Jan. 11, 1944. R. BAKER ET AL 2,339,134

BUTANE GAS TANK FEED DEVICE

Filed June 15, 1938 2 Sheets-Sheet 1

Fig.1

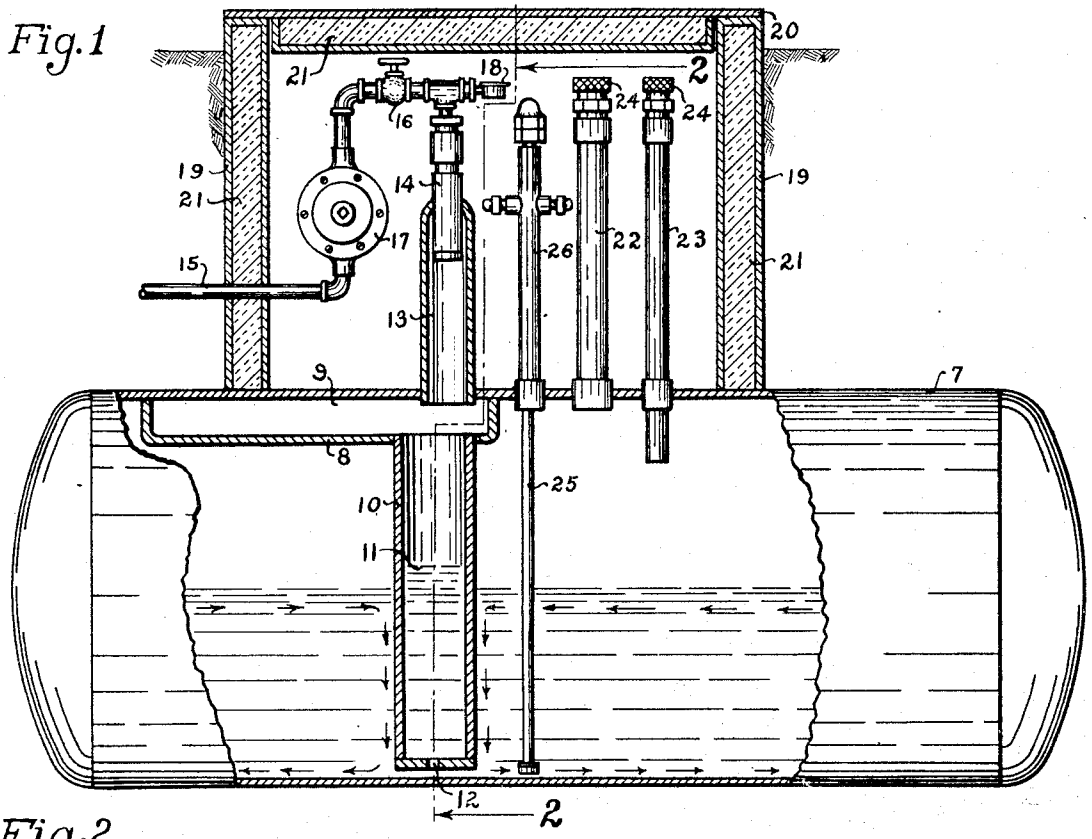


Fig.2

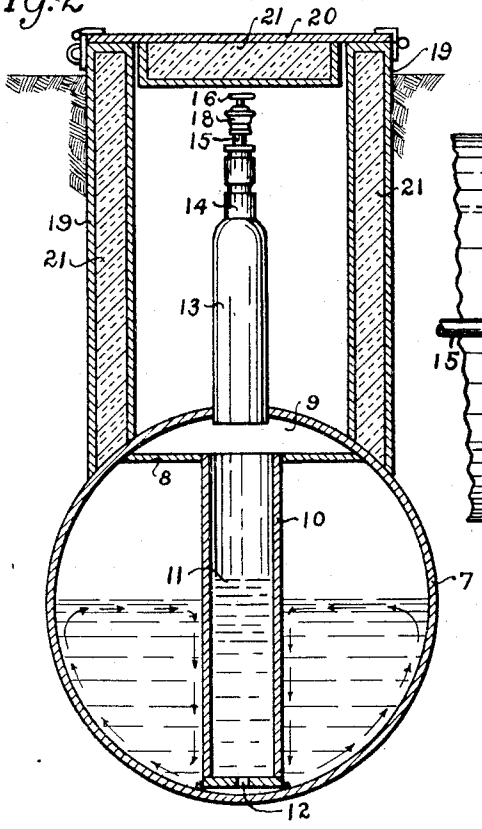
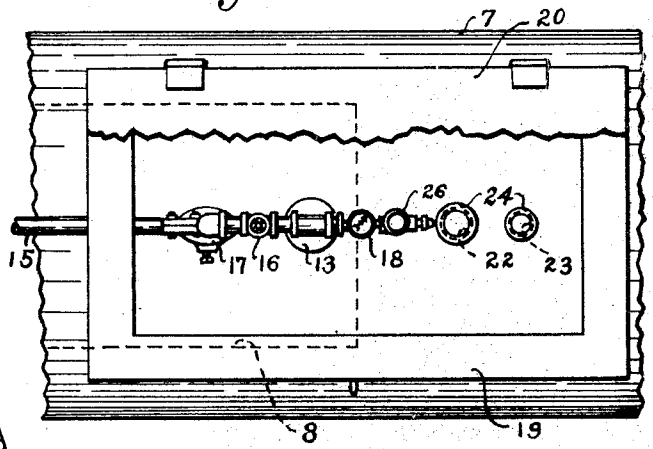


Fig.3



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Filed June 15, 1938 2 Sheets-Sheet 2

Fig.4

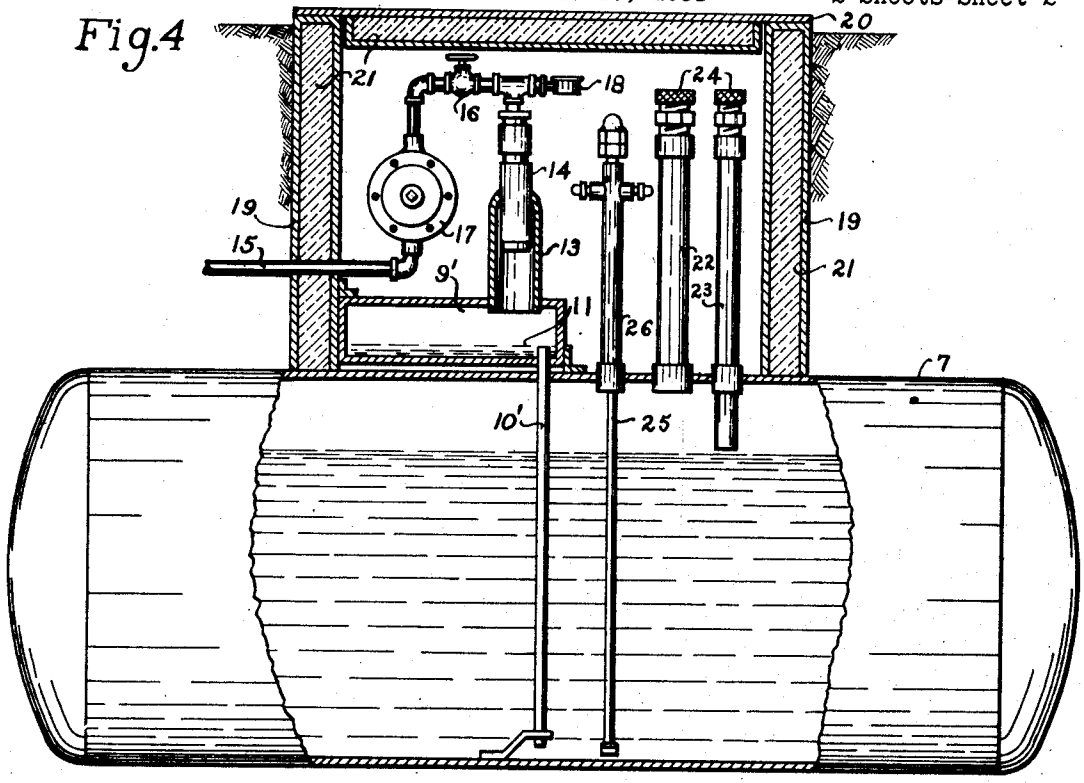
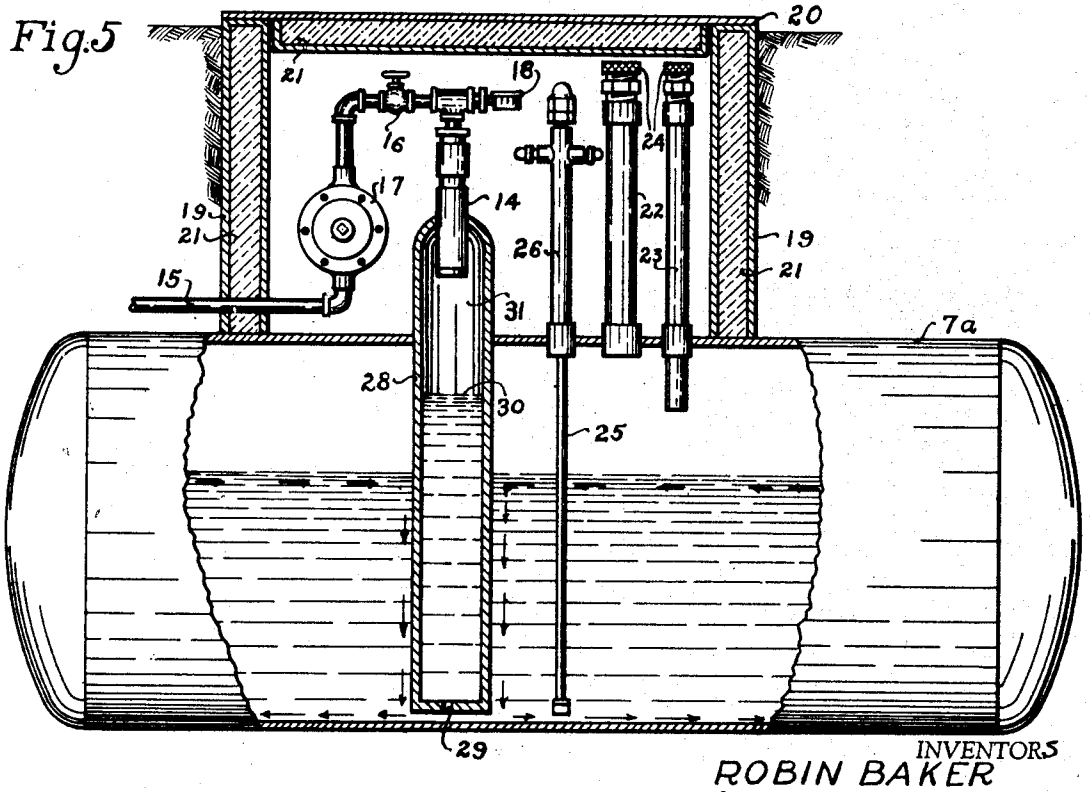


Fig.5



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BUTANE GAS TANK FEED DEVICE

Robin Baker and James C. Fleming, Lockney, Tex.

Application June 15, 1938, Serial No. 213,946

10 Claims. (Cl. 62—1)

This invention relates to an improvement in butane gas tanks and more particularly to the manner of removing the butane from the tank.

The use of butane gas for domestic and commercial purposes has become quite common in various sections of the United States. Butane maintains a liquid state at temperatures below 32° F. and may be held in a liquid state under pressure at higher temperatures. The tanks in which butane is stored usually operate under pressure obtained by temperature or other methods.

Various forms of butane tanks have been provided heretofore which utilize the upper portion of the tank itself as an evaporation chamber, whereby the lighter gases evaporate first and the evaporation continues until the liquid residue left in the bottom of the tank becomes so heavy that no gas will evaporate. As the use of the tank continues, this low gravity liquid accumulates until the efficiency of the gas system is impaired.

The object of this invention is to feed the agitated liquid fuel into an evaporation tube, whereby the lower specific gravity liquid fuels are carried off in vapor with the higher specific gravity liquid fuels, thereby vaporizing a more even B. t. u. content for feeding into the house line and to the appliances.

This object is accomplished by removing the liquid butane from a point near the bottom of the tank and conducting it through a small opening in the evaporation tube where the liquid is generated into a gas for use, which may thereafter be directed upwardly through a gas chamber and outlet tube, through a conventional control valve and pressure regulator to a desired point of use, such as an ordinary gas stove.

Another object of the invention is to set up an agitation and circulation of the liquids in the tank by the creation of unequal temperatures, brought about by the evaporation of the liquids in the tube.

A feature of this invention is the provision of a gas outlet tube of relatively large diameter with respect to the outlet pipe, so that wet gas will fall back into the evaporation tube from the outlet pipe, permitting only dry gas to be directed to the point of use. A thermo-insulated hood or box encloses the various fittings to keep the temperature of such fittings and gas outlet tube above the evaporation point.

We have illustrated in the accompanying drawings a preferred embodiment of this invention together with modifications thereof, but it is to be understood that the design may be varied and changes made in the minor details of construction within the scope of the invention as claimed, without departing from the spirit thereof.

In the accompanying drawings:

Fig. 1 is a side elevation of a butane gas tank and fittings, with parts broken away and in section and embodying this invention;

Fig. 2 is a vertical section therethrough on the line 2—2 of Fig. 1;

Fig. 3 is a fragmentary plan view of the box or housing and fittings therein;

Fig. 4 is a view similar to Fig. 1, but showing a modified form of the invention; and

Fig. 5 is a similar view showing a further modified form thereof.

Referring to Figs. 1, 2 and 3 of the drawings, the numeral 7 designates a tank adapted to receive and enclose the liquid, said tank being provided with a partition 8 in the upper portion thereof enclosing a gas chamber 9. A tube 10 has one end extending into the chamber 9 to a point level with or spaced above the bottom of the chamber to supply gas thereto and to maintain a predetermined quantity of liquid in the tube 10 substantially at the liquid level designated generally by the numeral 11 to provide evaporation area in the tube 10.

The evaporation tube 10 extends downwardly substantially to the bottom of tank 7 and is secured thereto as by welding. The lower end of said tube has a small opening 12 which permits the agitated liquid fuel to enter the tube 10 for evaporation of the gas therefrom. The evaporated gas is stored in gas storage chamber 9.

Communicating with the upper portion of the gas storage chamber 9 and carried by the top of the tank 7 is a bell-shaped outlet tube 13 of enlarged diameter into which the gas passes as it rises from the liquid in the evaporation tube 10. This enlarged diameter of the gas outlet tube 13 permits the wet gas particles to settle back into the evaporation tube 10, whereby only dry gas will be fed outward to the point of use. The upper end of the gas outlet tube 13 is connected with an excess flow valve 14 which in turn communicates with a gas line 15 leading to the point of use, such as an ordinary stove. The gas line 15 is provided with a manually controlled valve 16 therein and with a regulator 17, which holds the back pressure on the gas storage chamber 9 and tank 7. A pressure gauge 18 may be provided also and preferably connected with the pipe line 15 to indicate

the pressure of the gas passing therethrough and likewise the pressure in the tank 7.

As the liquid evaporates and the gas is used, the pressure in the evaporation tube 10 has a tendency to drop, which permits additional liquid butane to be forced into the evaporation tube by the pressure in the tank. This will cause the liquid level to rise in the tube thereby agitating the liquid fuel in both the evaporation tube 10 and tank 7.

The liquid in the tank 7 has three distinct movements, that is, a thermo-circulation as indicated by the arrows which is due to the chilling of the large tube 10; another circulation is produced by the travel of the liquid toward the opening in the bottom of the tube 10. A third movement, which is intermittent, is created by the opening of a gas burner or a withdrawing of gas from the chamber 9, which will cause an inrush of liquid into the tube 10, causing the level momentarily to rise, and as soon as the pressure becomes equalized, the fluid will settle back, agitating the liquid fuel in the tank. This constant agitation of the fuel in the tank permits the withdrawal of an agitated liquid of substantially an even specific gravity at all times. This is very desirable, as gas burners, when adjusted for a certain B. t. u. gas content, do not function economically on gases of different B. t. u. content.

Commercial butane gas contains approximately 70% butane which has a boiling point of 32° F. and weighs approximately five pounds per gallon. It contains approximately 3260 B. t. u. per cubic foot, and at 60° F. the gas enclosed within a tank will exert a pressure of approximately twenty pounds per square inch. Commercial butane also contains isobutane and propane in about equal proportions. Isobutane is lighter in specific gravity, weighing approximately four pounds fourteen ounces per gallon, and at 60° temperature will exert a pressure of approximately thirty-five pounds per square inch in a tank. The boiling point of isobutane is approximately 12° F. and it contains approximately 3000 B. t. u. per cubic foot. Propane weighs approximately four pounds twelve ounces per gallon and at 60° F. it exerts a pressure of approximately seventy-five pounds per square inch in a tank. The boiling point is approximately —48° F. and it has approximately 2550 B. t. u. per cubic foot. There are traces of heavier fuels in the liquified gas; consequently when the fuel remains in an unagitated static condition, these liquids of varying specific gravities tend to stratify, which happens when the evaporation methods used heretofore are employed.

By this invention, the agitated liquids are removed from the bottom of the storage tank and are conveyed into the evaporation tube 10. Furthermore, the evaporation of liquids within the tube 10 causes a lowering of the temperature of this chamber and the liquid butane in the tank is chilled near this chamber thereby setting up a circulation of the liquid butane in the tank, substantially as illustrated by the arrows therein, which will bring about the agitation of the liquid and serve to prevent stratification of liquids of different specific gravities.

The butane tank is usually buried in the ground, and to provide access thereto and to the fittings thereof, a hood or housing 19 extends upwardly from the tank to the surface of the ground, enclosing the fittings. The hood or housing 19 has a removable cover 20 hinged thereto and both the cover and the side walls are provided with insulating material 21 which serves to keep the temperature within the hood above the point of evaporation.

The outlet tube 13 is enclosed within the hood or housing 19, and also enclosed within this hood or housing and connected with the top of the tank 7 are a filling pipe 22 and a vent pipe 23, both provided with conventional valves 24 at the upper ends thereof. A gauge tube 25 extends through the top of the tank to a point near the bottom thereof and has its upper end enclosed in a housing 26.

The modification of the invention which is shown in Fig. 4, is similar in structure and operation to that described above, except that a combined gas and evaporation chamber 9' is disposed exteriorly of the tank 7 and a tube 10' extends into the chamber 9' from a point adjacent the bottom of the tank, having its upper end spaced above the bottom of the chamber 9' in order to maintain a liquid level therein, whereby to provide for evaporation of the butane gas from the liquid in the combined gas and evaporation chamber. Otherwise, this form of the invention operates in the same way as described above in connection with Figs. 1 to 3.

In the further modification shown in Fig. 5, a vertically disposed outlet tube 28 is mounted directly in the tank 7a and extends through the top of the tank being connected with the outlet pipe as described above. Outlet tube 28 extends downwardly in the tank to a point near the bottom thereof where it is provided with an orifice 29 to admit the liquid butane from the tank into the lower end of the tube, the liquid rising in the tube to a liquid level substantially as indicated by the numeral 30. The upper portion of the tube 28 forms an evaporation chamber that permits the butane gas to evaporate and pass off through the outlet pipe to the point of use. This form of the invention will function substantially in the same manner as described above in connection with the other forms thereof, having induced thermo-circulation due to the evaporation of the liquid and the discharge of the gas from the evaporation chamber 31.

While the system has been described in connection with butane gas, it is to be understood that any liquid suitable for the purpose may be used.

We claim:

1. A fuel storage receptacle comprising a tank for liquid fuel, a separate evaporation chamber adjacent the top of the tank and of wide shallow construction, means for withdrawing liquid from a point adjacent the bottom of the tank and directing the same into the evaporation chamber, and means for directing gaseous fuel from said evaporation chamber.

2. A fuel storage receptacle comprising a tank, an evaporation chamber separate from said tank and of wide shallow construction, means for withdrawing liquid fuel from a point adjacent the bottom of the tank and directing the same into the evaporation chamber, means for maintaining a liquid level in said evaporation chamber to provide for evaporation of gas from the liquid therein, and means for withdrawing the liberated gas from said chamber.

3. A fuel receptacle comprising a tank adapted to contain liquid fuel, means forming an evaporation chamber adjacent the top of said tank and of wide shallow construction, a tube extending from a point adjacent the bottom of the tank

into the evaporation chamber and having the discharge point thereof spaced above the bottom of said chamber for maintaining a liquid level in the evaporation chamber to provide for evaporation of gas from the liquid, and means for withdrawing the liberated gas from said chamber.

4. A fuel storage receptacle comprising a tank, and an enclosed gas storage chamber at an upper portion of the tank and having a substantially closed bottom with a tube separate from said chamber and extending downwardly from the bottom thereof in said tank, said tube having communication with the tank for withdrawing liquid therefrom into the storage chamber.

5. A fuel storage receptacle comprising a tank, a separated enlarged gas storage chamber at an upper portion of the tank having a substantially closed bottom, and an evaporation tube connected with the bottom of said storage chamber and extending downwardly therefrom in said tank, said tube having communication with the tank for withdrawing liquid therefrom and for maintaining a liquid level in the tube, said tube being of sufficiently large diameter for evaporation of gas from the liquid therein.

6. A fuel storage receptacle comprising a tank for liquid fuel, means forming an enclosed wide evaporation chamber adjacent the tank, and means for withdrawing liquid from the tank for liberation of gas in said evaporation chamber.

7. A fuel storage receptacle comprising a tank for liquid fuel, means forming an enclosed wide shallow evaporation chamber adjacent the tank separate therefrom, and means for withdrawing liquid from the tank for separation of gas in said evaporation chamber.

8. A fuel storage receptacle comprising a tank for liquid fuel, means forming a wide shallow closed-top evaporation chamber at the top of the tank, and means extending downwardly from said evaporation chamber in the tank to a point adjacent the bottom thereof for withdrawing liquid from the tank for liberation of gas in said evaporation chamber.

9. A fuel storage receptacle comprising a tank for liquid fuel, means forming a wide shallow evaporation chamber at the top of the tank, and means extending downwardly from said evaporation chamber in the tank to a point adjacent the bottom thereof for withdrawing liquid from the tank for liberation of gas in said evaporation chamber, and a bell receiver arranged over the chamber in open communication therewith for withdrawing the liberated gas therefrom.

10. A fuel storage receptacle comprising a tank for liquid fuel, means forming an enclosed wide shallow evaporation chamber extending horizontally at the top of the tank and of appreciable horizontal area, and a conduit extending downwardly from said evaporation chamber in the tank for withdrawing liquid therefrom into the evaporation chamber for liberation of gas therefrom.

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