LIQUID FUEL BURNING APPLIANCE AND COMPONENTS THEREFOR

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ABSTRACT OF THE DISCLOSURE

A liquid fuel burning appliance which vaporizes the fuel before it is ignited, including a fuel control valve having a single control member that closes to stop all fuel flow, that partially opens to pass mainly a gaseous mixture of fuel for ready initial ignition and that adjustably fully opens to meter liquid fuel for sustained operation; and including a fuel tank having readily separable components for improved maintenance and durability.

This invention relates to a liquid fuel fired appliance that requires the liquid fuel first to be vaporized before it is ignited and burned, and more particularly, to improved components thereto including a fuel control valve and a fuel tank. The particular valve has a single control member in one position for completely closing the valve to shut off the appliance, suitable in another position for delivering a highly vaporized mixture of gasoline and air to the appliance for initial ignition thereof, suitable in still another position for delivering liquid fuel which can be vaporized by the heat of combustion to the appliance for sustained operation at variable outputs. The subject fuel tank provides air pump and check valve components that can be readily assembled or disassembled for improved reliability.

Portable camping stoves, lanterns and other appliances commonly burn a liquid gasoline fuel which must first be vaporized before it is combusted. Ignition of the fuel is a problem with appliances of this type since the liquid fuel has little tendency to vaporize completely and excessive liquid fuel commonly can be delivered to the appliance before reliable combustion occurs. Consequently, serious accidents can occur during the starting of gasoline fired appliances, caused mainly by flashign of the excessive liquid gasoline. Moreover, improper maintenance of major components of the appliance, such as the air pump and check valve, impairs both the safety and the efficient operation of the appliance.

Accordingly, an object of this invention is to provide in a liquid fuel fired appliance a fuel control valve that can be moved to one position to permit easy initial starting of the appliance and yet can be moved to another position for smooth sustained operation of the appliance after it has been once started.

A more detailed object of this invention is to provide an improved fuel control valve having a single control member that discharges abundant vaporous fuel from a fuel tank to a mixing carburetor for initially starting the appliance, and that discharges liquid fuel only from the fuel tank after the initial ignition for sustained operation of the appliance.

Another object of this invention is to provide in a gasoline fired appliance an improved fuel tank having respective components including an air pump and check valve that are readily disassembled and assembled to provide for easy cleaning and/or replacement of the components.

These and other objects will be more fully understood and appreciated after referring to the following specification, including the accompanying drawing which forms a part thereof, wherein:

FIG. 1 is a perspective view of a typical gas fired appliance in the form of a camping stove incorporating the subject invention;
FIG. 2 is a side elevation view, partly in section, of the camping stove shown in FIG. 1, except with the cover closed;
FIG. 3 is an enlarged sectional view, as seen generally from line 3—3 in FIG. 1 of the subject control valve; and,
FIG. 4 is an enlarged section view, as seen generally from line 4—4 in FIG. 1, of the subject fuel tank.

In the drawing, a portable camping stove 10 shown which includes an open top body 12 and a cover 14 pivoted thereto by means of hinges 16 which when closed forms a generally boxlike structure (FIG. 2) and when opened exposes a grate 18 overlying spaced burners 20 and 21. Deflectors 24 are pivoted to the underside of cover 14 and can be swung out from the position shown in FIG. 1 to a position generally parallel to end walls 26 of the body 12 to shield the burners from the wind. A fuel tank 28 is releasably held to the body 12 by clips 30 received within openings in front wall 32 of the body, and a hollow conduit 34 communicates from the fuel tank through carburetor 36 and pipes 38 to the burner 20. The two burners 20 and 21 are connected together by pipe 40, with a valve 42 therein regulating the flow of combustible fuel mixture from burner 20 to the burner 21.

One feature of this invention is the fuel control valve 50 located on the fuel tank 28 in series connection with the conduit 34. The valve 50 includes a T-shaped housing 52 (FIG. 3) having leg portion 54 threaded for sealing connection within a tap on the fuel tank 28. A cavity 56 is formed within the housing, and two tubes 58 and 60 are connected to the housing and communicates between the cavity and fuel tank 28. Tube 58 is relatively short so that its lower open end is spaced above the top surface 62 (FIG. 2) of liquid fuel within the tank; whereas tube 60 is quite long to present its lower open end below the surface of liquid fuel in the tank and preferably adjacent the ignition of the fuel. The cavity 56 communicates through passageway 63 and the conduit 34 with the carburetor 36.

A valve member 64 is received within the housing 52 and movable axially therein upon rotation because of the cooperating threads 66. The valve member presents a portion 68 within the cavity and an elongated stem or throttle section 70 that extends completely through the conduit 34 into an orifice 72. Portion 68 of the valve member defines a number of valve areas each designed to perform a particular function as follows. Initially, first valve area 76 is adapted to seal over and block passageway 63 between the cavity 56 and the carburetor 36 when valve member 64 is threaded completely into the housing 56. This closes the valve and shuts the appliance off. The second valve area 80 cooperates with port 82 connecting the liquid fuel tube 60 to the cavity 56, the valve area being located somewhat downstream of the port when the valve is closed. The valve area 80 does not seal against the peripheral housing walls of the cavity 56, but merely restricts the passage of fluid past these locations. A tapering third valve area 84 cooperates with port 86 connecting the air tube 58 to the cavity 56. A ball check 88 is located in housing passageway 89 to the tube 58, and is normally maintained by spring 92 against the valve seat to close the passageway. A push rod or spacer element 94 is receiver within passageway 89 and is adapted to engage the ball check 88 and to ride on the third valve area or cam surface 94 of the valve member 64.

When the valve 64 is closed, rod 94 is on a high side of valve area 84 to maintain passageway 89 opened for communicating the vaporous section of the fuel tank 28 with cavity 56. Upon opening the valve, first valve area
80 opens passageway 63, and the high surface of valve area 84 engaging the rod 94 maintains ball check 88 open to communicate the vaporous section of the fuel tank 28 with the conduit 34 and the carburetor 36. Fuel is also permitted to flow from the fuel tank through the liquid tube 60 past the restricted valve area 88, but since the second valve area 80 still partially overlaps the port 82 from this tube, much of the fuel flow will be through the gas tube 58 and not the liquid tube 60. This vaporous fuel flow is readily combusted for initial starting of the burner 20.

The conduit 34 overflows and receives heat from the burner 20, so that after the burner is ignited the heated conduit vaporizes any fuel therein for sustained operation. In this regard, a metallic coil spring 100 is fitted loosely around the stem 70 within the conduit, which when heated, adds surface area for more completely vaporizing the liquid gasoline passing through the conduit.

Continued withdrawal of the valve member 64 provides that rod 94 rides off the tapered section on the valve area 84 to close the ball check 88 and block off the gas tube 58 from the cavity 56. Conversely, the second valve area 80 progressively passes the port 82 from the liquid tube 60 to permit freer unrestricted flow of liquid fuel to the cavity. The fuel flow is controlled by the valve area 80 clearing the liquid tube 60 and main valve area 76 separating from its cooperating seat. The stem 74 within the orifice 72 provides controlled discharge of the gaseous fuel to the carburetor, and since the stem tip within the orifice is tapered, withdrawal of the valve member 64 increases the orifice opening to admit a greater quantity of vaporous fuel to the burner.

It is readily understood that the appliance would be started by withdrawing the valve member the particular distance required, such as by rotating it one quarter of a turn from its closed position, to open the starting gas tube and the main valve opening. After the appliance has been fired for a time sufficient to heat the conduit to vaporize the liquid fuel therein, the valve member is withdrawn further to its regular operating condition which closes the gas tube and maintains liquid fuel discharge as required for the appliance output.

Also of concern in this invention is the fuel tank 28 and its construction. Note that the fuel tank is formed with a cup shaped body 106 having a threaded open section that is closed by cap 108 cooperating with the threaded open section. The cap 108 similarly has an opening 112 threaded internally that extends from the opening. A cup shaped pump cylinder 114 fits within the opening 110 and has a lip 116 that is restrained between the land area of the cap adjacent the opening and a plug 118 threaded into the threaded section 112. A pump piston 120 is located within the pump cylinder 114 and is connected by stem 122 to an actuating handle 124, the stem extending through opening 126 in the plug 118. The stem is hollow and communicates between the pump chamber 129 and the atmosphere at opening 130 in handle 124. A discharge check valve unit 138 is provided from pump chamber 129, and includes movable valve member 132 supported to cooperate with opening 134 to close the opening or to be moved from the opening for venting the chamber, and a spring 136 between the valve member 132 and the cylinder 114 normally holds the valve member closed. Appropriate seals 130 and 134 are contained between body 106 and cap 108, and cap 108 and cylinder lip 116, respectively, to seal the fuel tank.

The pump cylinder can be readily worked merely by withdrawing the handle 124 without covering the opening 130 to permit air to enter the chamber 129, and then advancing the handle toward the chamber while covering the opening 130 to dispense any air trapped in the chamber past valve member 132 to the interior of the fuel tank 28. The entire fuel tank is thus pressurized so that when the control valve 50 is opened, the vaporous fuel air mixture or liquid fuel will readily be dispensed to the carburetor. The fuel tank construction is of particular concern since the main working components can be readily disassembled for cleaning or replacing them as required.

What is claimed is:

1. In a liquid fuel powered appliance having a fuel tank, a carburetor, a conduit between the fuel tank and carburetor, and a burner for receiving vaporous fuel mixture from the carburetor and burning the same for among other things vaporizing liquid fuel for sustained operation, an improved control valve useful for both starting the appliance and controlling sustained operation thereafter, comprising a housing having a cavity open to the conduit; a pair of tubes connecting the cavity with the fuel tank, one tube being open to the fuel tank below the surface of liquid fuel wherein operable to carry mostly liquid fuel and the other tube being open to the fuel tank above the surface of the liquid fuel wherein operable to carry mostly vaporous fuel; a valve member movable in the housing to a closed position corresponding to an off condition of the appliance, a partially open position corresponding to a start condition of the appliance, and an open position corresponding to an operating condition of the appliance, and said valve member having spaced first, second and third valve areas; the valve member, when in its first valve area, being operable to close the conduit between the fuel tank and carburetor by means of the first valve area searing against a main valve seat in the housing and being operable by means of the third valve area to open the other tube to the cavity; the valve member, when partly open or in the start condition of the appliance, being operable to open the conduit between the fuel tank and carburetor, being operable to partially block the one tube by means of the second valve area to permit only limited restricted flow of liquid fuel to the cavity, and being operable by means of the third valve area to maintain the other tube to the cavity open to permit substantially unrestricted flow of mostly vaporous fuel to the carburetor for initial starting of the appliance; and the valve member, when open or in the operate condition of the appliance, being operable by means of the third valve area to close the other tube to the cavity, and being operable by means of the second valve area to maintain open the one tube for continued flow of mostly liquid fuel to the cavity.

2. A liquid fuel powered appliance control valve according to claim 1, wherein a check valve is located in the other tube between the fuel tank and the carburetor, the check valve being normally maintained in the closed position, and wherein means disposed between the check valve and third valve area on the valve member maintain the check valve open and thus open the other tube only when the valve member is in the closed and the partially open positions.

3. A liquid fuel powered appliance control valve according to claim 1, further including a stem connected to the valve member and extending through the conduit to within an orifice disposed adjacent the carburetor, and wherein the stem has a tapered nose section received within and cooperating with said orifice in the various operative positions of the valve member to meter proper volumes of vaporous fuel air mixture to the carburetor.

4. A liquid fuel powered appliance control valve according to claim 3, further including a coll element loosely surrounding the stem and disposed within the conduit operable to be heated during sustained operation of the burner to provide large heated surfaces for vaporizing the fuel.

5. A liquid fuel powered appliance control valve according to claim 1, wherein said second valve area is substantially cylindrical and overlies a port from the one tube open to the cavity; the valve member, when in the closed position, being operable by means of the valve member from the closed to the open positions gradually and progressively uncovers the port.

6. A liquid fuel powered appliance control valve according to claim 1, wherein said third valve area includes
a tapered cam surface, wherein a check valve is in the other tube and is normally held closed, and wherein a pusher rod rides on the cam surface as the valve member is at its respective partially open position and engages and holds the check valve open.

7. In a liquid fuel powered appliance having a fuel tank, a carburetor, a conduit between the fuel tank and carburetor, and a burner for receiving vaporous fuel mixture from the carburetor and burning the same for among other things vaporizing liquid fuel for sustained operation, an improved control valve useful for both starting the appliance and controlling sustained operation thereafter, comprising a housing having a cavity open to the conduit; a pair of tubes connecting the cavity with the fuel tank, with one tube being open to the fuel tank below the surface of liquid fuel therein operable to carry mostly liquid fuel and with the other tube being open to the fuel tank above the surface of the liquid fuel therein operable to carry mostly vaporous fuel; a valve member movable in the housing to a closed position corresponding to an off condition of the appliance, whereby the conduit between the fuel tank and carburetor is completely closed; said valve member also being movable to a partially open position corresponding to a start condition of the appliance, whereby both the conduit between the fuel tank and carburetor and the other tube are opened to permit abundant flow of mostly vaporous fuel to the carburetor; and the valve member further being movable to an open position corresponding to sustained operation of the appliance, whereby the conduit between the fuel tank and carburetor and the one tube are both opened and the other tube is closed to permit flow of mostly liquid fuel to the carburetor.

8. In a liquid fuel powered appliance having fuel tank, a carburetor, a conduit between the fuel tank and carburetor, and a burner for receiving vaporous fuel mixture from the carburetor for burning the same for among other things vaporizing liquid fuel for sustained operation, an improved fuel tank comprising a cup shaped body having an open end, and a cap removably threaded to the body across the open end; a cup shaped air pump cylinder extending into the fuel tank from an opening in the cap and having an open end exposed to the exterior of the fuel tank, means including a lip on the cylinder confined against the cap, and a plug confined against the lip and threaded into the open end of said cap for removably securing and sealing the cylinder to the fuel tank; a piston in the air pump cylinder defining a chamber, a rod connected to the piston and extending through an opening in said plug to the exterior of the fuel tank and being manipulated to move the piston, and a normally closed outlet check valve from the chamber to the interior of the fuel tank; and a control valve mounted on and communicat-