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LIQUEFIED GAS DISPENSING SYSTEM

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Fig. 1.

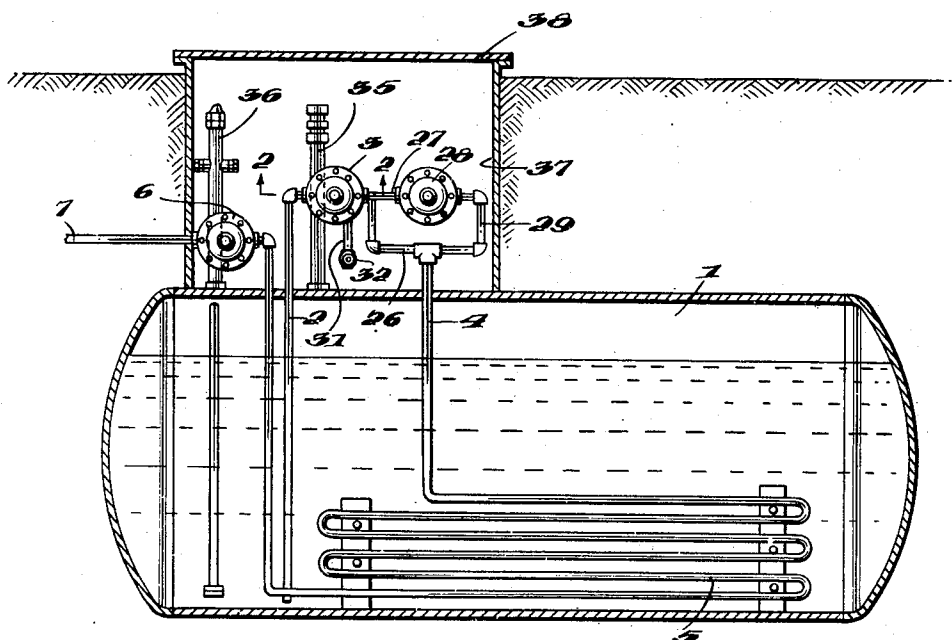
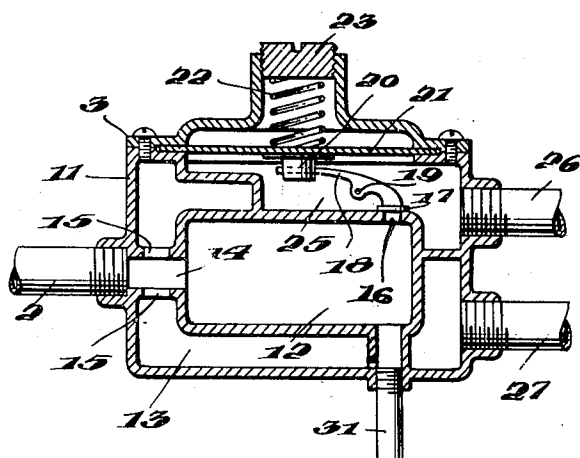


Fig. 2.



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LIQUEFIED GAS DISPENSING SYSTEM

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7 Claims. (Cl. 62—1)

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This invention relates to an improvement in liquefied gas dispensing systems of the type wherein a mixture of liquefied gas, such as butane, iso-butane and propane, is stored underground or above ground in a pressure tank in which it is vaporized by earth heat or heat from the atmosphere and dispensed therefrom for household purposes.

In such systems, it is customary for the liquefied gas to be withdrawn from within the tank through a first-stage pressure regulator into a vaporizer, from which the gas is directed through a suitable conduit to the point of use, usually through a second-stage regulator. In passing through the first-stage regulator and being vaporized thereat, the liquefied gas absorbs heat to such an extent as to cause a condensing of moisture around said regulator and vaporizer and a cooling thereof which frequently results in the freezing of the regulator valve, seriously interfering with the action thereof. This sometimes causes the valve to stick on its seat and prevents it from opening and also the discharge port sometimes freezes closed.

When the regulator valve is thus prevented from opening, the supply of fuel to the appliance is cut-off until the frozen valve eventually thaws out or the condition remedied by a service man.

The object of this invention is to provide for the automatic alternate supply of fuel in the event of freezing of the first-stage regulator, as well as to thaw out the regulator by the circulation of warm liquefied gas therearound, thereby providing automatically for the continuance of the supply of fuel to the appliance as well as for the removal of the obstruction that would otherwise remain.

This object is accomplished by the provision of a by-pass line about the first-stage regulator and containing an alternate regulator set to open at a lower pressure than the first-stage regulator and which will open in the event of failure of said first-stage regulator to open automatically. The first-stage regulator is constructed preferably with a jacket therearound through which the liquefied fuel flows to the alternate regulator, whereby upon opening of the latter, the fuel flows through the jacket and warms the first-stage regulator sufficiently to thaw it out and remove the frozen condition of the valve or discharge port thereof. Then when the first-stage regulator opens, the alternate regulator will close due to its lower set point.

A preferred embodiment of the invention is shown in the accompanying drawings in which:

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Fig. 1 is a vertical sectional view through a storage tank showing in elevation and somewhat diagrammatically the liquefied gas dispensing system; and

Fig. 2 is a vertical sectional view through a jacketed pressure regulator.

The invention is shown as applied to a liquefied gas dispensing system in which a mixture of gases is maintained in the liquid state under pressure, and is stored in a tank designated generally by the numeral 1. This tank is frequently buried underground when the mixture contains less than 50% propane, as shown in Fig. 1, below the frost line, so as to utilize the heat of the surrounding earth in vaporizing the liquefied fuel. When more than 50% of the mixture is propane, the boiling point of the mixture is low enough to permit above ground installations in most of the United States.

Extending from a point near the bottom of the tank 1 is an eduction pipe 2 to withdraw fuel from the body of fuel in the tank in the liquid phase. The upper end of the eduction pipe 2 is connected with a first-stage pressure regulator designated generally by the numeral 3, through which the liquefied gas is adapted to pass. The pressure regulator 3 has the discharge side thereof connected with a pipe 4 which in turn is connected with an internal vaporizer 5 within the tank 1, which internal vaporizer is shown as a coil in the pipe immersed in the liquefied gas held in the storage tank. The discharge side of the vaporizing coil 5 is connected with a second-stage regulator 6 from which the vaporized gas is discharged through a service line 7 to the appliance for use.

As is well understood, in such a system as here illustrated, the liquefied gas that is withdrawn from the tank through the eduction pipe 2 and delivered to the first-stage regulator 3, has its pressure reduced sufficiently in passing through said first-stage regulator to be substantially vaporized. In passing therefrom through the vaporizing coil 5, the latter not only insures the vaporization of the gas that has been discharged through the pressure regulator 3 but accomplishes vaporization of any droplets of liquid that may not have been effectively vaporized at the pressure reducer 3, so that only dry gas will be directed to the service line. The vaporizer 5 receives heat from the liquid contents of the tank 1 which in turn are in heat exchange relation with and are warmed by the heat from the surrounding earth or the atmosphere through the walls of the tank.

To prevent freezing of the first-stage regulator

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3, it is preferably constructed as shown in Fig. 2. As here shown, the regulator is constructed of a body 11 containing an internal chamber 12 having a surrounding liquid jacket 13. The internal chamber 12 is connected through a passageway 14 with the eduction pipe 2 for the supply of liquefied gas from within the storage tank 1. Openings 15 establish communication between the passageway 14 and the liquid jacket 13, so as to provide for open communication between said liquid jacket and the eduction pipe 2 thereby maintaining the liquid jacket full of liquefied fuel.

The internal chamber 12 has an outlet port 16 controlled by a valve 17 carried by one end of a lever 18 pivotally supported at 19. The opposite end of the lever 18 has a loose connection 20 with a diaphragm 21 mounted in the housing 11. A coiled spring 22 bears against the diaphragm 21 normally tending to move the latter to open the valve 17 in opposition to the pressure at the discharge side of the valved port 16. The tension of the coiled spring 22 may be regulated by an adjusting screw 23 acting thereon.

The port 16 opens from the internal chamber 12 into a narrow passageway 25, in the opposite side of which the pivot 19 is mounted. This passageway 25 is closed at one end while the opposite end is connected with a pipe 26 which joins the same with the upper end of the pipe 4.

The liquid jacket 13 that substantially surrounds the internal chamber 12 as well as the passageway 25 on opposite sides of the latter, is connected through a pipe 27 with a pressure regulator 28 of conventional construction. The opposite side of the pressure regulator 28 is connected through a pipe 29 with the upper end of the pipe 4 leading to the vaporizer 5. The pressure regulator 28 is preferably set at a lower pressure than the regulator 3, as for instance, at 5 pounds pressure when the regulator 3 is set at 6 pounds pressure. Thus the pressure regulator 28 will remain closed during normal functioning and operation of the regulator 3.

During the normal operation of the system, the pressure reducer 3 will control the supply of gas from the eduction pipe 2 to the vaporizer pipe 4, being open according to the set pressure, for the flow of gas through the passageway 14, internal chamber 12 and port 16 into the passageway 25, thence through the pipe 26 and pipe 4 to the vaporizer 5, being discharged from the latter through the second-stage regulator 6 to the service line 7 leading to the appliance. When the gas is discharged from the outlet port 16 into the passageway 25, its pressure is lowered sufficiently to cause vaporization of the gas, and any further vaporization thereof required is accomplished by the vaporizer 5 which absorbs heat from the contents of the tank and which in turn are heated by the surrounding earth or the atmosphere. The passageway 25 in which the valved outlet port 16 is located is substantially surrounded by the liquid jacket 13, and in the event that the valve should freeze or fail to open due to the collection of ice thereon, the pressure in the outlet pipe 4 would continue to drop due to the exhaustion of gas in the service line.

When the pressure therein should be reduced to the set point of the secondary reducer 28, the latter would be opened and would then discharge the gas to the pipe 4. The flow to the regulator 28 would take place from the ports 15 in the passageway 14, through the liquid jacket 13, pipe 27, regulator 28 and pipe 29, to the upper end of the pipe 4. The flow of warmed liquid through

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the jacket 13 about the valved port 16 would thaw the valve mechanism sufficiently to allow this to open in response to the reduction of pressure in the pipe 26. Then when the valve is thus opened, flow would resume through the port 16, passageway 25 and pipe 26, continuing until the pressure is built up to the set point of the pressure reducer 3. In the meantime, the pressure reducer 28 would have closed due to its lower set point, and the system would continue to function then in the normal manner. Thus it will be evident that provision is made for thawing out or defrosting the pressure regulator in the event that it ceases to function as a result of freezing action.

A moisture trap is shown at 31 connected with the liquid jacket 13 and also open to the chamber 12, and controlled by a drain plug 32. The purpose of this moisture trap 31 is to collect and discharge moisture from said chamber and jacket caused by the chilling of liquefied gas, whereby this regulator 3 acts as a dehydrator, as well as a pressure regulator.

The tank 1 may be constructed with the usual fittings required for practical operation. A filling pipe is shown at 35, and a gauge device at 36. These fittings and regulators are preferably enclosed in a housing 37 provided with a removable cover 38 located at or above the surface of the ground for access thereto. The housing 37 may be filled with insulating material, if desired.

We claim:

1. In a liquefied gas dispensing system, a container for confining liquefied gas and adapted to be buried underground, a conduit connected with the container to discharge liquefied gas therefrom, a pressure regulator connected with said conduit and having pressure controlled valve means for reducing the pressure of the gas flowing therethrough vaporizing said gas, said pressure regulator having a liquid jacket surrounding the major portion thereof adjacent the valve means, and means for circulating liquefied gas from said container through said liquid jacket in heat exchange relation with the regulator valve means when said valve means is closed.

2. In a liquefied gas dispensing system, a container for confining liquefied gas and adapted to be buried underground, a conduit connected with the container to discharge liquefied gas therefrom, and a pressure regulator connected with said conduit, said pressure regulator comprising an internal chamber having a surrounding liquid jacket, means for connecting said internal chamber and jacket in open communication with the conduit, pressure responsive means for controlling discharge from said internal chamber, and means for passing the liquid out of the jacket upon freezing of the discharge from the internal chamber to warm said discharge.

3. In a liquefied gas dispensing system, a container for confining liquefied gas, a conduit connected with said container to discharge liquefied gas therefrom, and a pressure regulator connected with said conduit, said pressure regulator comprising an internal chamber with a discharge port and having a surrounding liquid jacket, means for connecting said internal chamber and jacket in open communication with the conduit, pressure responsive means for controlling discharge through said port from said internal chamber, and separate means for controlling discharge from said liquid jacket upon freezing of said port thereby causing liquid movement in

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heat exchange relation with said port to reduce the freezing condition thereat.

4. In a liquefied gas dispensing system, the combination of a container for confining liquefied gas, a conduit connected with said container to discharge liquefied gas therefrom, and a pressure regulator connected with said conduit, said pressure regulator comprising a chamber having a discharge port and an external receptacle in heat exchange relation with said port, means connecting said chamber and receptacle in open communication with the conduit, pressure responsive means for controlling the discharge through said port from said chamber, and separate means for controlling the discharge from said receptacle upon freezing of said port, thereby causing liquid movement in heat exchange relation with said port to reduce the freezing condition thereat.

5. In a liquefied gas dispensing system, the combination of a container for confining liquefied gas, a discharge conduit connected with said container, a service line, a pressure reducing regulator connecting said discharge conduit with said service line, said regulator having a pressure controlled discharge port, and means for by-passing liquefied gas from said container in heat exchange relation with said port upon freezing action at said port.

6. In a liquefied gas dispensing system, the combination of a container for confining liquefied gas, a discharge conduit connected with said container, a service line, a pressure reducing regulator connecting said discharge conduit with said service line, said regulator having a pressure controlled discharge port, and means for by-

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passing liquefied gas from said discharge conduit to the service line, in heat exchange relation with said port upon freezing action at said port.

7. In a liquefied gas dispensing system, the combination of a container for confining liquefied gas, a discharge conduit connected with said container, a service line, a pressure reducing regulator connecting said discharge conduit with said service line, said regulator having a pressure controlled discharge port, and means for by-passing liquefied gas from said discharge conduit to the service line, in heat exchange relation with said port upon freezing action at said port, and a pressure reducing regulator connected in said by-pass means and arranged to reduce the pressure of the gas passing therethrough.

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