Oct. 29, 1968 C. E. GOLDEN 3,407,787

LPG VAPORIZER

Filed Jan. 3, 1967 3 Sheets-Sheet 1

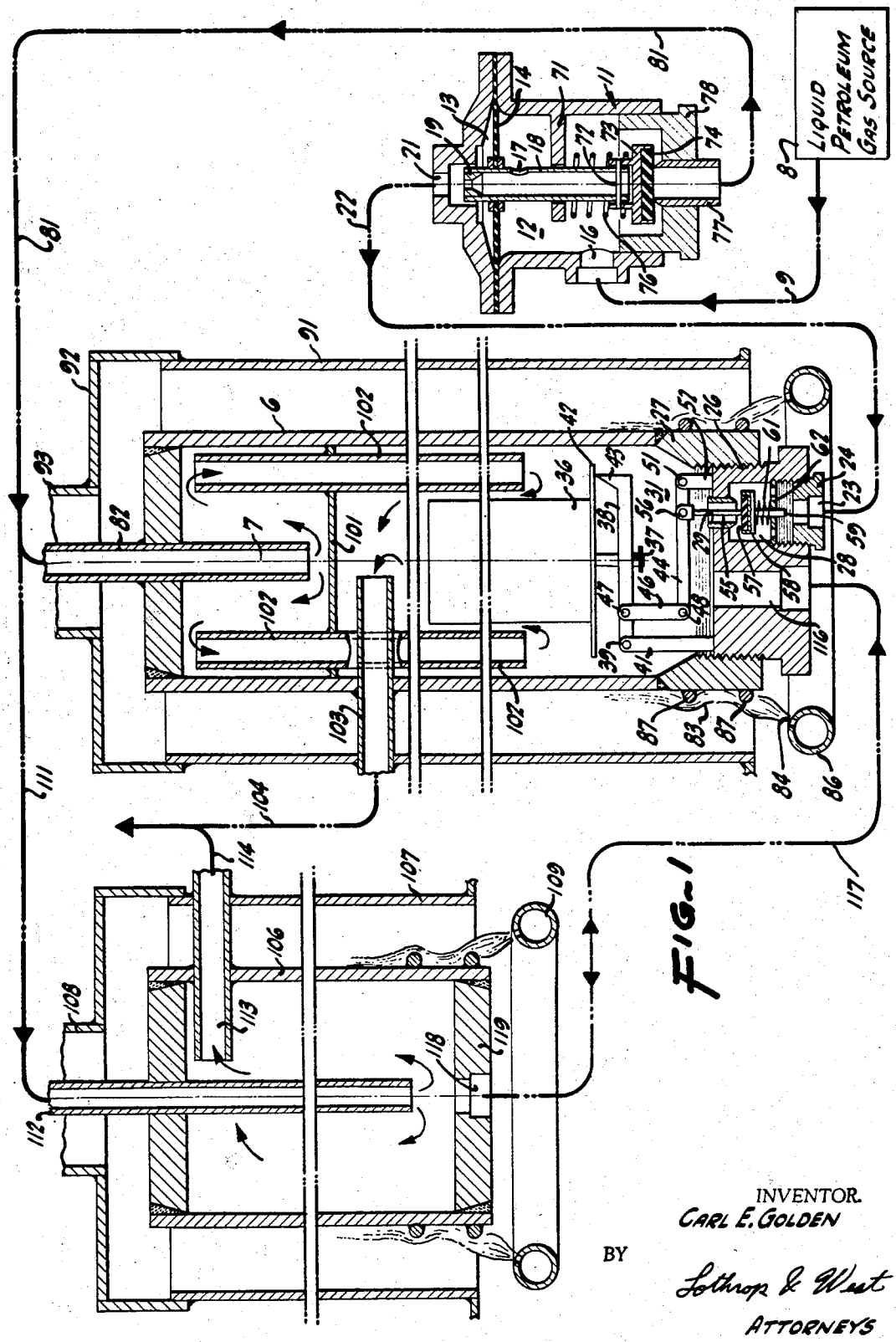


FIG. 1

INVENTOR.
CARL E. GOLDEN

BY

Lothrop & West
ATTORNEYS

Oct. 29, 1968 C. E. GOLDEN 3,407,787

LPG VAPORIZER

Filed Jan. 3, 1967 3 Sheets-Sheet 2

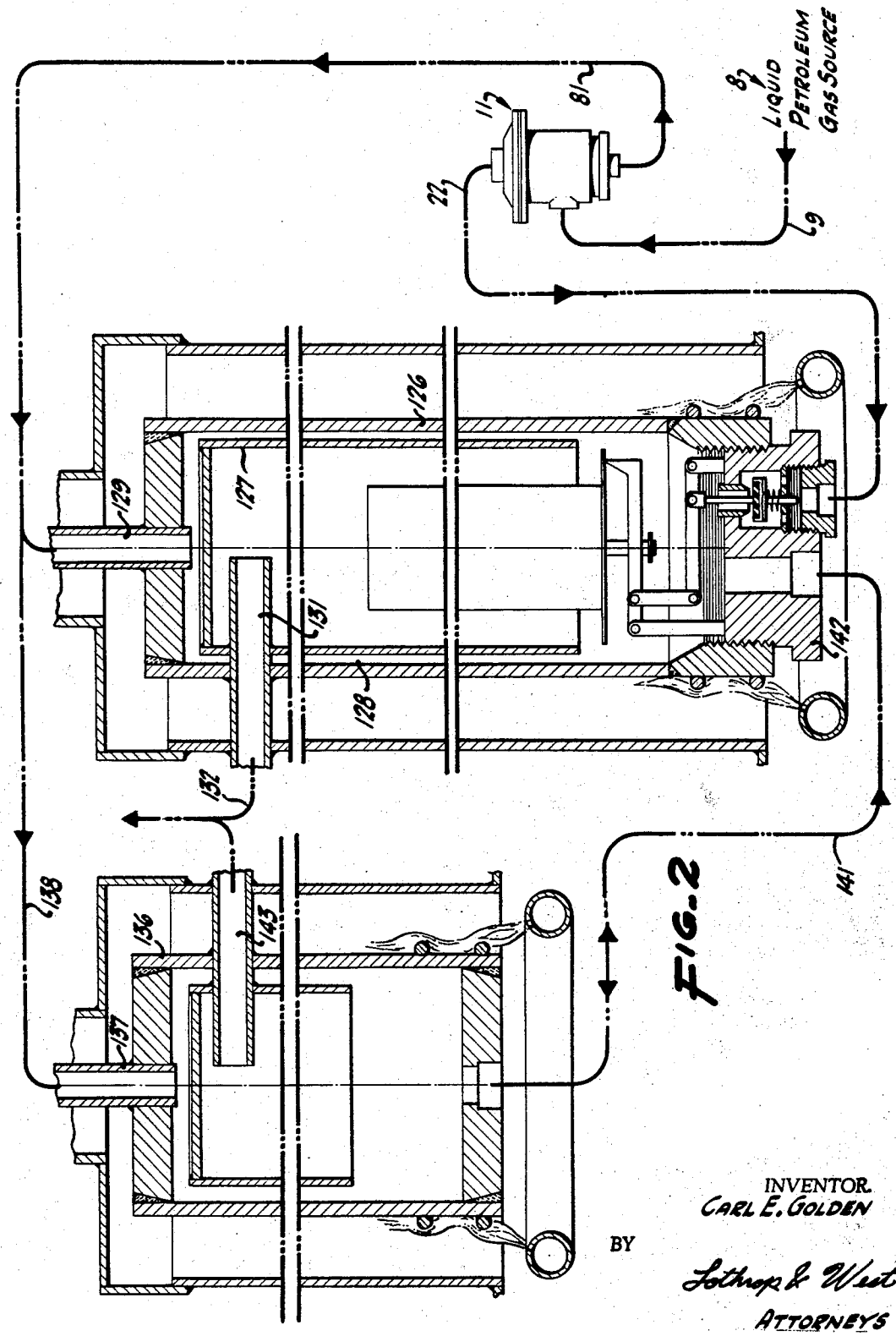


FIG. 2

INVENTOR.
CARL E. GOLDEN

BY

Lothrop & West
ATTORNEYS

Oct. 29, 1968 C. E. GOLDEN 3,407,787

LPG VAPORIZER

Filed Jan. 3, 1967 3 Sheets-Sheet 3

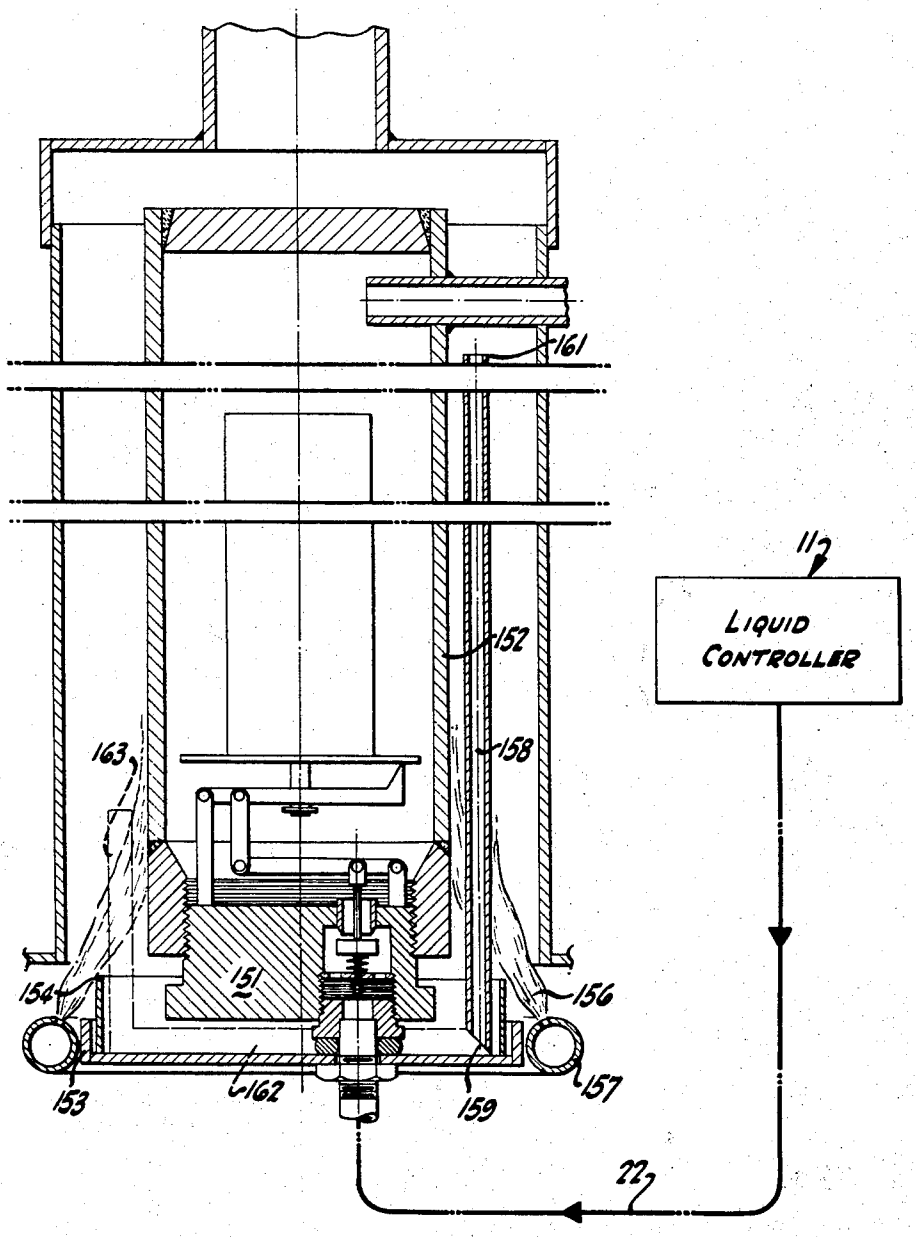


FIG. 3

INVENTOR.
CARL E. GOLDEN

BY

Lothrop & West
ATTORNEYS

United States Patent Office 3,407,787 Patented Oct. 29, 1968

3,407,787

LPG VAPORIZER

Carl E. Golden, Burlingame, Calif., assignor to Ransome Torch & Burner Co., a corporation

Filed Jan. 3, 1967, Ser. No. 607,010
10 Claims. (Cl. 122—4)

ABSTRACT OF THE DISCLOSURE

An LPG vaporizer mechanism includes a controller having first and second chambers, the first chamber having an outlet valve. LPG supplied to the first chamber flows under control of the outlet valve into a heated container through a float controlled level valve in the container. LPG also flows from the first chamber through an orifice into the second chamber and from there to a port in the bottom of the heated container. LPG gas is released from the top of the heated container.

My invention relates to means especially useful in connection with the vaporization of liquid petroleum gas, usually abbreviated "LPG," and is especially concerned with an improved version of a device for taking petroleum gas in liquefied form and subjecting it to heat under appropriate control in order to afford a supply of burnable gas at another location.

The vaporization of liquid petroleum gas is necessarily attended by a number of controls since combustion of the gas itself must be carefully arranged at a regulated rate or according to demand. It is advisable to avoid mechanisms that might in use be dangerous or deteriorate so that the equipment will run a long time in a safe fashion. It is important, too, that the mechanism be able to respond quickly to demand changes and without wide fluctuations in vaporizing temperatures.

It is therefore an object of my invention to provide an LPG vaporizer which is effective to afford an adequate and regulated supply of gas from the liquid initially supplied.

Another object of the invention is to provide an LPG vaporizer which is relatively safe and responds in a safe fashion to wide variations in operation.

Another object of the invention is to provide an LPG vaporizer which is controlled within relatively narrow limits in accordance with the requirements upon it.

Another object of the invention is to provide an LPG vaporizer in which the heat transfer or vaporizing is effectively carried out.

Another object of the invention is to provide an LPG vaporizer of an improved nature.

Other objects together with the foregoing are attained in the embodiments of the invention described in the accompanying description and illustrated in the accompanying drawings, in which:

FIGURE 1 is a diagrammatic showing with portions largely in cross section on a vertical axial plane through an assemblage of LPG vaporizers pursuant to the invention;

FIGURE 2 is a view comparable to FIGURE 1 and showing a different relationship of LPG vaporizers; and

FIGURE 3 is a view of a typical LPG vaporizer constructed pursuant to the invention with an added safety device.

In the initial form of the invention, there is provided a container 6 preferably of metal and disposed with its central axis 7 in an upright position and at an appropriate elevation. The container is generally closed and is utilized as a heat transfer mechanism for converting liquid petroleum gas into vapor or gas form.

Liquid petroleum gas from a source 8 is led through

a conduit 9 to a liquid controller 11. This is a body in which two chambers are defined. The first chamber 12 is separated from the second chamber 13 by a diaphragm 14 of considerable flexibilty. The conduit 9 leads through a port 16 into the first chamber 12. The liquid can flow in two ways. If there is no substantial pressure on the underside of the diaphragm 14, within the first chamber 12, the liquid can flow through a port 17 in a central tube 18. An end orifice disk 19 in the tube opens to an outlet port 21 from the upper part of the second chamber 13. A pipe 22 leads from the outlet port 21 to a lower port 23 formed in a bushing 24. A bottom plug 26 seals the relatively heavy lower end band 27 of the container 6 and receives the bushing 24.

Flow can continue from the lower port 23 through a valve chamber 28 in the plug 26 and through an outlet tube 29 into the lower chamber 31 enclosed by the bottom portion of the tubular container 6. Liquid can rise in the chamber 31 until such time as it lifts a float 36. This is preferably a hollow metallic member having a central stem 37 loosely guided in a lever 38 supported on a fulcrum 39 at the upper end of a standard 41 projecting from the plug 26. The float 36 includes a bottom disk 42 bearing upon a knife edge 43 at the extreme end of the lever 38, so that the float moves the lever 38 correspondingly. A secondary lever 44 moves concurrently with the lever 38 by reason of an interposed link 46 having pivots 47 and 48 interconnecting the link and levers. The lever 44 has a fulcrum 51 on a standard 52 projecting from the plug 26.

Motion of the float 36 is utilized to control a level valve. For that reason, the lever 44 has a freely depending rod 55 connected to the lever 44 by a pin 56 and designed to pass through the tube 29. In its lower range of movement, the rod 55 abuts the resilient seat 57 of a level valve disk 58. the disk has a stem 59 surrounded by a closure spring 61 and is guided in a spider 62 located at the upper end of the bushing 24. With this arrangement, when the float 36 rises due to rising liquid level in the lower chamber 31, the lever 38 is rocked counterclockwise as seen in FIGURE 1. This in turn rocks the lever 44 in a clockwise direction to lift the rod 55 and relieves the valve 58 of the weight of the float. The spring 61 is then effective to move the level valve toward closed position.

In this way, when liquid first enters the chamber 31, the valve 58 is kept open by the weight of the float, but as the liquid rises within the lower chamber the float similarly rises and eventually rises high enough to permit closure of the valve 58 by the spring 61. As the liquid level varies within the chamber 31 between relatively narrow limits, the linkage makes the level valve open and close, so that the level of liquid within the chamber is maintained substantially constant. Since flow to the lower chamber 31 is directly from the source 8 through the liquid controller without any restriction except that due to the orifice 19, a steady supply of liquid at not more than a maximum rate is available at the valve 58 for further regulation.

The liquid controller 11 has additional flow governing means. The tubular stem 18 is operative in a guide 71 forming part of the body of the controller and at its lower end has a cross pin 72 carrying a valve disk 73 with a yielding seat 74. A spring 76 urges the valve disk toward closed position on a thimble 77 secured in a bottom plug 78 screwed into the lower portion of the controller housing. The thimble 77 leads through a conduit 81 to a central tube 82 entering the upper portion of the container 6.

With this mechanism, liquid arriving in the first chamber 12 in an amount not able to pass through the opening 17 and through the orifice 19 into the lower portion of the container 6 increases the pressure and flexes the dia-

phragm 14 upwardly. If the pressure rise is sufficient to lift the valve 74, some of the fluid can flow through the line 81 into the top of the vaporizer. Should the liquid level in the vaporizer already be relatively high, then the valve 58 is closed and the pressure in the second chamber 13 rises relatively rapidly. The inflowing fluid is then unable to deflect the diaphragm 14 upwardly, thus permitting the spring 76 to urge the valve 74 closed. Consequently, when the liquid level is too high within the vaporizer, both supplies of liquid thereto are halted, but when there is a deficiency of liquid within the vaporizer, then liquid can flow thereto. Stated differently, the level valve 58 is responsive to the liquid level within the vaporizer, whereas the liquid controller 11 is responsive to the difference in pressure between the first chamber and the second chamber.

Liquid entering the container 6 through the central upper tube 82 must follow a tortuous path and be heated as it flows. In order to effectuate vaporization or gasification of the liquid, the exterior of the container 6 adjacent its lower end is subject to the play of flames 83. These result from the combustion of gas issuing from orifices 84 in a ring burner 86 disposed coaxially with the container 6 and located at its lower end. A ring of flame impinges upon the relatively heavy lower end of the container. I have found that the heat transfer is particularly expedited by the provision of one or a plurality of hoops 87 around the lower portion of the container. The hoops are conveniently made of circular stock bent into annular form and welded in place. While the reason for their beneficial operation is not fully understood, it appears that they induce a Coanda effect and tend to cause the flames 83 to adhere to or hug the surface of the container 6 for a substantial distance upwardly along its length.

To assist in confining the flames and to afford an appropriate enclosure for the container, I arrange a circular cylindrical jacket 91 coaxial with the axis 7. The jacket leads into an adapter 92 joined to a flue 93 extending upwardly to discharge. The gas supplied to the ring burner 86 can be some of the product of a vaporizer similar to that shown or can be from an entirely different source.

Liquid entering through the tube 82 follows a tortuous path because it encounters a transverse barrier plate 101 having a number of openings, in each of which axially extending tubes 102 are disposed. The tubes accept fluid flow from the discharge of the tube 82 and direct it downwardly toward the liquid in the bottom of the container 6; that is, in the lower chamber 31. As it flows, the liquid becomes gasified since the tubes 102 are heated because of their thermal connection to the container 6. The gas makes an abrupt bend at the bottom of the tubes 102 and rises toward the lower side of the baffle 101. The abrupt turns tend to dislodge any suspended or entrained liquid which flows down into the lower chamber 31. The relatively dry gas then ascends around the upper portion of the float 36 and is released from the container 6 by a duct 103 extending horizontally from a point near the upper end of the chamber 31. A connected discharge pipe 104 continues from the outside of the jacket 91 to a point of use.

In an actual installation, it is preferred that the liquid controller 11 be physically situated at a level so that the pipe 22 is approximately horizontal for most of its length; that is, the liquid controller is preferably about even with or below the liquid valve 58. This leaves a relatively long rise in the pipe 81. In the event for some reason the heating means should fail, then liquid flowing in the pipe 81 tends to have a syphon effect and this accelerates the closure of the valve 74.

In some installations it is desired to have more capacity than can be supplied by a single container 6, although the liquid controller 11 is adequate, as is the liquid level valve, to handle additional capacity. Under those circumstances, I preferably provide one or more secondary containers 106 of quite similar construction to the one previously disclosed but without the float mechanism. However, the container 106 is preferably arranged so that its lower portion is about on a level with the lower portion of the container 6, the vertical displacement shown in FIGURE 1 being merely for convenience in drawing.

The container 106 is in a jacket 107 connected to a vent 108, as before, and is supplied with heat from a ring burner 109 of the sort previously described. In this instance, the duct 81 leads not only into a central tube 82 for the first vaporizer, but is continued by a duct 111 to lead into a central tube 112 for the additional vaporizer. In this instance, as an illustration of a variation in construction, the tube 112 instead of terminating above a barrier plate 101 continues down very nearly to the bottom of the container 106, so that the material discharging therefrom makes an abrupt turn, is heated as it travels on the inside of the container 106 and then leaves through a gas-releasing pipe 113 connected by a conduit 114 to the discharge pipe 104. In a similar fashion, there is a parallel construction for the incoming liquid from the pipe 22. Instead of having a T directly into this pipe, a port 116 is provided in the plug 26. A pipe 117 joins the port 116 to an inlet port 118 in a plug 119 closing the bottom of the container 106. In actual installations, the ends of pipe 117 are about at the same level. Since there is free vapor communication through the pipe 104, the liquid level in both vaporizers is the same.

It is possible to vary the heat transfer and flow mechanism of the vaporizer while retaining the control instrumentalities. As shown particularly in FIGURE 2, there is provided a container 126 having the same connections as before and the same fittings, but instead of having a transverse diaphragm plate 101, there is disposed inside the container an inverted cup 127 leaving a relatively narrow annular path 128 between the container 126 and the cup 127. Liquid coming in through a conduit 129 corresponding to the pipe 82 flows downwardly over the outside of the cup in close proximity to the heated wall of the container 126. The resulting vapor flows then toward the bottom of the annular duct 128, makes an abrupt reversal, rises inside the cup 127 and discharges through a releasing means 131 in the form of a pipe acting as a support for the cup and opening to a discharge duct 132. The general function of this structure is as previously described.

The arrangement in the right-hand portion of FIGURE 2 can be utilized alone or, for augmentation, can be exactly duplicated. If desired, there can be supplied a structure as shown in the left half of FIGURE 2 in which the float mechanism is not duplicated. In this instance, the supply of liquid enters the top of the container 136 through a pipe 137 joined by a conduit 138 to the source supplying the pipe 129. The bottom supply of liquid is through a pipe 141 opening through a plug 142 at the bottom of the container 126, as before. The discharge of gas is from a release means in the form of a conduit 143 leading into the conduit 132. It is to be understood that the position of the corresponding parts is preferably at substantially the same level, the lower portion of the additional structure in FIGURE 2 being raised merely for convenience in illustration. In this way, the mechanism affords an increased capacity without additional controllers.

In some instances, the lower part of the vaporizer, partly due to expansion of gas therein and partly due to cold climate, is cold enough to condense water of combustion. This condensate may drip off of the unit onto the floor. To avoid such difficulty, I preferably provide an arrangement as shown in FIGURE 3, which in general is comparable to those previously described. The liquid controller in the pipe 22 can be of the sort previously described or can be a simple shut-off valve. In this instance, beneath a lower plug 151 of a container 152 there is dis-

posed a relatively shallow pan **153** having an upstanding circular collar **154** terminating below the path of flames **156** established by a surrounding ring burner **157**. Any liquid condensate which drains from the lower portion of the container **152** instead of going onto the floor is caught in the pan **153** and is evaporated therein, the resulting steam mingling with the flames **156** and thus being harmlessly disposed of.

Sometimes it is preferred to make sure that steam be discharged above the reach of the flames well above the lower portion of the container. Under those circumstances, I provide a standpipe **158**. The lower end has a bevel **159** and terminates at an open upper end **161** farther up the walls of the container **152**. The tube **158** receives some of the liquid from the pan **153**. The liquid tends to become vaporized in the tube since the flames **156** keep the tube **158** hot. The liquid then is changed to steam within the tube **158** and ascends by gravity to the upper end **161** whereat it mixes with the other hot gases and is discharged therewith. Even if the tube **158** is replaced by a solid rod, it conducts enough flame heat to the liquid in the pan **153** to evaporate it.

As an alternate construction, the tube **158** can be continued as shown by the dotted lines **162**, thus constituting a J-shaped conduit having a relatively low leg **163** with an opening near the bottom portion of the container **152**. This structure operates, when it is heated, by providing a convection current of hot gas through the interior of the tube portion represented by the lines **162** as well as the tube **158**, the flow being from the low inlet **163** to the high outlet **161**. The hot gases thus induced to flow by convection travel through the liquid within the pan **153**, cause it to vaporize and to mix with and travel with the gas from the burner **157**. In this way, any overflow or spillage of condensate is prevented.

What is claimed is:

1. An LPG vaporizer mechanism comprising a container, means for heating said container, a source of LPG, a liquid controller including first and second chambers separated by a diaphragm, an outlet valve from said first chamber controlled by said diaphragm, means for connecting said source to said first chamber, means establishing an orifice for controlling flow from said first chamber to said second chamber, means for connecting said second chamber to a lower port at the bottom of said container, means for connecting said first chamber to a port leading into said container, and means adjacent the top of said container for releasing gas therefrom.

2. An LPG vaporizer as in claim **1** in which a level valve is arranged to control flow through said lower port and said level valve is actuated by a float in the lower portion of said container.

3. An LPG vaporizer as in claim **1** in which said outlet valve in said liquid controller is a poppet valve urged closed by a spring.

4. An LPG vaporizer as in claim **2** in which said level valve is a poppet valve urged closed by a spring upon rising movement of said float.

5. An LPG vaporizer as in claim **1** in which fluid flow in said container from said upper port to said gas releasing means is through a tortuous path at least partially defined by means for directing flow downwardly within said container.

6. An LPG vaporizer as in claim **1** in which said container is an upright circular cylinder and said heating means is a ring burner arranged to play flame over the lower exterior portion of said circular cylinder.

7. An LPG vaporizer as in claim **6** in which at least one hoop is secured to the exterior of said circular cylinder in the flame area of said burner.

8. An LPG vaporizer as in claim **1** in which a plurality of said containers are arranged substantially at a common level, said second chamber is connected to the lower ports of said containers, said first chamber is connected to the upper ports of said containers, and said gas releasing means of all of said containers are connected together.

9. An LPG vaporizer as in claim **1** and including a pan in position beneath said container to catch condensate therefrom, and means for heating said pan.

10. An LPG vaporizer as in claim **1** in which said means for connecting said second chamber to said lower port and said means for connecting said first chamber to said upper port are arranged to be simultaneously open at least some of the time whereby LPG can flow simultaneously through both of said means to both said lower port and said upper port.

References Cited

UNITED STATES PATENTS

2,618,935	11/1952	Malir	62—52 XR
3,044,482	7/1962	Golden	158—53 XR
3,153,439	10/1964	Golden	158—53

KENNETH W. SPRAGUE, *Primary Examiner.*