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PRIMING AND VENTING ARRANGEMENT FOR FUEL FEED SYSTEM

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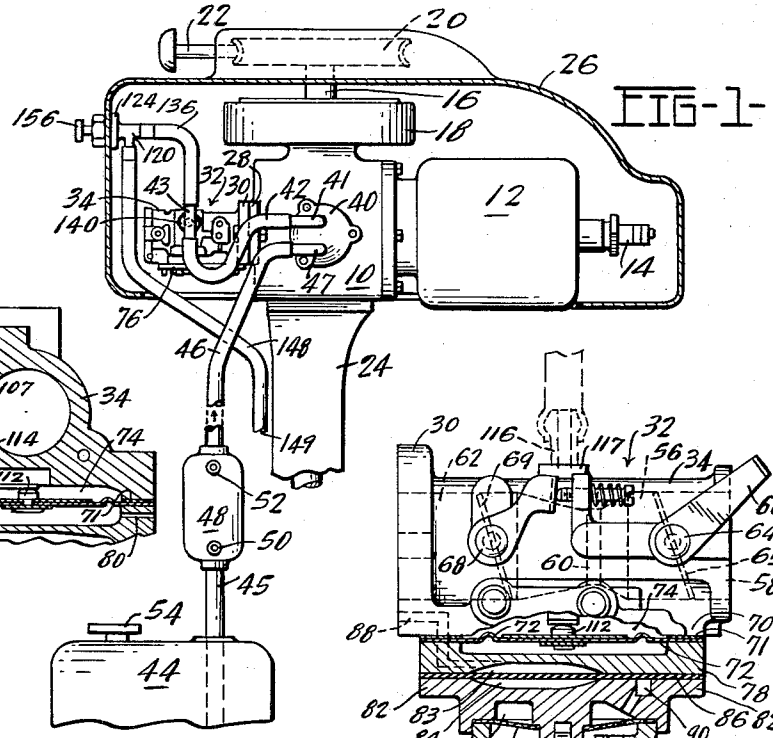


FIG-1-

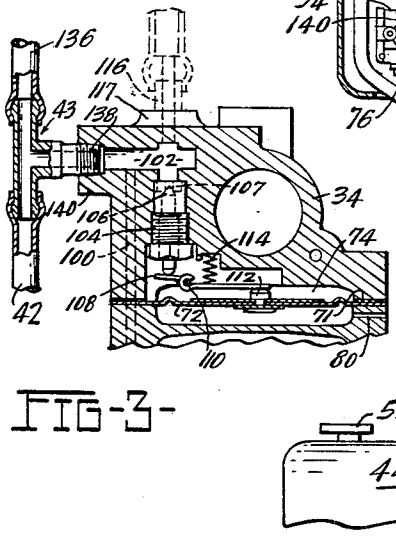


FIG-3-

FIG-2-

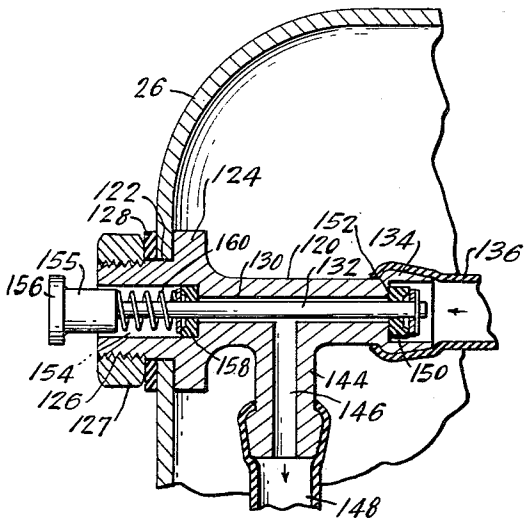


FIG-4-

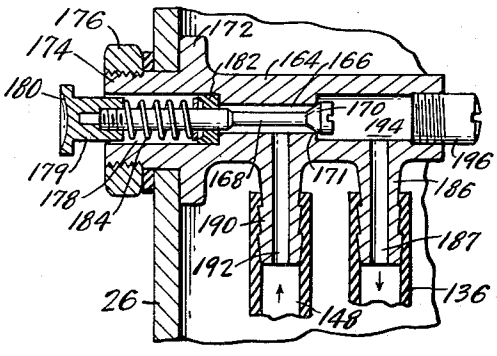


FIG-5-

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PRIMING AND VENTING ARRANGEMENT FOR FUEL FEED SYSTEM

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This invention relates to a priming and venting arrangement or system for a fuel feed system especially of the character for supplying liquid fuel to an internal combustion engine and more especially to an arrangement of this character usable with a fuel feed system embodying a diaphragm type carburetor or charge forming apparatus wherein the metering of fuel into the mixing passage of the charge forming apparatus is controlled by aspiration in the mixing passage.

The invention has particular utility with the fuel feed system of internal combustion engines of the character employed for marine or outboard installation of the character wherein priming is usually necessary in order to successfully initiate the operation of the internal combustion engine. Priming devices have been employed with charge forming apparatus of outboard engines particularly of the two cycle type embodying so-called float type carburetors wherein the fuel level in a vented bowl of the carburetor is regulated by a float actuated inlet valve.

With this type of carburetor, a hand operated priming pump of the "squeeze bulb" type may be successfully employed to elevate fuel from a supply tank disposed at a lower level than the carburetor through a tube into the carburetor and the air purged from the tube through the carburetor bowl as the latter is vented, thus enabling the escape of air entrapped in the fuel supply tube connected with the carburetor. In a diaphragm type carburetor wherein a metering diaphragm controls the flow of fuel into a diaphragm or fuel chamber, the fuel chamber is unvented and it is difficult or virtually impossible to prime air locked fuel lines from the supply tank through a fuel pump to the diaphragm carburetor. The fuel pump is usually of the diaphragm type actuated by pulsations from the crankcase of a two cycle engine or other source of varying fluid pressure. In a fuel feed system of this character, the fuel inlet valve of the carburetor is biased to closed position by a spring. If pressure is exerted upon a priming pump sufficient to overcome the spring pressure holding the fuel inlet valve in closed position, the inlet valve is opened and fuel flows through the diaphragm chamber directly into the mixing passage flooding the same so that it is impossible to initiate operation of the engine.

The present invention embraces a method, arrangement or system particularly usable with a diaphragm type carburetor or charge forming apparatus and a fuel pump wherein a priming means is associated with a venting means whereby entrapped air in the fuel lines or tubes may readily escape in order to successfully prime the fuel lines to the carburetor and through the fuel pump to initiate operation of an internal combustion engine with which the arrangement is associated.

Another object of the invention resides in a priming and venting system for purging fuel conveying means or tubes from a fuel tank to a carburetor wherein the operator is visually informed by flow of fuel out of the venting means that the system has been purged of entrapped air and the system conditioned for engine operation.

Another object of the invention is the provision of a priming and venting system or arrangement for fuel feed apparatus for an internal combustion engine embodying a relief or venting valve arranged to be automatically

biased toward vent closing position during all normal operations of the engine to thereby avoid inadvertent waste of fuel.

Another object of the invention is the provision of a venting and priming arrangement or system for a fuel feed system and apparatus for an internal combustion engine which is usable with various types of carburetor and fuel pump constructions without modification of these components of the fuel feed system, the arrangement being such that comparatively low pressure upon the priming pump is required to purge iar from the fuel supply to the charge forming apparatus or carburetor for engine operation.

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 semi-diagrammatic illustration of the priming and venting arrangement or system of the invention associated with a fuel feed pump and charge forming apparatus associated with a two cycle internal combustion engine of the outboard type;

FIGURE 2 is an elevational view of a combined diaphragm type carburetor and pulse operated fuel pump with which the invention has particular utility, portions of the carburetor and fuel pump being shown in cross-section for purposes of illustration;

FIGURE 3 is a transverse sectional view through the charge forming apparatus or carburetor illustrated in FIGURE 2;

FIGURE 4 is an enlarged sectional view illustrating one form of valved venting means of the invention, and

FIGURE 5 is a sectional view illustrating another form of valved venting means of the invention.

While the priming and venting arrangement or system of the invention has particular utility in combination with a fuel feed system embodying a carburetor or charge forming means of the diaphragm type utilized in conjunction with either two cycle or four cycle engines of the outboard marine type, it is to be understood that the priming and venting arangement may be utilized with other types of charge forming apparatus for use with stationary internal combustion engines or other fuel feed systems where priming means is essential or desirable.

Referring to FIGURE 1 of the drawings, there is illustrated in semi-diagrammatic form the arrangement or system of the invention utilized with a carburetor or charge forming device of the aspirated diaphragm type and a pulse actuated fuel pump comprising a fuel delivery system for delivering liquid hydrocarbon fuel and air mixture into the crankcase of an internal combustion engine of the two cycle type usable for propelling boats where it is conventional for the fuel tank or fuel receptacle to be positioned beneath or at a lower level than the carburetor requiring fuel pumping means to deliver fuel from the tank or receptacle to the carburetor.

With particular reference to FIGURE 1 the engine illustrated comprises a crankcase **10**, a cylinder **12** secured to the crankcase, a crankshaft **16**, piston and connecting rod of conventional construction (not shown) being enclosed within the crankcase and cylinder, the cylinder being provided with a spark plug **14** for igniting charge forming mixture in the cylinder. The engine crankshaft **16** is equipped with a flywheel **18** and a starting pulley **20**, the latter adapted to be initially rotated by a starting cable **22** in the conventional manner.

A hollow strut or tubular enclosure **24** secured to the crankcase **10** projects downwardly and encloses a shaft for transmitting power to a propeller (not shown) at the lower end of the hollow strut **24**. A sheet metal enclosure **26** surrounds the crankcase, the cylinder and the flywheel as illustrated in FIGURE 1.

The crankcase **10** is provided with a boss portion **28** adapted to mate with a mounting flange **30** of a diaphragm carburetor or charge forming device or apparatus **32**. The carburetor **32** in FIGURE 1 is the same as that shown in FIGURE 2. However the carburetor **32** shown in FIGURE 2 is provided with a pulse operated fuel pump while the carburetor shown in FIGURE 1 receives liquid fuel from a separate fuel pump **40**. The mounting flange **30** is integrally formed with the carburetor body **34** as shown in FIGURE 2, and is secured to the crankcase by suitable bolts (not shown).

In the arrangement shown in FIGURE 1, the fuel pump **40** is secured to the crankcase **10**, the pump being of a diaphragm type in which the diaphragm is actuated or vibrated by varying fluid pressure in the crankcase **10** of the two cycle engine in which the fuel and air mixture is pre-compressed in the crankcase prior to its delivery into the combustion chamber of the cylinder. A tube or duct means **42** connects the outlet fitting **41** of the fuel pump **40** with the inlet duct of the carburetor through a T-shaped fitting **43**.

A fuel tank or fuel receptacle **44** disposed below the carburetor **32** is connected to the inlet fitting **47** of the fuel pump **40** by tubular means or tubes **45** and **46** and a priming pump **48** of the flexible squeeze bulb type connected with the tubular means **45** and **46**. The priming pump means **48** is provided with inlet and outlet check valves **50** and **52** of conventional type to promote fluid or liquid flow from the receptacle to the pump **40** thence to the carburetor **32** under conditions hereinafter described. The fuel tank **44** is preferably provided with a manually operated vent valve **54** to close the vent in the fuel tank when the engine is not in operation.

The carburetor illustrated in FIGURES 1 through 3, with which the invention has particular utility is of the so-called aspirated type, the body **34** being formed with a mixing passage **56** including an air inlet **58**, a Venturi **60** and a mixture outlet **62**, the latter registering with a valved passage of conventional construction provided in the boss **28** on the crankcase **10**. A shaft **64** journaled in openings in the body **34** extends across the air inlet **58** and is equipped with a conventional disk-type choke valve **65** for restricting the air inlet during engine starting operations.

The choke valve is manipulated by an arm **66** secured to the shaft **64**. A shaft **68** extends across the mixture outlet passage **62** and is equipped with a disk-type throttle valve **69** of conventional construction for controlling delivery of fuel and air mixture into the crankcase of the engine. The throttle is operated by an arm (not shown) mounted on the shaft **68**. The charge forming device or carburetor **32** is provided with a circular wall portion **70** which forms a seat for a gasket **71**, a diaphragm **72** made of flexible imperivous material such as nylon fabric impregnated with a synthetic rubber-like material or resin which is not subject to deterioration by liquid hydrocarbon fuels.

The diaphragm is highly flexible and forms a wall of a shallow fuel chamber or diaphragm chamber **74** formed in the body **34**. When the carburetor of the character shown in FIGURES 1 through 3 is employed with a separate fuel pump **40** as shown in FIGURE 1, the diaphragm **72** is covered by a closure plate **76** shown in FIGURE 1 which is recessed at the region adjacent the diaphragm to permit flexing movements of the diaphragm **72**.

When the carburetor is used in combination with a fuel pump secured directly to the body **34**, the diaphragm **72** is secured in place by a disk-like member **78** shown in FIGURES 2 and 3 which also forms a component of

the diaphragm fuel pump construction. The cover **76** shown in FIGURE 1 is secured to the carburetor body by suitable screws. The clearance space between the recessed central region of the cover **76** and the diaphragm is vented to the atmosphere through a suitable small opening (not shown) to prevent air lock in the recess.

In the arrangement shown in FIGURE 2 the vent opening for the recessed cover member **78** is illustrated at **80** in FIGURE 3. The diaphragm fuel pump construction, forming a part of the carburetor combination shown in FIGURES 2 and 3, includes a member **82**, the members **78** and **82** being formed respectively with cavities, recesses or chambers **83** and **84**, a pumping diaphragm **86** being disposed between the members **78** and **82** and extending across and between the cavities **83** and **84**.

The cavity or recess **83** provides with the diaphragm **86** a pumping chamber, the diaphragm being pulse operated by varying fluid pressure, a pulse channel **88** formed in the mounting flange **30** being in communication with the pumping chamber **83** is also in communication with an opening in the cranckcase of the engine registering with the pulse channel. The varying fluid pressure in the crankcase provides the movant for pulsing or vibrating the pumping diaphragm **86** to exert pumping impulses in the fuel chamber **84**.

The pump construction illustrated in FIGURE 2 is of the character shown in my Patent No. 2,841,372. The member **82** is provided with inlet and outlet ports, the inlet port being illustrated at **90** in FIGURE 2 which is in communication with a recess **92** formed in the member **82**. A filter screen **93** extends across the recess **92** and a closure member **94** is secured to member **82** by means of a screw **95**. The member **94** is provided with a recess **96** which receives incoming fuel through a tubular nipple portion **98** and a flexible tube **46'**, the tube **46'** being connected with the priming pump **48** shown in FIGURE 1.

The pumping diaphragm **86** is provided with integral flap valves for cooperation with the inlet and outlet ports formed in the member **82**. The outlet port (not shown) is connected by an internal channel or fuel conveying duct **100** with the inlet **102** formed in the carburetor body **34**. A threaded fitting **104** in the carburetor body is provided with a bore in which is disposed a fuel inlet control valve **106**, the lower end of which engages or contacts one arm of a lever **108** fulcrumed on a pin **110** in the carburetor body.

The other arm of the lever engages a member **112** carried by the central region of the fuel metering diaphragm **72** of the carburetor. The valve member **106** has a cone shaped portion which cooperates with an annular valve seat **107** disposed in the inlet passage in the carburetor body. A spring **114** engages the lever **108** to normally bias the valve **106** toward closed position and the end of the lever toward engagement with the member **112** mounted on the fuel metering diaphragm **72**.

Under the varying pulsing pressure derived from the crankcase which is communicated to the pumping chamber **83** through the pulse passage **88**, the region of the pumping diaphragm at the cavities **83** and **84** is caused to vibrate to elevate fuel from the supply tank when the fuel conveying arrangement is properly primed.

The fuel feeding and priming system of the invention is inclusive of a valve arrangement or construction for venting the fuel supply tubes or tubular means during manual operation of the priming pump **48** to purge the fuel lines or air and elevate fuel through the pump to the carburetor preparatory to starting the engine. One form of valve construction is illustrated in FIGURES 1 and 4. The valve arrangement comprises a T-shaped fitting or member **120** provided with a tenon portion **122** which extends through an opening in the casing or engine enclosure **26**, an abutment **124** engaging the housing to position the fitting with respect thereto.

The tenon portion has a threaded region **126** to receive a securing nut **127**, a sealing gasket **128** being disposed between the securing nut and the outer surface of the housing **26**, the nut serving to hold the fitting **120** securely to the housing. The fitting **120** is provided with a bore or passage **130** in which is slidably disposed a rod or member **132** of lesser diameter than the passage **130** to facilitate flow of fuel through the passage **130**.

The fitting is provided with a nipple portion **134** which is adapted to receive one end of a fuel conveying tube or tubular means **136**, the other end of the tubular means **136** being connected with the T-shaped fitting **43**, a stem **138** of the fittting being threaded into a boss **140** formed on the carburetor body when the arrangement shown in FIGURE 1 is employed in association with the fuel pump **40**.

When the carburetor-pump combination shown in FIGURE 2 is utilized, the T-shaped fitting **43** is replaced by a threaded plug, and a nipple **116** threaded into a threaded passage formed in a boss **117** on the carburetor body, the passage communicating with the inlet **102**. In this arrangement, the fuel from the fuel pump shown in FIGURE 2 is conveyed to the carburetor inlet **102** through the internal passage **100** in communication with the outlet port of the fuel chamber **84** of the pump. The nipple **116** is connected with the vent fittting **120**.

A side branch **144** of the fitting **120** is provided with a vent passage or port **146** to which may be secured a vent tube **148** projecting through an opening in the housing **26** to a position illustrated in FIGURE 1 with its outlet **149** visible to the operator. Thus during a priming operation, fuel discharged through the vent outlet **149** indicates to the operator that the fuel feed lines or tubular means have been purged of air and are filled with liquid fuel.

Secured to one end of the rod **132** in the fitting **120** is a valve member or obturator **150** of rubber-like material which is adapted to seat against a shoulder **152** formed in a recess in the fittting and close the inlet of the passage **130** in the manner shown in FIGURE 4. The opposite end of the fitting is provided with a bore **154** which accommodates a tenon portion **155** of a manipulating button or member **156** secured upon the end of the rod **132**. A sealing gasket **158** surrounding the rod **132** is disposed in the recess **154**, a spring **160** positioned between the sealing gasket and the tenon portion of the button **156** normally biasing the valve or obturator **150** toward closed position.

This is the normal position of the valve during engine operation and prevents flow of fuel through the passage **130** to the outlet or port **146**. The valve arrangement is adapted to be opened by the operator exerting pressure upon the button **156** to move the rod **132** and the valve **150** in a right-hand direction, as viewed in FIGURE 4, which opens or vents the passage **130** to facilitate flow of entrapped air or volatilized fuel in the fuel line arrangement through the vent or port **146** and through the tube **148**.

In initiating starting operations of the engine the operations of venting and priming the fuel conveying lines or tubular means are as follows:

The operator depresses the button **156** by exerting pressure thereon to move the valve **150** to open position away from the shoulder **152** shown in FIGURE 4 establishing communication between the tube **136** and the vent or outlet port **146**. The operator then exerts squeeze pressure upon the priming pump member **48**, the latter action forcing any entrapped air in the tubular means **46**, **42** and **136** through the passage **130** into the outlet or vent **146**.

When fuel is discharged from the outlet **149** of tube **148**, the operator is thus visually informed that the system is purged of air. The operator releases pressure upon the button **156** and the valve member **150** is closed automatically by the biasing pressure of the spring **160**. Further operation of the priming pump **48** is unnecessary. These operations fill the tubular means **45**, **46**, **42**, the fuel pump and the T-shaped fitting **43** with fuel so that fuel is at the region of the inlet valve **106** of the carburetor.

The throttle valve **64** is opened, the choke valve **65** is closed, and the engine then cranked by manipulation of the starting cable **22**. Reciprocation of the engine piston sets up reduced pressure in the crankcase **10** effective to cause flow of air through the mixing passage in the carburetor and flow of fuel through a main orifice opening into the mixing passage from the diaphragm fuel chamber **74**. The reduced pressure or aspiration in the mixing passage is effective in the chamber **74** to cause upward flexure of the diaphragm **72** whereby the inlet control valve **106** is moved away from its seat and fuel flowed through the inlet passage **102** into the chamber **74** thence into the mixing passage.

The carburetor may be provided with a secondary fuel delivery system including engine idling and low speed orifices (not shown) of conventional construction to facilitate operation of the engine at low or idling speeds. In the arrangement shown in FIGURE 1, the pulse operated diaphragm pump **40** continues to elevate fuel from the fuel receptacle **44** and deliver the fuel to the carburetor as long as the engine is in operation.

FIGURE 5 is illustrative of a modified form of valve construction for venting the fuel feed or supply tubes. In this form the fitting **164** is provided with a passage **166** in which is disposed a longitudinally movable rod **168** equipped at one end with a valve means or obturator **170**. The fitting has a shoulder or flange **172** which abuts the housing **26**, the threaded tenon portion **174** of the fitting receiving a nut **176** for securing the fitting to the housing **26**.

The fitting is provided with a bore **178** accommodating a tenon portion **179** of a manipulating member or button **180** which is secured to the opposite end of the rod **168**. A sealing gasket **182** surrounds the shaft in the bore **178** to prevent flow of liquid fuel along the shaft in the region of the bore **178**. An expansive coil spring **184** is disposed between the sealing gasket **182** and the manipulating button **180**, the spring normally and automatically biasing the valve **170** into its seat **171** at the entrance of the passage **166**.

The fitting **164** is provided with a hollow nipple **186** providing an inlet passage or port **187** which is adapted to be connected with the tube **136** which is in communication with the fuel inlet region of the carburetor as hereinbefore described. The fitting **164** is provided with a second hollow nipple portion **190** providing an outlet, vent or port **192**. The tube **148** is connected to the nipple **190** and serves the purposes hereinbefore described in reference to the arrangement shown in FIGURE 1. Fuel flow through the outlet end of the tube **148** indicates to the operator that the fuel supply lines or system have been purged of air.

The end of a passage **194** adjacent the valve **170** is closed by means of a threaded plug **196**. The operation of the vent valve arrangement shown in FIGURE 5 is substantially the same as the operation of the vent valve arrangement shown in FIGURE 4. When it is desired to prime the fuel system by purging air from the fuel lines, the operator depresses the plunger **180** moving the valve member **170** to open position and, while holding the valve in open position, operates the squeeze member or priming pump **48**, which action forces air in the fuel lines through the inlet or inlet port **187** and past the valve **170** along the passage **166** and through the vent or outlet port **192**.

When fuel is delivered from the outlet end **149** of the tube **148**, the operator is visually informed that the fuel lines have been filled with liquid fuel and purged of air and releases pressure on the button **180**.

The expansive pressure of spring 184 automatically closes the vent valve 170 to prevent any further flow of fuel through the vent or outlet port 192.

If desired, a transparent sight tube may be inserted in the discharge tube 148 in convenient view of the operator and, with such installation, the outlet or vent 149 may be discharged into the tubular strut 24, the fuel supply tank 44 or other region remote from the vent control valve.

Through the arrangement of the invention, the fuel feed system may be readily and quickly primed and as soon as the priming operations are completed, the vent valve member is automatically maintained in closed position under the biasing pressure of the spring means so that during engine operation no further flow of fuel through the vent means will take place.

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. A fuel feed system including a charge forming apparatus, a fuel pump arranged to receive liquid fuel from a fuel tank, a manually operable priming pump, tubular means connecting the priming pump with the fuel pump and the supply tank, duct means arranged to convey liquid fuel from the fuel pump to the charge forming apparatus, venting means including a fitting formed with a vent passage having communication with said duct means, manually operable valve means normally closing the passage, said valve means being movable to a position to vent the passage for purging air from the tubular means and the duct means, and means normally biasing the valve means toward closed position said venting means including means arranged to be visible to the operator whereby discharge of fuel through the venting means indicates the completion of purging of air from the fuel feed system.

2. A fuel feed system including a charge forming apparatus, a fuel pump arranged to receive liquid fuel from a fuel tank, a manually operable priming pump, tubular means connecting the priming pump with the fuel pump and the supply tank, duct means arranged to convey liquid fuel from the fuel pump to the charge forming apparatus, venting means including a fitting formed with a passage having communication with said duct means, manually operable valve means for closing the passage, means biasing the valve means toward closed position, said valve means being movable to an open position to vent the passage for purging air from the tubular means and the duct means venting means including means arranged to be visible to the operator whereby discharge of fuel through the venting means indicates the completion of purging of air from the fuel feed system.

3. A fuel feed system for delivering liquid fuel to a charge forming apparatus including a fuel pump connected with a fuel supply tank, a manually operated priming pump, tubular means connecting the priming pump with the fuel pump and the supply tank, duct means adapted for conveying fuel from the fuel pump to the charge forming apparatus, venting means including a fitting having a passage formed therein for venting the system, said fitting being formed with inlet and outlet ports for said passage, tubular means connecting the inlet port with said duct means, and manually operable valve means obturating said passage movable to a position venting the inlet port to the outlet port, and resilient means normally biasing the valve means to passage obturating position said venting means including means arranged to be visible to the operator whereby discharge of fuel through the venting means indicates the completion of purging of air from the fuel feed system.

4. A fuel feed system for delivering liquid fuel to a charge forming apparatus including a fuel pump connected with a fuel supply tank, a manually operated priming pump, tubular means connecting the priming pump with the fuel pump and the supply tank, duct means adapted for conveying fuel from the fuel pump to the charge forming apparatus, venting means including a fitting having a passage formed therein, inlet and outlet ports of said passage, tubular means connecting the inlet port with said duct means, manually operable valve means for said inlet port movable to a position venting the inlet port to the outlet port, and resilient means normally biasing the valve means to close the inlet port said venting means including means arranged to be visible to the operator whereby discharge of fuel through the venting means indicates the completion of purging of air from the fuel feed system.

5. A fuel feed system for delivering liquid fuel to a charge forming apparatus including a fuel pump connected with a fuel supply tank, a manually operated priming pump, tubular means connecting the priming pump with the fuel pump and the supply tank, duct means adapted for conveying fuel from the fuel pump to the charge forming apparatus, venting means including a fitting having a passage formed therein, inlet and outlet ports for said passage, tubular means connecting the inlet port with said duct means, manually operated valve means cooperating with the passage in the fitting for normally closing the inlet port in said fitting, said manually operated valve means being movable to a position venting the inlet port to the outlet port during manual operation of the priming pump to purge said tubular means and duct means of air, said venting means including means arranged to be visible to the operator whereby discharge of fuel through the venting means indicates the completion of purging of air from the fuel feed system.

6. A fuel feed system for an internal combustion engine including a diaphragm carburetor and a fuel pump associated therewith and adapted to receive fuel from a supply tank, a manually operated priming pump, tubular means connecting the priming pump with the supply tank and the fuel pump, duct means arranged to convey fuel from the fuel pump to the carburetor, venting means including a fitting provided with a vent passage, means establishing communication of said passage with the duct means, and a manually operable valve for the vent passage, a spring biasing the valve toward closed position, said valve being movable to a position to open said vent passage, said venting means including means arranged to be visible to the operator whereby discharge of fuel through the venting means indicates the completion of purging of air from the fuel feed system.

7. A fuel feed system including an aspirated diaphragm carburetor, a fuel pump, a fuel supply tank, a fuel conveying means arranged to connect the tank with the fuel pump and carburetor, a manually operated priming pump interconnected with the fuel conveying means, venting means including a fitting provided with an inlet and outlet and a relatively movable valve member in said fitting, resilient means normally biasing the valve member to close the inlet, means connecting the inlet of the fitting with a fuel inlet duct of the carburetor, said valve member being arranged to be manually moved to open position during actuation of the priming pump to vent air in said fuel conveying means through the outlet in said fitting, said venting means including means arranged to be visible to the operator whereby discharge of fuel through the venting means indicates the completion of purging of air from the fuel feed system.

8. A fuel feed system including an aspirated diaphragm carburetor, a fuel pump, a fuel supply tank, a fuel conveying means arranged to connect the tank with the fuel pump and carburetor, a manually operated priming pump interconnected with the fuel conveying means, venting means including a fitting provided with an inlet and outlet, a relatively movable valve member in said fitting, resilient means normally biasing the valve member to closed position, means connecting the inlet of the fitting

with a fuel inlet duct of the carburetor, and manually operable means for moving said valve member to open position during actuation of the priming pump to vent air in said fuel conveying means through the outlet in said fitting, said venting means including means arranged to be visible to the operator whereby discharge of fuel through the venting means indicates the completion of purging of air from the fuel feed system.

9. A fuel feed system for an internal combustion engine, said system including a diaphragm carburetor provided with a diaphragm-controlled fuel inlet valve and a fuel pump associated therewith and adapted to receive fuel from a supply tank, a manually operated priming pump, tubular means connecting the priming pump with the supply tank and the fuel pump, duct means connecting the fuel pump with the carburetor, venting means including a fitting provided with a vent passage, means establishing connection of said passage with the duct means, the means connecting the passage and duct means being arranged to bypass the fuel inlet valve, and a manually operable valve for the vent passage, means normally biasing the valve toward closed position, said valve being movable to a position to open the vent passage to purge the tubular means and duct means of air, said venting means including means arranged to be visible to the operator whereby discharge of fuel through the venting means indicates the completion of purging of air from the fuel feed system.

10. A fuel feed system for an internal combustion engine including a diaphragm carburetor provided with a diaphragm-controlled fuel inlet valve and a fuel pump associated therewith and adapted to receive fuel from a supply tank, a manually operated priming pump, tubular means connecting the priming pump with the supply tank and the fuel pump, duct means connecting the fuel pump with the carburetor, a fitting provided with a vent passage, means establishing connection of said passage with the duct means, the means connecting the passage and duct means being arranged to bypass the fuel inlet valve, a manually operable valve for the vent passage, said valve being movable to a position to open the vent to purge the tubular means and duct means of air, and means normally biasing the vent valve toward closed position, the vent

being arranged to be visible to the operator whereby discharge of fuel through the vent indicates the completion of purging of air from the fuel feed system.

11. A fuel feed system for an internal combustion engine including a diaphragm carburetor provided with a diaphragm controlled fuel inlet valve and a fuel pump associated therewith and adapted to receive fuel from a supply tank, a manually operated priming pump, tubular means connecting the priming pump with the supply tank and the fuel pump, duct means connecting the fuel pump with the carburetor, a fitting provided with a vent passage, means establishing connection of said passage with the duct means, the means connecting the passage and duct means being arranged to bypass the fuel inlet valve, a manually operable valve for the vent passage, a tube connected with the vent passage, said valve being movable to a position to open the vent to purge the tubular means and duct means of air, means normally biasing the vent valve toward closed position, the vent tube being disposed in a position of view of the operator whereby discharge of fuel through the vent tube indicates the completion of purging of air from the fuel feed system.

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2,795,269	6/57	Witte	158—36.4 X
2,808,102	10/57	Lidecker	158—38
2,818,111	12/57	Ross	158—36.4

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