankcase **23'** of a two cycle engine. A gasket **208** is disposed between the carburetor body and the member **206** and a gasket **209** disposed between the member **206** and the engine crankcase boss **22'**.

The mixture outlet **20'** of the mixing passage in the carburetor body **12'** is in registration with an opening **211** in the crankcase wall, the conventional one-way reed valve construction being omitted for purposes of illustration. The bolts (not shown) extending through openings in the carburetor body **12'** are of a length to extend through openings in the member **206** and into threaded openings in the engine crankcase wall whereby the bolts for securing the carburetor in position also secure the member **206** in the position shown in FIGURE 10.

The member or spacer **206** is equipped with a tubular fitting or elbow **212** having a fuel passage **214**. The elbow fitting **212** is connected by a tube **216** with the nipple portion **150'** of a valve housing means **142'**. The valve housing means is provided with a nipple **152'** connected by a tube **170'** with a nipple **172'** connetced with a variable volume member or squeeze bulb **178'**. The housing means **142'** has a nipple **140'** connected by a tube **138'** with a nipple **136'** on the T-shaped fitting **70'**.

The T-shaped fitting **70'** has a branch portion extending into the carburetor body **12'** in the manner illustrated in FIGURE 2. The nipple or branch **74'** of the fitting is connected with a fuel tank of the character shown at **78** in FIGURE 1.

The operation of the arrangement shown in FIGURE 10 is similar to that hereinbefore described in connection with the arrangement shown in FIGURES 1 and 2. When the operator desires to prime the engine for starting, the squeeze bulb **178'** is depressed and the valve means in the housing means **142'** which is of the character shown in FIGURE 3, directs fuel from the squeeze bulb **178'** through tube **216** and passage **214** in the fitting **212** into the interior of the member **206** which is a part of the engine induction system.

When the engine is cranked manually, air flowing through the mixing passage in the carburetor body, with the throttle opened, mixes with the priming fuel delivered from the passage **214** thereby providing a rich mixture for engine starting purposes. Upon the release of pressure from the squeeze bulb **178'**, the squeeze bulb expands to its normal volume and from the valve means in the housing means **142'** admits fuel from the fuel tank into the squeeze bulb **178'** and tube **170'** to provide fuel therein for the next succeeding engine starting operation.

The arrangement shown in FIGURE 10 is adapted for use with a carburetor of the character shown without modification of the carburetor. Thus, the priming device and components shown in FIGURE 10 may be marketed as a separate unitary construction for embodiment in any conventional carburetor and engine combination.

The unit construction includes the T-shaped fitting **70'**, the housing means **142'** and valve structure therein, the squeeze bulb assembly, the spacer **206**, fitting **212** and the fuel conveying tubes **138'**, **170'** and **216**. By making available the priming assembly components as a package or kit, a conventional carburetor installation can be readily supplemented by the engine starting priming device of the invention without the use of special tools.



FIGURE 11 illustrates the priming arrangement employed for delivering priming fuel into the mixing passage in the carburetor downstream of the throttle valve. The carburetor and fuel pump construction **10''** is of the same type as hereinbefore described, the carburetor body **12''** having a mixing passage shown in broken lines including the mixture outlet region **20''**. The throttle valve is journaled on the shaft **34''**.

The carburetor body is fashioned with a bore opening into the mixing passage outlet region **20''**, the bore accommodating a fitting **220** which may be of the character shown at **212** in FIGURE 10, the passage in the fitting opening directly into the mixing passage in the carburetor body. The T-shaped fitting **70''** has a nipple portion **74''** which is connetced by a tube (not shown) with a fuel tank of the character shown at **78** in FIGURE 1.

A branch of the fitting **70''** extending into the carburetor body and another branch or nipple portion **136''** is connected by a tube **138''** with the housing means **142''** containing the valve means for cooperation with the squeeze bulb **178''**. The squeeze bulb is connected to the housing means **142''** by a tube **170''** and the fitting **220** connected to the housing means **142''** by a tube **224**.

The operation of the arrangement shown in FIGURE 11 is the same as that shown in FIGURE 10 except that the priming fuel from the fuel tank is delivered directly into the mixing passage in the carburetor which is a component of the engine induction system.

The arrangements of priming device illustrated herein are also usable with four cycle internal combustion engines, the priming fuel being delivered either into the mixing passage of the carburetor as illustrated in FIGURE 10 or directly into the mixture intake manifold of a four cycle engine.

I claim:

**1.** Priming means for an internal combustion engine comprising housing means having an inlet port and an outlet port, a passage in communication with the inlet port adapted to be connected with a supply of liquid fuel, a manually actuable variable volume fuel storage member connected with said housing means, passage means connecting the outlet port with the induction system of an engine, a valve member in said housing means for cooperation with both the inlet and outlet ports and disposed to admit fuel from the supply through the inlet port into the variable volume storage member upon increase in volume of the said fuel storage member, said valve member being movable responsive to reduction in volume of the variable volume member to admit fuel from the variable volume member through said passage means to the induction system of the engine.

**2.** Priming means for a two-cycle internal combustion engine equipped with a charge forming apparatus in communication with the engine crankcase including, in combination, tubular means for conveying liquid fuel from a supply to the charge forming apparatus, housing means having an inlet port and an outlet port, said inlet port being arranged to receive fuel from the supply, a manually actuable variable volume fuel storage member having connection with the inlet port of said housing means, a valve of flexible material in said housing means for cooperation with both the inlet port and the outlet port, and means connected with the outlet port of the housing means for conveying fuel from the housing means to the crankcase of the engine, said valve being responsive to manual pressure on said variable volume fuel storage member to direct the fuel from said member through the fuel conveying means to the crankcase of the engine and upon an increase in volume of the fuel storage member to admit fuel from the supply into the storage member.

**3.** Priming means for an internal combustion engine comprising housing means having a passage adapted to

be connected with a supply of liquid fuel, a manually actuable variable volume fuel storage member connected with said housing means, passage means connecting the housing means with the induction system of an engine, valve means in said housing means, said valve means comprising a disc of flexible material, an interior portion of the housing means providing an annular seat engageable with the peripheral region of a major surface of the valve disc, said housing means having a second annular valve seat engaged by the opposite major surface of the valve disc adjacent a central region thereof, resilient means normally biasing the central region of the valve disc into engagement with the second valve seat, said valve disc being flexed to admit fuel from the supply into the variable volume storage member upon increase in volume of the said fuel storage member, said valve disc being flexed in response to reduction in volume of the variable volume member to direct fuel from the variable volume member through said passage means to the induction system of the engine.

4. Priming means for an internal combustion engine comprising housing means having a passage adapted to be connected with a supply of liquid fuel, a manually actuable variable volume fuel storage member connected with said housing means, passage means connecting the housing means with the induction system of an engine, valve means in said housing means, said valve means comprising a disc of flexible material, an interior portion of the housing means providing an annular seat engageable with the peripheral region of a major surface of the valve disc, said housing means having a second annular valve seat engaged by the opposite major surface of the valve disc adjacent a central region thereof, an expansive coil spring normally biasing the central region of the valve disc into engagement with the second valve seat, and a spherically-shaped member disposed between the coil spring and the valve disc, said valve disc being flexed to admit fuel from the supply into the variable volume storage member upon increase in volume of the said fuel storage member, said valve disc being flexed in response to reduction in volume of the variable volume member to direct fuel from the variable volume member through said passage means to the induction system of the engine.

5. Priming means for an internal combustion engine comprising housing means having a passage adapted to be connected with a supply of liquid fuel, a manually actuable variable volume fuel storage member connected with said housing means, said variable volume fuel storage member being of flexible material having an open end defined by an inwardly extending flange, a body member having an outwardly extending flange contiguous with the flange on said variable volume member, said body member having a shank portion, a collar having an opening receiving the shank portion and having a peripheral region contiguous with the exterior wall of said variable volume member, said shank portion having passage means for connection with said housing means, locking means cooperating with the shank portion of the body member for securing said flanges and said collar in sealing engagement with the variable volume member, passage means connecting the housing means with the induction system of an engine, valve means in said housing means disposed to admit fuel from the supply into the variable volume storage member upon increase in volume of the said fuel storage member, said valve means being movable responsive to reduction in volume of the variable volume member to direct fuel from the variable volume member through said passage means to the induction system of the engine.

6. Priming means for an internal combustion engine equipped with a carburetor having a fuel and air mixing passage, housing means, a fuel delivery passage opening into the mixing passage and in communication with said housing means, means for conveying liquid fuel from a supply to said carburetor and to said housing means, a manually actuable variable volume fuel storage member having connection with said housing means, a valve of flexible material in said housing means, said valve being responsive to manual pressure on said variable volume fuel storage member to direct fuel from said member through the fuel delivery passage into the mixing passage of the carburetor and upon enlarging volume of the fuel storage member to direct fuel from the supply into said member.

7. The combination according to claim 6 wherein the carburetor is of the aspirated diaphragm type and the variable volume member is a squeeze bulb.

8. Fuel priming means for an internal combustion engine equipped with a carburetor having a mixing passage, means for conveying liquid fuel from a supply to the carburetor, a fitting disposed between the carburetor and the engine having an opening registering with the mixing passage of the carburetor, a fuel passage in a wall of said fitting, housing means in communication with said full passage, a manually actuable variable volume fuel storage member, said housing means having fuel conveying connections with the fuel supply and the variable volume member and the passage in said fitting, and valve means in the housing means, said valve means being responsive to variations in volume of the member to admit fuel from the supply into the variable volume member upon enlargement of the said member and to direct fuel from the variable volume member through the passage and into the opening in the fitting upon reduction in volume of the variable volume member.

9. Fuel priming means for an internal combustion engine equipped with a carburetor having a mixing passage, means for conveying liquid fuel from a supply to the carburetor, a spacer member disposed between the carburetor and the engine having an opening registering with the mixing passage of the carburetor, a fuel passage in said spacer member, a squeeze bulb, housing means having fuel conveying connections with the fuel supply and the squeeze bulb and the fuel passage in said spacer member, and valve means in the housing means, said valve means being responsive to variations in volume of the squeeze bulb to admit fuel from the supply into the squeeze bulb upon enlargement of the said bulb and to direct fuel from the bulb through the fuel passage and into the opening in the spacer member upon reduction in volume of the bulb.

10. Fuel priming means for an internal combustion engine comprising housing means having a passage adapted to be connected with a supply of liquid fuel, a manually actuable variable volume fuel storage member connected with said housing means, a fitting having an opening forming a component of the induction system of the engine, a fuel passage in a wall of said fitting in communication with the opening in the fitting, tubular means connecting the fuel passage with said housing means, a manually actuable variable volume fuel storage member connected with the housing means, said housing means having a tubular portion arranged to receive liquid fuel from a supply, valve means in said housing means comprising a disc of flexible material, said housing means having valve seats engaged by opposite major surfaces of the valve disc, said valve disc being flexed by reduction in volume of the variable volume member to direct fuel from said member to the fitting, said valve disc being flexed to admit fuel from the supply upon increase in volume of the variable volume member to fill the variable volume member with fuel.

11. The combination according to claim 10 wherein the variable volume fuel storage member is a squeeze bulb of flexible material.

12. In a priming means for an internal combustion engine, housing means having connection with a supply of liquid fuel, means connecting the housing means with the induction system of the engine, flexible valve means in the housing, a manually actuable squeeze bulb as-

sociated with said housing means forming a variable volume fuel storage means, said squeeze bulb being of flexible material and having an internally extending flange defining an opening in one end thereof, a metal member extending through the opening and having an outwardly extending flange contiguous with the flange on said squeeze bulb, said metal member having a passage in communication with the housing means for admitting fuel into and conveying fuel away from the squeeze bulb, said metal member having a shank portion, a reinforcing collar having an opening accommodating the shank portion and a peripheral portion contiguous with a peripheral region of the squeeze bulb, and locking means cooperating with the shank portion for effecting a liquid tight seal between the flanges on the metal member and the squeeze bulb.



**References Cited**

UNITED STATES PATENTS

| | | | |
|---|---|---|---|
| 1,369,608 | 2/1921 | Bintliff | 123—187.5 |
| 1,495,315 | 5/1924 | Ball | 123—187.5 |
| 3,371,658 | 3/1968 | Turner | 123—187.5 |

FOREIGN PATENTS

| | | |
|---|---|---|
| 13,058 | 12/1911 | Great Britain. |
| 486,858 | 2/1918 | France. |

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123—73; 230—228