Feb. 23, 1954

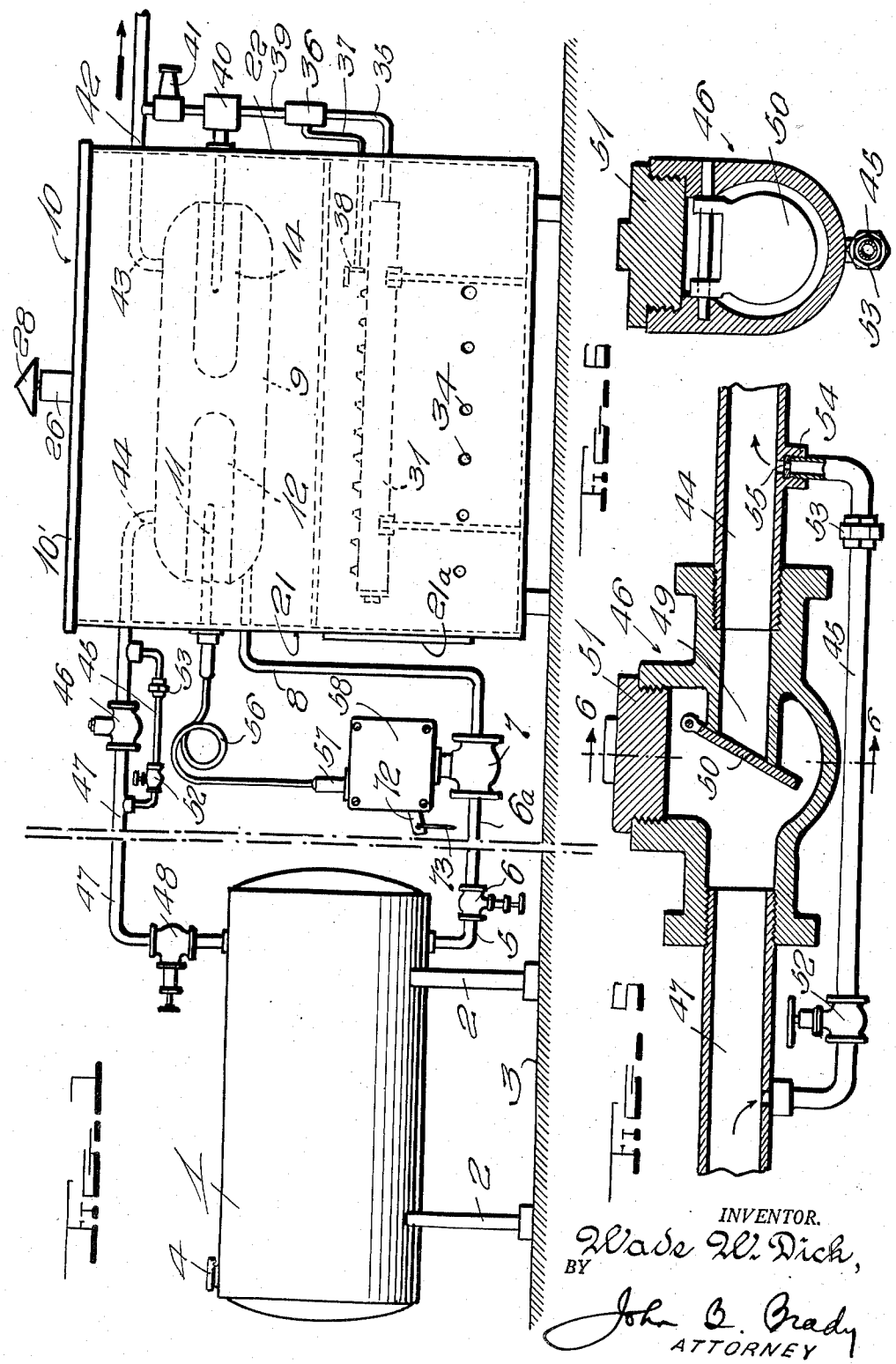
W. W. DICK

2,669,847

METHOD AND APPARATUS FOR VAPORIZING AND DISTRIBUTING HYDROCARBON FUELS

Filed Dec. 29, 1950

3 Sheets-Sheet 1



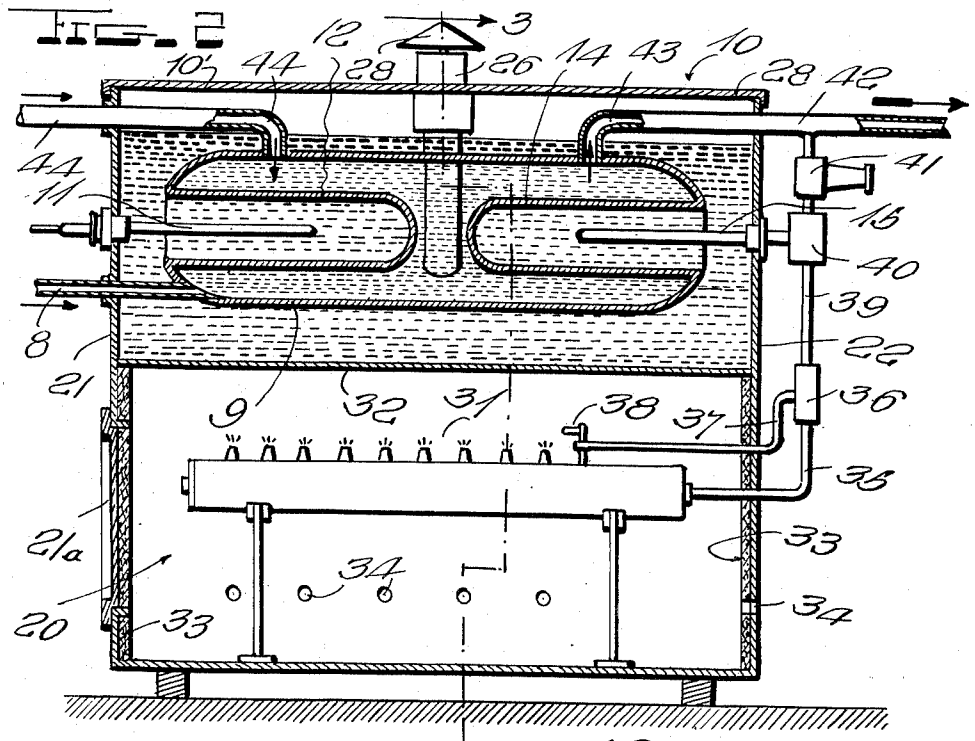
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Feb. 23, 1954 W. W. DICK 2,669,847

METHOD AND APPARATUS FOR VAPORIZING AND DISTRIBUTING HYDROCARBON FUELS

Filed Dec. 29, 1950 3 Sheets-Sheet 2

FIG. 2



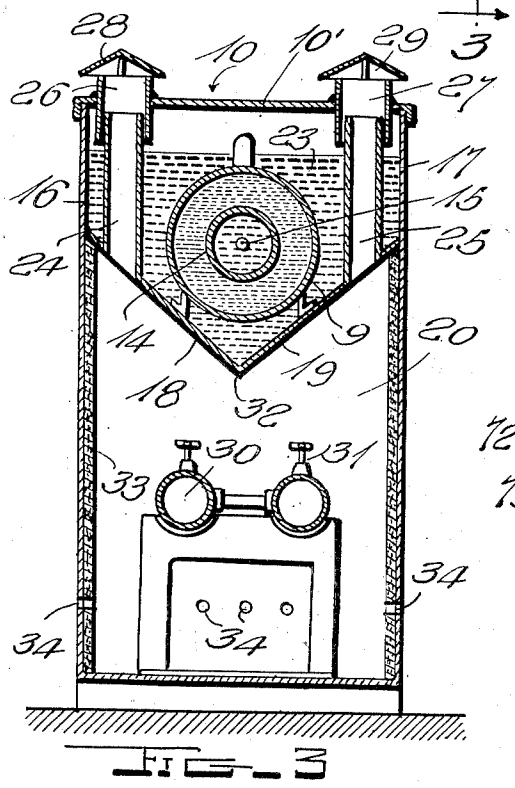
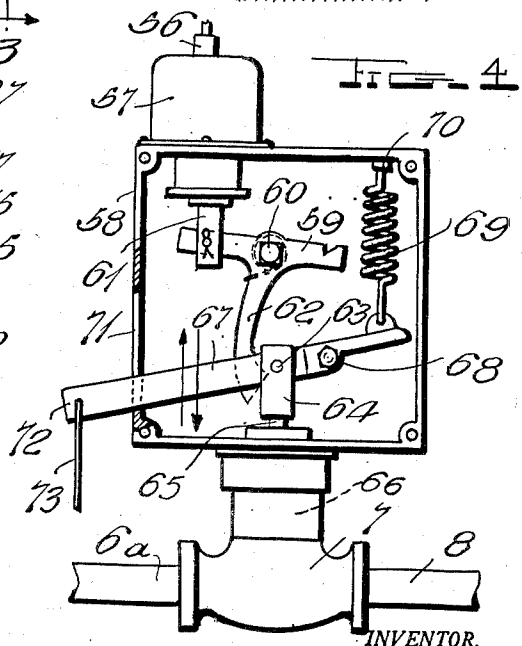


FIG. 3

FIG. 4



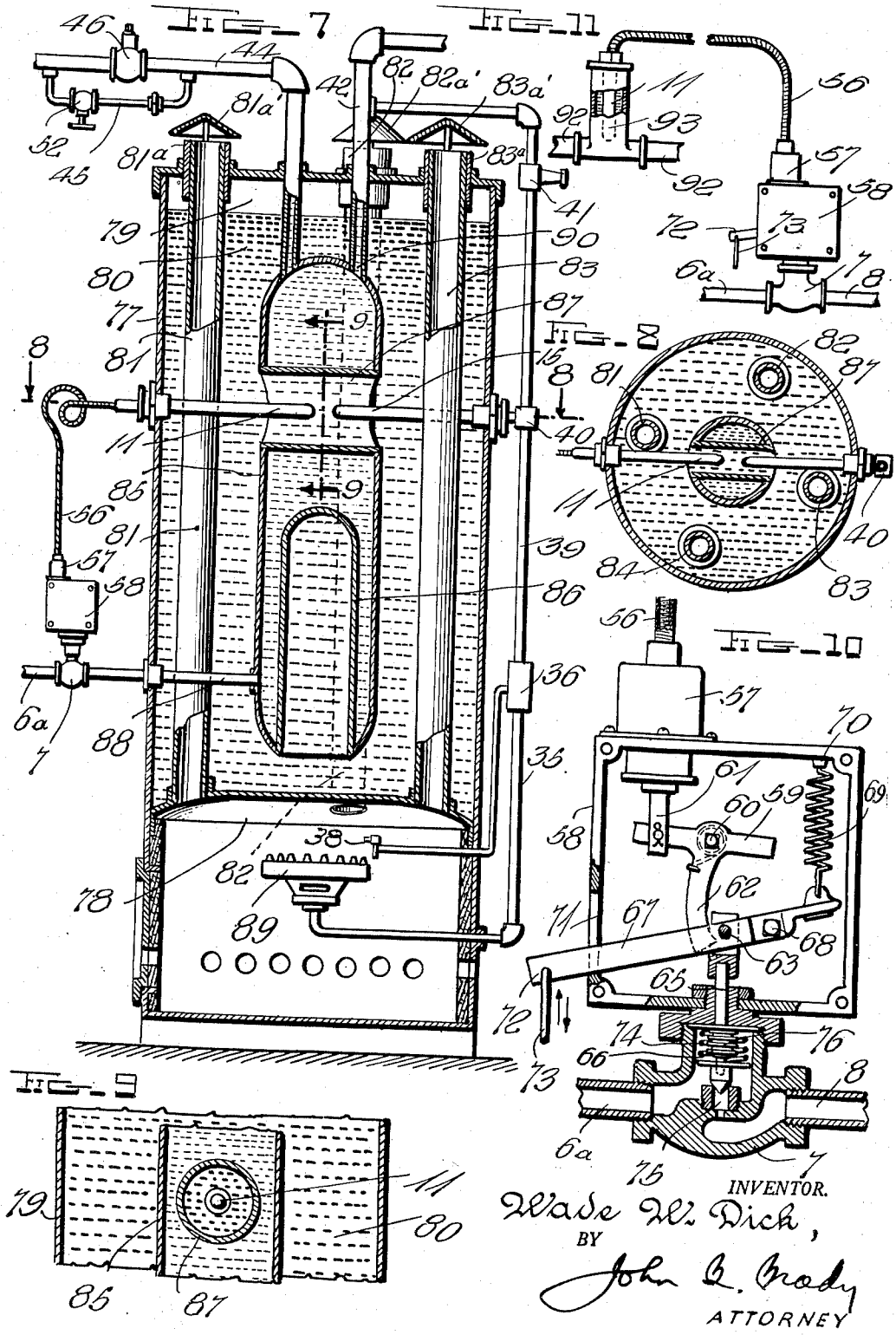
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Feb. 23, 1954 W. W. DICK 2,669,847

METHOD AND APPARATUS FOR VAPORIZING AND DISTRIBUTING HYDROCARBON FUELS

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3 Sheets-Sheet 3



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UNITED STATES PATENT OFFICE

2,669,847

METHOD AND APPARATUS FOR VAPORIZING AND DISTRIBUTING HYDROCARBON FUELS

Wade W. Dick, Shreveport, La.

Application December 29, 1950, Serial No. 203,275

13 Claims. (Cl. 62—1)

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My invention relates broadly to gas distributing systems and more particularly to an improved method and apparatus for reliably distributing such gases as butane and propane for industrial purposes.

One of the objects of my invention is to provide a gas distribution system which will reliably distribute such gases as butane, propane, etc., without the use of float mechanisms conventionally employed for operation of valves intended for cutting off the flow of liquid if and when the main burner fails.

Another object of my invention is to provide a gas distribution system having a reliable arrangement of cut off valve which becomes instantly effective to cut off the flow of the liquid hydrocarbon externally of the vaporizer if and when the main burner of the vaporizer fails for eliminating danger of explosion due to continuous flow of the hydrocarbon after a cut off temperature has been reached.

Still another object of my invention is to provide a method of vaporizing such hydrocarbons as butane or propane which comprises passing the liquid hydrocarbon through a confined path subject to a temperature of approximately 200° F. for vaporizing the liquid hydrocarbon and distributing the vapor to the consuming system.

Still another object of my invention is to provide an improved method of vaporizing liquid hydrocarbon which involves passing the liquid hydrocarbon from a storage position through a tank subject to transfer of heat from a liquid having an extremely high boiling point for rapidly elevating the temperature of liquid hydrocarbon to a condition of vaporization and facilitating distribution of the vapor, the entire process of vaporization being carried out through control means which does not involve any form of float control valve subject to all of the inherent conditions of operation of such valves often leading to operation failure with resulting damage from fire and explosion.

Another object of my invention is to provide a construction of vaporizing unit for hydrocarbon such as butane and propane in which the unit includes a gaseous fuel burner operative for heating a boiler unit containing liquid of relatively high boiling point within which there is submerged a chamber through which the liquid hydrocarbon is passed for elevating the temperature thereof and generating vapor for distribution to the consuming system.

Still another object of my invention is to provide a system for vaporizing butane, propane

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and other similar hydrocarbons and distributing the same including temperature controlled safety means by which excess vaporized gas may be recovered for reuse in the system for insuring the economic operation of the gaseous distribution system and minimum loss of the hydrocarbon.

Other and further objects of my invention reside in an arrangement of improved valve mechanism for automatically insuring a high condition of safety to a hydrocarbon gaseous distributing system as set forth more fully in the specification by reference to the accompanying drawings in which:

Figure 1 is an elevational view of the vaporizer and gaseous distributing system of my invention; Fig. 2 is a vertical sectional view taken through the vaporizer of my invention and illustrating particularly the manner in which the liquid hydrocarbon is passed through a submerged tank within the boiler which contains the liquid of high temperature boiling point; Fig. 3 is a vertical sectional view taken substantially on line 3—3 of Fig. 2; Fig. 4 is a view of the automatic control valve by which the flow of hydrocarbon to the submerged tank is controlled in accordance with conditions of temperature adjacent the submerged tank; Fig. 5 is a fragmentary cross sectional view of the valve mechanism by which the system is economically operated by permitting recovery of excess hydrocarbon for reuse in the vaporizer system; Fig. 6 is a vertical sectional view taken substantially on line 6—6 of Fig. 5; Fig. 7 is a vertical sectional view through a modified form of vaporizer embodying the principles of my invention and illustrating the method of passing hydrocarbon therethrough without the employment of any form of float valve which has proven so dangerous in operation in vaporizer systems where hydrocarbon has continued to flow after a condition of essential cut off has been reached; Fig. 8 is a transverse sectional view taken substantially on line 8—8 of Fig. 7; Fig. 9 is a fragmentary vertical sectional view through the upper portion of the submerged vaporizer tank; Fig. 10 is a cross sectional view taken through the safety valve that controls the flow of liquid hydrocarbon to the submerged tank in accordance with temperature conditions adjacent the submerged tank; and Fig 11 shows the principle of my invention as applied to a variable temperature system of any kind and utilized to control a supply of liquid hydrocarbon.

My invention provides a vaporizer for butane or propane and the like in which a flame is directed upon a receptacle or submerged tank con-

taining a high boiling point liquid or chemical such as "Prestone," as a heat transfer liquid raising the temperature of same to approximately 200° F. By the term "high boiling point" I mean any temperature that is substantially above 212° F., the boiling point of water. Submerged in this bath of hot liquid there are a number of high pressure tubes carrying the liquid butane or propane and the like to be vaporized by the absorption of heat from the hot liquid bath. After the liquid butane or propane and the like has absorbed enough heat from the hot bath to become a vapor it then passes on through an adjustable high pressure regulator to whatever device or burners that is to consume the vaporized gas.

The main burner flame and safety cutoff is of the conventional approved type used on liquified petroleum gas devices. A pipe line is provided carrying vapor from a storage tank. This vapor is also directed into the high pressure vaporizing tubes through a metering aperture in the pipe line which by-passes a high pressure swing check valve. This metering aperture is provided for the purpose of initially feeding vapor to supply the vaporizing burner of the device when first putting the vaporizer into operation. Later after the operation cycle is initiated and should the vaporizing capacity exceed the requirements of the burners at the dry kiln or cotton dryer, the excess vaporized gas will flow back to the butane storage tank through the previously mentioned swing check valve; thus permitting a large volume of gas to flow back to said tank, but only a small amount of gas to flow from the tank to the vaporizer through the metering aperture.

The jacket which surrounds the heater is insulated and the burned gases travel around and upward and exhaust themselves through small stacks extending through the bath. The stacks may be provided with dampers controlled by a bi-metal strip thermostat so that when the burner cuts off the dampers will automatically close, thereby conserving the heat within the vaporizer jacket and vaporizing liquid and increasing the efficiency of the system.

Heretofore conventional industrial vaporizers have required a float and valve arrangement inside of a pressure vessel containing liquid butane to be vaporized. This float and valve is for the purpose of shutting off or prohibiting the entry of liquid butane in the case of a burner failure in the vaporizer, which would result in a liquid butane passing on through the vaporizing chamber and on into the vapor line going to the various industrial driers. Such accidental excess supply of fuel could cause a serious fire or explosion. The system of my invention employs a special valve which automatically cuts off the liquid butane outside the vaporizer if and when there is a burner failure in the vaporizer. In my system, should a vaporizer burner fail, the liquid in the vaporizer vat begins to cool off due to the absorption of heat by the liquid butane passing through the heating medium. When this occurs the special precalibrated automatic cutoff valve closes by automatic spring action, thus prohibiting any more butane liquid from entering the vaporizer until the vaporizer burner trouble is corrected. This valve is so designed that any temperature from 100° F. upward will hold the valve in an open position due to a temperature bulb arrangement. But when the temperature of the vaporizing vat liquid drops below 100° F. the valve automatically snaps shut and a manual resetting or opening of the valve is necessary before the vaporizer is put back in operation.

The special automatic cutoff valve in the liquid butane line will absolutely keep any liquid from getting through or past the vaporizer, as all float valve mechanisms that have proven so unsatisfactory are eliminated.

Referring to the drawings in more detail, reference character 1 designates the storage tank for liquid hydrocarbon such as butane or propane which tank is suitably erected on standards 2 extending upwardly from foundation 3. The tank is provided with a filling aperture 4 normally closed by a suitable cap. The liquid hydrocarbon is returned to tank 1 through pipe 5 connected with safety hand valve 6 connected through pipe 6a with the special cut off valve 7 of my invention. The cut off valve 7 connects through pipe 8 leading to the bottom of the submerged tank 9 in the vaporizer shown generally at 10. The submerged tank 9 is maintained on a level above the normal hydrocarbon level in storage tank 1 so that excess hydrocarbon may drain through pipe 8 and cut off valve 7 and the open manually controlled valve 6 to the storage tank 1, when conditions of temperature as determined by thermostat 11 so requires.

The submerged tank 9 is of special construction for obtaining maximum surface area for imparting heat to the hydrocarbon and effecting rapid vaporization thereof. The submerged tank 9 consists of a cylindrical body structure shown more clearly in Fig. 3 with recessed centrally disposed pockets 12 and 14 in each end thereof. These pockets 12 and 14 are in the nature of reentrant portions in the cylindrical submerged tank forming pockets for receiving the thermostats 11 and 15. The submerged tank 9 is mounted in spaced relation to the opposite side walls 16 and 17 of the vaporizer 10 and adjacent the angularly inclined bottom walls 18 and 19 which extend downwardly into the burner section 20 of the vaporizer. The side walls 16 and 17 and the bottom walls 18 and 19 comprise a vat closed at opposite ends by end walls 21 and 22 which contains the liquid of high boiling point in which the tank 9 is submerged as represented at 23. The vat is provided with upwardly extending flues 24 and 25 intermediate the exterior surface of the submerged tank 9 and the side walls 16 and 17 of the vaporizer. These flues 24 and 25 extend upwardly in the central portion of the vaporizer 10 and terminate interiorly of sleeve members 26 and 27 that depend downwardly from the removable top 10' of the vaporizer 10. The sleeve members 26 and 27 are protected by transversely extending caps 28 and 29 spaced from the upper extremities of the sleeve members sufficient to allow the passage of gases passing through the flues 24 and 25.

The vat is heated by burners represented at 30 and 31 located within the base of the vaporizer and distributed symmetrically on opposite sides of the central apex portion 32 of the vat and in positions where the gaseous flame strikes the outwardly directed surfaces 18 and 19 enabling the flame to travel upwardly and through the flues 24 and 25. Thus, the maximum amount of heat is transferred to the body of fluid 23 in the vat. The inside walls of the vaporizer are protected by heat resisting material which I have represented at 33. Air is admitted to the burner section through ports 34 provided in the side walls and ends of the vaporizer. Access to the interior of the vaporizer for maintenance and

repair may be had through the door 21*a* in end wall 21.

The burners 30 and 31 are supplied with gas through pipe line 35 connected in series with the 100% cut off valve 36 having a pilot connection through pipe line 37 to the pilot light 38 arranged adjacent the burners 30 and 31. Gas is supplied to the pilot burner passage line 37 and the valve 36 through pipe 39 which extends into a valve housing 40 in which there is located a snap action thermostatic valve controlled by thermostat 15. The valve housing 40 connects through the reducing regulator represented at 41 which reduces the gas pressure from pounds to ounces and is supplied with gas from the gas distribution line 42.

The gas distribution line 42 extends from one end of the top of the submerged tank 9 as represented at 43. The other end of the top of the submerged tank 9 is provided with a connection 44 which extends through the by-pass hydrocarbon supply line 45 and through the check valve 46 to the pipe line 47 and valve 48 and to the hydrocarbon fuel storage tank 1. The check valve 46 and the by-pass hydrocarbon supply line 45 are shown more clearly in Figs. 5 and 6 as including connections for pipes 44 and 47 between which the by-pass hydrocarbon supply line 45 extends. The valve 46 includes an interiorly arranged cylindrical valve seat 49 adjacent the top of which the check valve plate 50 is pivotally mounted so that passage line 44 is normally sealed by gravitation of plate 50 against seat 49 at approximately 45°, but wherein excessive pressure in pipe line 44 may raise plate 50 allowing excessive quantities of fuel to be returned to the storage tank 1. The interior of check valve 46 may be inspected through removable plug 51 in the top of the check valve housing. The by-pass supply line 45 includes the manually controlled shut off valve 52, the coupling 53 and the connection 54 to the pipe line 44 which allows a selected size orifice plate 55 to be inserted in or removed from the by-pass supply line 45. For the most efficient functioning of different systems, I have found that different sized orifice plates 55 may be utilized.

The control valve 7 is shown in association with the temperature controlled valve in Figs. 4 and 10. The thermostat 11 is of the bulb type which is charged with an expandable and contractable solution confined within a flexible pipe which is protected by the flexible sheathing represented at 56 and which leads to the Sylphon bellows housing 57 mounted on the housing 58. The housing 58 encloses the valve operating linkage which includes the spring biased rocker arm 59 pivotally mounted at 60 and connected at one end with the plunger 61 leading to the Sylphon bellows mechanism in the Sylphon bellows housing 57. The rocker arm 59 is integrally connected with downwardly extending latching member 62 which is hook shaped in contour for engaging a transverse pin 63 carried by the slotted head 64 on the upwardly projecting stem 65 of a diaphragm valve 66 located interiorly of the housing of cut off valve 7. The slotted head 64 also provides connection means for the lever 67 which is pivotally connected at 68 with the head 64 and is journalled at 69 in housing 58. Lever 67 is connected at one end through coil spring 69 with a connection point 70 inside the housing 58. The lever 67 projects at its other end through a slot 71 in housing 58 so that the protruding end 72 of the lever 67 may be engaged by a pull chain or

link 73 for enabling the valve to be manually actuated in the event that automatic operation should fail. The diaphragm valve 66 includes spring means 74 normally operating to urge valve 66 into engagement with the annular valve seat 75 mounted interiorly of the housing of the cut-off valve 7 for controlling the passage of hydrocarbon between pipes 6*a* and 8. It will be noted that packing may be eliminated around the valve stem 65 by reason of the diaphragm construction represented at 76 which is flexible enough to permit up and down travel of the valve but which prevents leakage from the interior of the valve housing around the stem 65.

Heretofore I have described my invention as directed to a horizontally arranged installation. My invention is accordingly applicable to a system employing a vertically arranged installation as illustrated in Figs. 7–9.

In this arrangement I provide a vertical extending vaporizer designated generally at 77 having a lower fuel burner compartment 78 and an upper tank compartment 79 containing the liquid of high boiling point such as "Prestone" shown at 80. The compartment 79 is provided with a multiplicity of spaced vertically extending flues shown at 81, 82, 83 and 84 which extend from the fuel burner compartment 78 and through the liquid of high boiling point 80 and project in stacks at the top of compartment 79 as represented in Fig. 7 as indicated at 81*a*, 82*a* and 83*a*. Suitable stack covers are provided at the upper extremities of the stacks as represented at 81*a'*, 82*a'* and 83*a'*.

Submerged within the liquid of high boiling point shown at 80, I provide an interiorly disposed liquid hydrocarbon tank represented at 85 having a bottom reentrant portion 86 and a transverse flue portion 87. The lower end of the tank 85 is connected with the hydrocarbon fuel supply pipe 88 corresponding to the pipe 8 in the arrangement of my invention shown in Figs. 1–6. The control for this hydrocarbon fuel supply line is identical with the control previously described including the thermostat 11, the expandable and contractable liquid line 56, the Sylphon bellows mechanism in Sylphon bellows housing 57, the valve control mechanism in housing 58 and the cut-off valve 7 which connects to pipe line 6*a*. The end of thermostat 11 extends into the transverse passage 87 in the tank 85. The oppositely arranged thermostat 15 corresponding to the similarly numbered thermostat in the previously described form of my invention is also arranged in the transverse passage 87 and extends outwardly beyond compartment 79 for controlling the snap thermostat valve in housing 40 as previously explained. The balance of the gaseous heating burner mechanism is the same as previously explained; that is, a main burner path 9 is supplied with gas through pipe line 35 which connects to the 100% cut-off valve in housing 36 which also provides a connection to the pilot light 38 through pipe line 37. Pipe line 39 which connects to 100% cut-off valve 36 extends through the snap thermostat housing 40 and through the reducing regulator 41 to the gaseous fuel distribution line 42 which connects to the top of the hydrocarbon tank 85 as represented at 90. The hydrocarbon supply line 44 previously described includes the same check valve 46 and by-pass system 45 as previously described and connects at 91 to the top of the hydrocarbon tank 85. The surfacing of the vertical structure installation is

often more convenient than the horizontal structure heretofore described.

I may employ the system of my invention generally as represented in Fig. 11 where the special temperature controlled valve in housing 58 may be connected in any liquid hydrocarbon supply line such as 6a and 8 and controlled by the Sylphon bellows housing 57 in turn controlled from the thermostat 11 which may be inserted in an engine water circulating line represented at 92. A suitable pipe T 93 may be mounted in the circulating line 92 to provide for the mounting of the thermostat 11. No liquid hydrocarbon can reach the water heated vaporizers until the engine water temperature has risen high enough to permit the manual control 72 to keep the valve 66 latched in an open position. Thus it will be seen that very substantial protection is afforded to any system employing the principles of my invention.

After the vaporizer is ready to light, the first step is to open vapor valve on top of the storage tank which will permit vapor to flow through the metering hole in the by-pass line around the check valve which is designed to pass only enough vapor to permit full operation of the vaporizer burner. The pilot light is lighted and attended until the pilot light has generated enough heat to hold open the 100% cut off valve 36 which will permit gas to flow to the main burner. The heat transfer liquid in the vaporizer is initially cold so that the thermostat 11 keeps valve 7 closed. Vapor flows from the storage tank through 47, 44 and the vaporizer to the distribution line 42. Some of the gas in line 42 is bled off to supply the burner. When the "Prestone" or other heat transfer liquid reaches 100° F. valve 7 opens, permitting liquid to flow through 5 from the storage tank to the vaporizer. Vapor flows out through line 42. If too much vapor is generated, the excess is returned through conduits 44 and 47 and check valve 50 to the storage tank.

There is no pump of any kind incorporated in the lines connected to the vaporizer. The resulting flow of the liquid gas to the vaporizer is dependent upon the withdrawal requirements downstream. Excess vapor can be charged back from the vaporizer back to the storage tank at any time the withdrawal downstream suddenly ceases, due to the manner in which the check valve is installed in the vapor line. The by-pass shown around the check valve is for the sole purpose of utilizing tank vapor to fire the vaporizer main burner until the temperature in the non-evaporating liquid in the vat has reached the temperature in excess of 100° F.

The flow or cycle of liquid gas from the tank to the vaporizer is entirely dependent upon the requirements of appliances or industrial burners on the downstream side of same. Any reduction in the pressure of the vaporizer pressure chamber caused by downstream withdrawal would necessarily permit liquid gas to flow into the vaporizer and become vaporized into dry vapor. Thus, discharge downstream varies as demands increase or decrease. The latent heat of vaporization of the gas is approximately 834 B. t. u.'s per gallon and this heat is supplied through the medium of the non-evaporative anti-freeze solution, or heat transfer liquid having the advantage of not evaporating and not freezing.

The thermostat 15 controls the off and on sequence of the main burner and is set to cut-off the main burner flame at between 180° and 200° F. There is also incorporated in the burner system the 100-percent cut-off valve so that in the event of the failure of the pilot light the main burner fuel is automatically cut-off, since the pilot light generates the necessary power to keep the main burner valve wide open. But, if the pilot light becomes inoperative, then the main burner fuel line becomes closed off. Valve 7 is of a manual rest type and will not remain in an open position to supply liquid butane-propane to the vaporizer until the liquid in the vat has reached a temperature of slightly above 100° F. The charging in the bulb and bellows assembly is specifically designed to fully contract at temperatures below 100° F. which would cause the latch to become disengaged, allowing valve on liquid butane-propane line to close by spring action. This eliminates any possibility of liquid butane-propane from passing on through the vaporizer and, hence, downstream. But, any amount of gas remaining in the pressure chamber of the vaporizer, after the valve becomes closed, will be thoroughly vaporized, due to the presence of the heat value concentrated in the vat liquid, since at 100° F. there is still a temperature 68° above the boiling or the vaporizing point of butane and 144° F. above the boiling or vaporizing point of propane. It will readily be understood that the latent heat or residue B. t. u. value in the vat liquid is a valuable safety asset. The burners in the industrial plant, the consuming system or any other application may now be lighted and from then on the operation of the vaporizer is entirely automatic and safe. But, if main burner or pilot generator should fail, causing the vat temperature to drop to 100° F. or below the chemical in the bulb assembly of the special valve will contract causing the special valve to close off the flow of liquid butane while Prestone in the vat still has a temperature well above the boiling point of butane which is 32° F. Thus it is clear that it will be impossible for any liquid butane to get downstream of the vaporizer and thus cause a hazard in the consuming apparatus. Conventional vaporizers that have float valve mechanisms which are intended to cut off the flow of liquid if and when the main burner fails are not reliable. All valve control bulbs in the recesses of the inverted bull plugs in the structure of my invention take advantage of quicker temperature changes in the Prestone present in these smaller chambers, during the time that the main burner is cut off automatically and the flow of liquid butane is absorbing heat from the Prestone. A faster temperature change results in these cavities than in the entire vat thus causing a more frequent on and off operation of the main burner and a more uniform heat and a more constant pressure to the consuming burners or distribution system.

I have found the system of my invention as herein set forth highly practical and efficient in operation and while I have described my invention in certain of its preferred embodiments, I realize that modifications may be made and I desire that it be understood that no limitations upon my invention are intended other than may be imposed by the scope of the appended claims.

What I claim as new and desire to secure by Letters Patent of the United States is as follows:

1. A gas generating and distributing system comprising a storage tank for supplying liquid hydrocarbon, a vaporizer including a container for enclosing a fluid, a tank disposed within said container in a position substantially covered by

the fluid within said container, connections between said tank and said storage tank, a gas distributing pipe line connected with said tank, a gas burner tapped from said gas distributing pipe line and operative beneath said fluid bath, the fluid in said container having a boiling point substantially above 212° F. and thermostatic means associated with said tank and submerged below the fluid level in said tank for controlling the supply of liquid hydrocarbon to said tank concurrently with the vaporization and distribution thereof to said distributing pipe line.

2. A gas generating and distributing system comprising a vaporizer divided into upper and lower compartments one above the other, the upper compartment providing an enclosure for enclosing a fluid, the fluid having a boiling point substantially above 212° F. the lower compartment containing a gaseous burner for directing a gas flame on said upper compartment, a container for hydrocarbon disposed within said upper compartment in a position substantially covered by the fluid within said upper compartment, a supply tank for hydrocarbon, connections between said supply tank and the aforesaid container, a gas distribution pipe extending from said container, a tap connection between said gas distribution pipe and said gaseous fuel burner and thermostatic means submerged in said upper compartment for regulating the quantity of hydrocarbon supplied from said hydrocarbon supply tank to the container submerged within the fluid in the upper compartment.

3. A gas generating and distributing system as set forth in claim 2 which includes a multiplicity of heat distributing flues opening into said lower compartment and extending through the fluid in said upper compartment for transferring heat to the fluid at locations immediately adjacent the container and facilitating the vaporization of the hydrocarbon for delivery to said gas distribution pipe.

4. A gas generating and distributing system as set forth in claim 2 in which the container submerged in the fluid in the upper compartment is substantially cylindrical and is indented in at least one end thereof for providing a pocket for the fluid in said upper compartment and wherein the control means for controlling the supply of hydrocarbon to the submerged container extends into the indentation in the end of the container.

5. A gas generating and distributing system as set forth in claim 2 in which the container submerged in the fluid in the upper compartment is substantially cylindrical and is indented at opposite ends for providing pockets for the fluid in the upper compartment and wherein control means extend into both of the indentations through the fluid in said upper compartment, one of said control means operating to determine the gas flow from said gas distribution pipe to the gaseous fuel burner beneath said upper compartment while the other of said control means operates to regulate the quantity of hydrocarbon supplied to the container submerged in the fluid in said upper compartment.

6. A gas generating and distributing system as set forth in claim 2 in which said upper compartment includes flues which extend from openings leading into said lower compartment to discharge ports above said upper compartment, the said container which is submerged in the fluid in said upper compartment extending on a horizontal axis between said flues.

7. A gas generating and distributing system as set forth in claim 2 in which the container for hydrocarbon extends on a vertical axis within said upper compartment and in which hydrocarbon fuel connections are made to the upper and lower portions of the container and in which the gas distribution line connects with the upper portion of the container.

8. A gas generating and distributing system including a vaporizer constituted by upper and lower compartments with the lower compartment housing gaseous fuel burners and the upper compartment comprising an enclosure for fluid, in which the fluid has a boiling point substantially above 212° F. of the order of 100° F., the enclosure formed by said upper compartment terminating in a bottom structure formed by plates extending downwardly at an angle to each other with the juncture of the plates meeting in an apex located above the gaseous fuel burners for spreading the flame from the gaseous fuel burners and directing the same upwardly, flues extending vertically through said upper compartment from openings in the said plates above said lower compartment and discharging through ports at the top of said upper compartment, a container for hydrocarbon fuel disposed in said upper compartment and submerged in the fluid therein between the said flues and immediately above the apex juncture of said plates, hydrocarbon fuel connections to the top and bottom of said submerged container adjacent one end thereof and a gaseous fuel distributing pipe line connected adjacent the other end of said submerged container.

9. A gas generating and distributing system as set forth in claim 8 which includes a storage tank for hydrocarbon fuel connected with the connections leading to the first mentioned end of the container submerged in said upper compartment and means in each of said connections for regulating the flow of hydrocarbon with respect to the said tank.

10. A gas generating and distributing system as set forth in claim 8 including a storage tank for hydrocarbon fuel, connections extending from said storage tank to each of the hydrocarbon fuel connections leading to the top and bottom of one end of said submerged container, a metering valve in one of said connections and a temperature controlled valve in the other of said connections, said temperature controlled valve being operative in accordance with the temperature of the fluid in said upper compartment.

11. A gas generating and distributing system as set forth in claim 8 in which a storage tank for hydrocarbon fuel is provided with a pair of connections leading to the hydrocarbon fuel connections on the container submerged in the fluid in said upper compartment, a temperature controlled valve disposed in one of said connections and operative in accordance with the temperature of the fluid in the upper compartment, a pressure operated unidirectional valve located in the other of said connections, a by-pass path for gas connected around said unidirectional valve in said last mentioned connection and a metering valve in said by-pass connection.

12. A gas generating and distributing system including a vaporizer having upper and lower compartments, the upper compartment comprising an enclosure for fluid having a boiling point substantially above 212° F. and said lower com-

partment including a gaseous fuel burner, a multiplicity of flues extending through said upper compartment and discharging above the top thereof and opening into said lower compartment for directing heat from said gaseous fuel burner therethrough for facilitating the heating of the fluid in said upper compartment, a container for hydrocarbon suspended vertically within said upper compartment between said flues, a transverse flue extending diametrically through said container, connections for hydrocarbon adjacent both the upper and lower ends of said container on opposite sides of said transverse flue, a connection with the upper end of said container for distributing gas therefrom and thermostatic means extending through said upper compartment and into the transverse flue in said submerged container for controlling the supply of hydrocarbon to said submerged container and the by-passing of part of the gas from said hydrocarbon container to the gaseous fuel burner for heating the liquid in which said hydrocarbon container is submerged.

13. A system for converting liquid hydrocarbons into gaseous fuels for distribution to a consuming load comprising a storage tank, a vaporizer including a vat for enclosing a fluid having a boiling point substantially above 212° F., a hydrocarbon container submerged in the fluid in said vat, a gaseous fuel burner located in said

vaporizer beneath said vat, a gaseous fuel distribution pipe line connected with one end of said hydrocarbon container, connections from the other end of said hydrocarbon container to said storage tank, one of said connections including a pivoted plate valve gravitationally disposed against a seat extending approximately 45° to the vertical and operative to be displaced from its seat when pressure in said hydrocarbon container exceeds the pressure in said storage tank for returning the hydrocarbon to said storage tank and in which the connection that includes said pivoted plate valve also contains a shunt pipe connection around said pivoted plate valve wherein the shunt pipe connection contains a metering orifice and a manually controllable valve whereby a path for hydrocarbon may be maintained around said pivoted plate valve extending between said storage tank and said hydrocarbon container.

WADE W. DICK.

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