March 31, 1936. B. W. TULLIS 2,035,680

LIQUID HYDROCARBON FUEL BURNING DEVICE

Filed Dec. 13, 1933 2 Sheets-Sheet 1

FIG 1

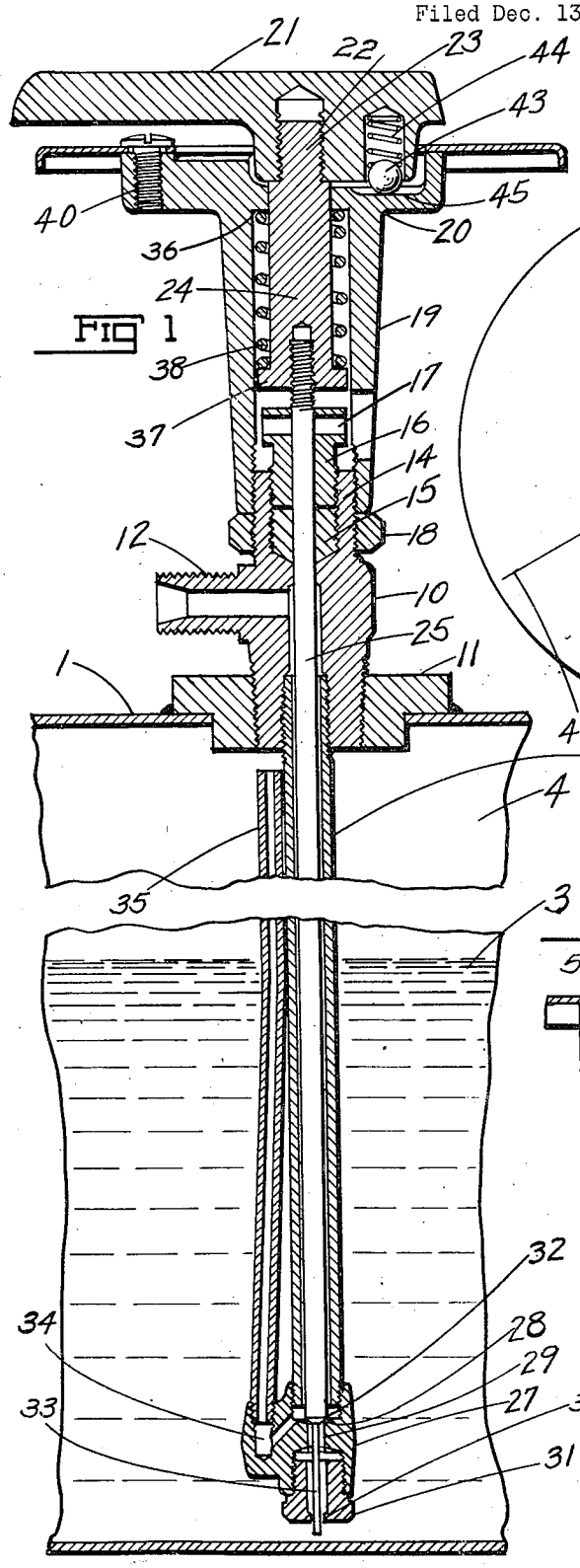

FIG 2

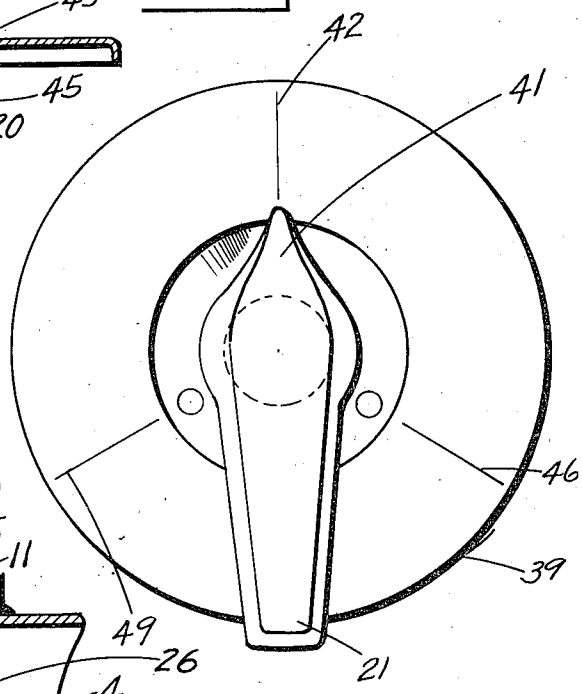

FIG 3

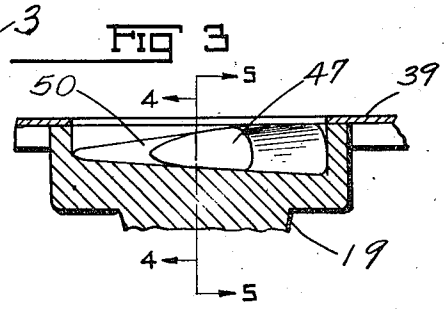

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FIG 4

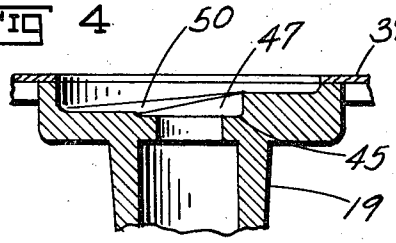


FIG 5

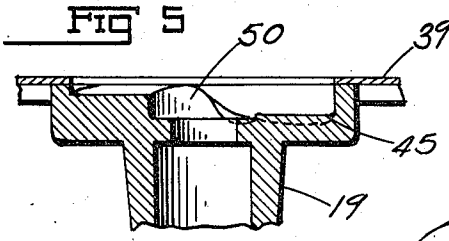


FIG 6

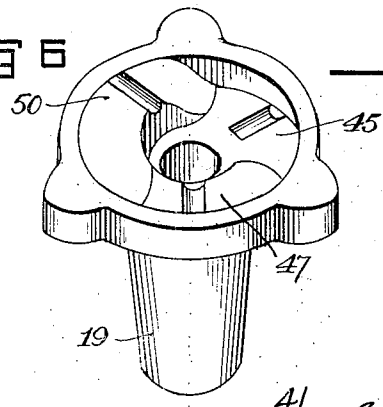


FIG 8

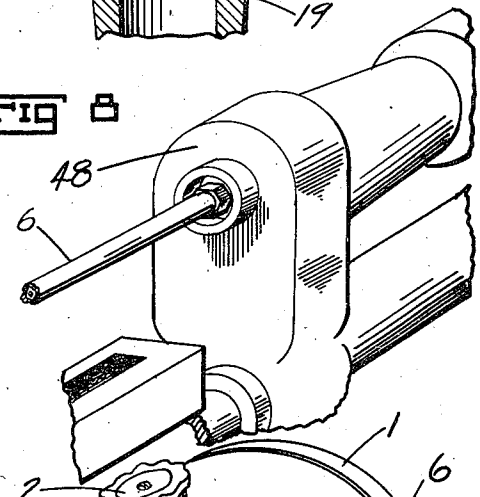
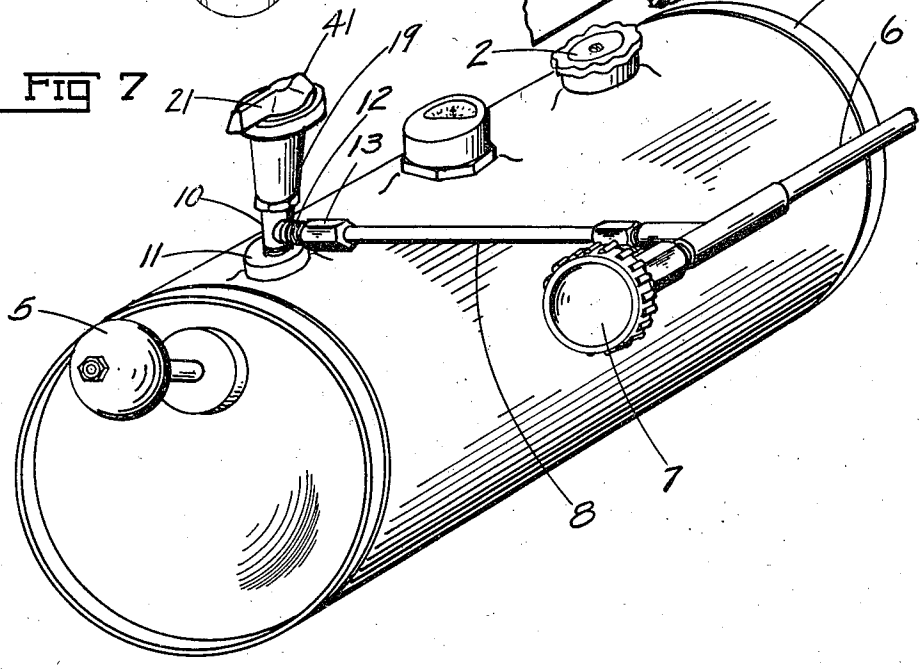


FIG 7



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Patented Mar. 31, 1936

2,035,680

UNITED STATES PATENT OFFICE

2,035,680

LIQUID HYDROCARBON FUEL BURNING DEVICE

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Application December 13, 1933, Serial No. 702,176

7 Claims. (Cl. 158—81)

This invention relates to liquid hydrocarbon fuel burning devices in which there is a tank to contain liquid fuel under air pressure in contact therewith, and a vaporizing generator connected to the tank to convert the liquid fuel into the vapor phase before it enters the burner.

The primary object of my invention is to take off some of the air as fuel to preheat the generator to liquid vaporizing temperature and then cause the air flow to cease and to thereafter allow liquid only to flow to the generator.

This general plan is disclosed in United States Patent 1,718,473, issued June 25, 1929, to J. E. McCutchen, but while the device disclosed in said patent operates successfully when the liquid level in the tank is relatively high and the air pressure is high, some difficulty has been experienced in obtaining the ideal operation at low liquid levels and reduced air pressure.

Another important part of my invention is the provision of means for urging the valve and its cooperating parts of accumulated fuel vapor which has a tendency to co-mingle with the atmosphere in the room and cause special odors. For example, usually hydrocarbon fuel burning devices emit odoriferous vapors after the supply valve is shut off, but with my invention, these vapors are consumed prior to the actual shutting off of the supply line with respect to the generator so the objections heretofore encountered are eliminated.

The novelty of the invention will be clearly understood by reference to the following descriptions in connection with the accompanying drawings in which:

Figure 1 is a vertical longitudinal sectional view through a valve structure constructed in accordance with my invention.

Figure 2 is a plan view of same.

Figure 3 is a sectional view on the line 3—3 of Figure 6.

Figure 4 is a sectional view on the line 4—4 of Figure 3.

Figure 5 is a sectional view on the line 5—5 of Figure 3.

Figure 6 is a perspective view of cam head, and

Figure 7 is an enlarged prospective view of the tank, valve and part of the burner, and

Figure 8 is a fragmentary perspective view of a part of the burner and the vaporizing generator.

Referring now to the drawings by numerals of reference, 1 designates a tank to contain liquid fuel under air pressure in contact therewith. The tank may be provided with a filler plug 2 to fill the tank with liquid fuel to about the level indicated at 3 so as to leave an air space 4 above the liquid level which may be supplied with air under pressure by the hand pump 5, or any other suitable means. A burner not shown having a vaporizing generator 6 controlled by a valve 7 is connected to the tank 1 by a conduit 8. The valve 7 in the generator is the usual valve for controlling the flow of fuel into the generator. All the structure thus far described is old and well known.

The fitting 10 is screwed in a bushing 11 in the tank 1. Its discharge outlet 12 connects to the pipe or conduit 8 by a nut 13. There is a packing gland 14 in the top of the fitting to contain a packing 15 with a packing nut 16 screwed in the gland, the packing nut having a transverse opening 17 to receive a pin or similar tool adapted to turn the nut so as to tighten the packing.

On the outside of the fitting is an adjustable stop nut 18 to limit the hollow elongated tubular skirt 19 of a cam stand or cam head 20 for the control lever 21. The control lever 21 has a threaded socket 22 in threaded engagement with the threaded end 23 of the connector 24 which is in threaded connection with the valve stem 25 projecting through the nut 16 the packing gland 14, the fitting 10 and extending into the supply tube 26 having at its lower end a hollow head 27. The hollow head 27 has a valve seat 28 surrounding an inlet opening 29 in line with the opening 30 in the tip 31. The opening 29 can be closed by the shut off valve 32 on the end of the stem 25. A needle 33 projects from the end of the stem 25 beyond the valve 32 and it is adapted to project through the tip opening 31.

It should be observed that the opening 29 is appreciably larger than the tip opening and that the needle 33 is of less diameter than both openings 29 and 30 so neither of these openings are ever closed by the needle.

The hollow head 27 has an air inlet 34 communicating with the air space 4 through the air tube 35 and discharging into the fuel supply tube 26 in rear of the valve seat 28.

Interposed between the end 36 of the stand 20 and the stop collar 37 is an expansion spring 38. The purpose of the spring 38 is to urge the valve 32 on the seat 28 and to urge the needle 33 into the opening 30.

The valve 32 can be unseated and the needle 33 can be withdrawn through the tip opening by the lever 21 which rides over a cam system

on the stand 20 surrounded by a scale or indicating disc 39 fastened to the stand by screws 40 or any other suitable means. The indicating disc is provided with three indicating points for the pointer 41 on the handle 21.

The point 42 is the shut off position. When the pointer 41 is opposite the point 42 on disc 39 all the parts are in the position shown in Figure 1, with the ball 43 urged by spring 44 on the door of the recess 45 of the stand. Then all ports except 35 are closed.

When the pointer is moved to the point indicated by line 46 on the disc 39, Figure 2, the ball 43 will have ridden upon the cam 47 on the floor of recess 45. The pressure of the ball against the spring 44 will raise the lever 21, the connector 24 and the stem 25 to unseat the valve 32 but the longitudinal movement of the stem 25 will not be enough to draw the needle or pin from the tip orifice 30. When the parts are in these positions the valve 7 is unseated and air from the air space 4 will flow through the tube 35 through the pipe 26 to the generator 6 and to the burner. During the time the air flows as just described it will be enriched by liquid fuel admitted into the pipe 26 through the tip orifice, restricted by the pin or needle 33 (which is of less diameter than that of the tip orifice) so that a combustible mixture will be provided at the burner. This mixture will ignite at the burner as a fuel even when the generator is cold. Therefore, the burner can be lighted without the necessity of preheating the vaporizing generator. After the generator is heated to vaporizing temperature, the pointer 41 is moved to the point or position indicated at 49 causing the ball 43 to ride upon the cam 50 which has a lobe higher than that of the cam 47. As a result, the stem 25 is raised high enough to completely retract the needle from the tip orifice 30 so that the liquid fuel can now flood the tube 26 to supply the generator demand. The flooding of the tube 26 seals off the air supply from the space 4 so that now only liquid hydrocarbon will be supplied from the tank 1 so that no appreciable amount of air pressure will be lost.

When it is desired to discontinue the burner operation, the pointer 41 is turned to the position indicated at 42 with the ball off both cams 47 and 50 so the spring 38 will seat the valve 32 so that no more liquid will be fed to the tube 26 but the air space will still be open with relation to the tube 26 so the air pressure will continue to force the liquid in the tube 26 and through the generator into the burner until the liquid hydrocarbon is consumed by the burner so that only air from the air space 4 will flow through the generator and the burner and inasmuch as air from the air space will free the line from liquid there will be no liquid in the hot generator to distill off obnoxious vapors. Of course, the valve 7 should be closed as soon as the burner becomes extinguished so as to prevent loss of pressure in tank 1. When it is recognized that with the valve 7 open and the valve 32 closed only air can flow through the line in the rear of the liquid which has previously been admitted thereto, it will be apparent that all liquid will be consumed as a fuel before the air alone passes through the line to the burner. This air from the space 4 is not sufficiently rich to burn and inasmuch as the air flowing through the burner tends to cool it, there will be no vaporous discharge from the burner and consequently there will be no obnoxious odors. As heretofore stated it is important to close the valve 7 as soon as the "burner goes out", for by that time the air will have freed the line of liquid fuel. The element 33 is an orifice regulating valve which at no time closes the orifice. The air from space 4 will purge the tubes of all vapors so that if the generator valve 7 is now closed, there will be no objectionable odor in the room. The burner is diagrammatically indicated at 48 since the particular type of burner is unimportant. Attention is called to the fact that the effective cross-sectional area of the tube 35 is small enough so that when the shut-off valve 31 is first unseated, and the valve 7 is open, the pressure in the font 1 will force the carbureted air up thru the supply tube at a pressure less than the pressure exerted on the liquid, so that initially the liquid will flow up into the supply tube to enrich the air supplied from space 4. This is due to the fact that when the valves are all shut off, there is an equalization of pressure in the lower end of the supply tube and upon the liquid, therefore the only thing that would urge the liquid to flow into the tube would be the static head which is variable according to the depth of the liquid in the font. When the tank is full, the static head is enough to cause the liquid to instantly flow into the supply tube when the shut-off valve is unseated, but when the liquid level is very low the static head is so slight that the liquid will not flow into the tube fast enough to make the desirable rich mixture for instant lighting. However, inasmuch as the cross-sectional area of the tube 35 is relatively small, the frictional resistance offered to the air from space 4 initially cuts down the pressure at the discharge end of the tube 35, so the pressure momentarily preponderates at the inlet 30.

Of course, if the lamp has been ignited, the controlling pin 33 is withdrawn from the tip orifice so that now the tip orifice is so large that the liquid will readily flow into the supply tube.

What I claim is:

1. In a device of the class described comprising a tank to contain liquid hydrocarbon fuel under air pressure in contact therewith, a liquid fuel pipe having an inlet orifice at its lower end below the normal liquid level in the tank and a discharge orifice at its upper end outside the tank, a burner connected to the discharge end of the fuel pipe, an air supply tube having an inlet orifice in the air space above the normal liquid level in the tank and an outlet orifice discharging into the supply pipe between the liquid level in the tank and the inlet orifice to the supply pipe, a stem in the fuel supply pipe in spaced relation therewith having a valve between the liquid inlet orifice in the liquid supply pipe and the air outlet of the air supply tube to close the liquid supply pipe between its liquid inlet orifice and the discharge orifice for the air tube so that when the lower end of the liquid supply pipe is closed air only will flow through the liquid supply pipe to the burner to purge it.

2. A device of the class described comprising a closed tank to contain liquid hydrocarbon fuel under air pressure in contact therewith, a liquid fuel supply pipe having an inlet orifice below the normal liquid level in the tank and a discharge orifice outside the tank, a burner connected to the discharge end of the supply pipe, an air supply tube having an inlet orifice in the air space above the normal liquid level in the tank and an outlet orifice discharging into the supply pipe above the liquid inlet orifice, a valve seat in the liquid supply pipe between its inlet orifice and the out-

let orifice of the air supply tube, a stem in the liquid supply pipe in spaced relation therewith having a valve to engage the seat and close off communication between the liquid in the tank and the supply pipe so that air only can flow through the supply pipe and to the burner to purge it when the inlet orifice of the liquid supply pipe is closed.

3. In a hydrocarbon fuel burning device, a closed tank to contain liquid hydrocarbon fuel under air pressure in contact therewith, a liquid supply pipe in the tank having a constricted liquid inlet orifice below the normal liquid level in the tank, said pipe having a valve seat above the inlet orifice below the normal liquid level in the tank, an air supply tube, said tube communicating with the air space above the normal liquid level in the tank and with the liquid supply pipe below the normal liquid level in the tank, a fitting connected to the liquid supply pipe having an outlet orifice, a burner, a fuel supply pipe leading from the fitting to the burner, a valve stem in the liquid fuel supply pipe in spaced relation with the walls thereof, longitudinally movable therein, a shut off valve on the end of the stem to engage the valve seat so that when the liquid fuel supply is shut off air may continue to flow through the liquid supply pipe to purge the same.

4. In a hydrocarbon fuel burning device a closed tank to contain liquid hydrocarbon fuel under air pressure in contact therewith, a liquid supply pipe in the tank having a constricted liquid inlet orifice below the normal liquid level in the tank, said pipe having a valve seat above the inlet orifice and below the liquid level in the tank, an air inlet tube said tube communicating with the air space above the normal liquid level in the tank and discharging into the liquid supply pipe below the liquid level in the tank, a fitting connected to the liquid supply pipe having an outlet, a burner, a fuel pipe leading from the fitting to the burner, a valve stem in the first named pipe in spaced relation with the walls thereof, longitudinally movable in the same, a shut off valve on the lower end of the stem between the liquid inlet orifice of the liquid supply tube and the discharge orifice of the air supply tube to engage the valve seat so that when liquid fuel supply is shut off air may continue to flow through the liquid supply pipe, and a liquid inlet orifice regulator on the stem projecting through the inlet orifice for the liquid supply pipe said regulator being of uniform diameter less than that of the diameter of the inlet orifice.

5. A device of the class described comprising a closed tank to contain liquid hydrocarbon fuel under air pressure in contact therewith, a vertical liquid fuel supply pipe having its inlet orifice below the normal liquid level in the tank and its discharge end outside the tank, the inlet orifice for the liquid fuel supply pipe being of less diameter than that of the pipe, an open air supply tube having an inlet orifice in the air space above the normal liquid level in the tank and its outlet orifice discharging into the supply pipe above the liquid inlet orifice and below the normal liquid level in the tank, a valve seat in the liquid supply pipe above its inlet orifice and below the outlet orifice for the air tube, a stem in the supply pipe having a valve to engage the seat and manually operated means for actuating the stem to cause the valve to seat and unseat.

6. A device of the class described comprising a closed tank to contain liquid hydrocarbon fuel under air pressure in contact therewith, a vertical liquid fuel supply pipe having its inlet orifice below the normal liquid level in the tank and its discharge end outside the tank, the inlet orifice for the liquid fuel supply pipe being of less diameter than that of the pipe, an air supply tube having its inlet in the air space above the normal liquid level in the tank and its outlet discharging into the supply pipe above the liquid inlet orifice and below the normal liquid level in the tank, a valve seat in the liquid supply pipe above its inlet orifice and below the outlet orifice for the air tube, a stem in the supply pipe having a valve to engage the seat, a stand having cams thereon and a head on the stem movable over the cams to longitudinally move the stem to cause the valve in the liquid supply pipe to seat and unseat so that when the valve is unseated air and liquid will be supplied to the liquid supply pipe and when the valve is seated air only will pass through the liquid supply pipe.

7. In combination with a portable tank to contain liquid hydrocarbon fuel under air pressure in contact therewith a fuel supply pipe in the tank having a restricted liquid inlet orifice at its lower end and a valve seat at the juncture of the constricted inlet orifice and the larger portion of the pipe, an open ended air tube having its inlet end in communication with the air space in the tank and its outlet end discharging into the pipe above the valve seat, a valve stem extending into the supply pipe having a constricted inlet regulator of less diameter than that of the inlet orifice, a valve at the juncture of the stem and the inlet regulator to engage the seat and manually operated means for the valve stem so that when the valve is unseated with the regulator in the inlet orifice air and liquid hydrocarbon will pass into the fuel supply pipe with the air preponderating over that of the liquid and when the stem is operated to withdraw the regulator a preponderating amount of liquid fuel will pass into the supply pipe to seal off the air and when the valve is seated liquid will be shut off and air only will be permitted to pass through the liquid supply pipe.

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