

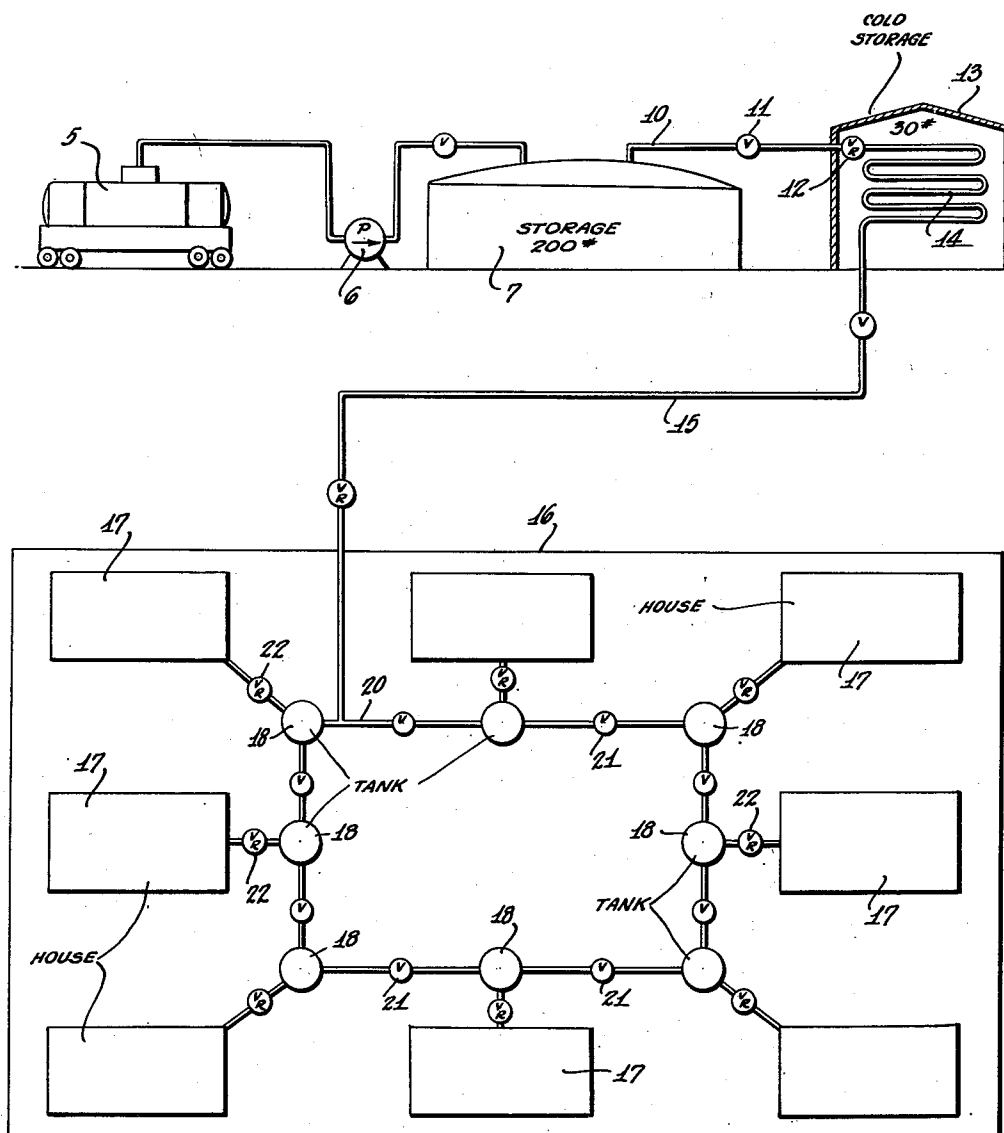
April 7, 1942.

V. STARK

2,279,097

COMMUNITY REFRIGERATION AND GAS SYSTEM

Filed Aug. 18, 1941



Inventor

VIRGIL STARK

By

Blair Kilgus

Attorneys

UNITED STATES PATENT OFFICE

2,279,097

COMMUNITY REFRIGERATION AND GAS SYSTEM

Virgil Stark, Forest Hills, Long Island, N. Y.

Application August 18, 1941, Serial No. 407,349

7 Claims. (Cl. 62—1)

This invention relates to an improved refrigeration and gas system particularly suitable for small communities such as army cantonments, temporary villages and the like, although, of course, it is to be understood that many features are applicable to other uses and installations of a more permanent character.

In order that a clearer perception of the present invention may be had, it is stated that in many out of the way communities, farms, etc. petroleum gases such as propane or butane are furnished in relatively small cylinders which are connected with the gas stove of a house for supplying cooking fuel for example. This gas is furnished in liquid form, expands as it is released and is converted to a gas and consequently absorbs heat from the atmosphere, but such absorption as far as known has not heretofore been used for practical refrigeration purposes as the flow is too irregular. However, when these gases can be used in relatively large quantities and means for a substantially constant flow is provided, then the constant change from a liquid to a gas and the inherent absorption of heat will permit such installation to be used commercially for refrigerating purposes. The present invention is, therefore, directed to a unique system of refrigeration and heating or cooking gas supply with a novel arrangement and proportioning of parts particularly suitable for a community where there are a relatively large number of users of the gas and in such quantities as to permit the utilization of heat absorption to be utilized for refrigeration purposes.

Accordingly it is one of the objects of the present invention to provide a simple and practical system of the above general character which may be assembled and installed at very low expense. Thus reduction in the installation cost is in part by reason of reduction in size of supply pipes, thereby better accommodating the system to variations from peak load to practically zero and permit a more uniform flow.

A further object is to provide a better service at the consuming point by installing pressure regulators as may be necessary together with accumulators whereby the pressure at the consuming point will be substantially constant and will not fluctuate materially with variations in the load imposed upon the system at individual points.

A further object is to provide a system with reserve accumulators adjacent the various points of use so connected as to provide a substantially constant pressure and also permit an individual

user to draw upon the accumulators of adjacent establishments should occasion arise.

A further object of the invention is to provide a system of the above character whereby in case of breakdown or repairs at one part of the system the remaining part will be substantially unaffected.

A further object is to provide for the utilization of drop in pressure between the main source of supply and the point of use for practical refrigeration purposes.

A further object is to provide an improved method of refrigeration and gas distribution.

Other objects will be in part obvious and in part hereinafter pointed out in connection with the following analysis of this invention.

In the accompanying drawing there is illustrated diagrammatically such parts of a complete community installation as will be necessary to fully understand the same and suggest variations to suit varying requirements.

As is well known to those familiar with the subject, propane and butane gases are by-products of natural gas and oil refinement and are usually shipped in liquid form in trucks or tank cars, one of which is indicated at 5, although it is to be understood that this may be any other suitable form of transporting vehicle.

This tank car is connected with a suitable compressor or pump 6 to withdraw the contents of the car 5 and transmit the same to a storage tank 7 of suitable capacity where it is kept under pressure depending on the outside temperature, preferably not over 200 pounds, which is sufficient to maintain most gases suitable for the present use in liquid form. A suitable valve 8 is provided in the connecting pipe line to cut off the pump when not in operation.

The gas from the storage tank 7 then flows through a pipe 10 provided with a shut-off valve 11 and a reducing valve 12 within a cold storage chamber 13. Here the pressure is reduced to approximately thirty pounds absolute pressure as the gas flows through the coils indicated at 14. During this transformation from liquid to gas and the reduction of pressure, heat is consumed which is extracted from the atmosphere within the cold storage chamber 13 and the temperature reduced in the chamber from substantially normal atmospheric temperature.

The gas then passes through a small main 15 to the points of use which is indicated diagrammatically by the rectangle 16 containing, in the present instance, nine different buildings or groups of buildings which, for illustration, may be

considered as individual houses or barracks or groups of them.

Each one of these building units is provided with an accumulator or tank 18 and these tanks are connected in series by means of a continuous pipe 20. Between each accumulator tank and the adjacent tanks are shut-off valves 21. Between each accumulator tank and the point of use is a further reducing valve 22 which will reduce the pressure at the point of use to approximately 12 inches. Other shut-off valves may be provided as necessary or desired.

Thus we have a system where the accumulator tanks are all connected with each other yet may be disconnected or shut off from adjacent tanks in case of breakdown or repair of any particular installation unit. Such breakdown however, will not affect the use of adjacent units for with the accumulator tanks connected in series as herein shown, the user may draw not only from his own accumulator, but also from adjacent neighbors, provided such is not undergoing repairs. The pressure in the series will tend to equalize throughout.

It is to be noted particularly that in gas distribution systems now in general use for cooking and other purposes, the installation has to be figured for a peak load quantity which is approximately five times more than the average quantity as the gas is used in relatively large quantities at certain hours, as for example immediately prior to meal time. Because of this the diameter of the distributing pipes has to be figured for a quantity five times larger than the average quantity needed in a twenty-four hour day thereby to prevent a serious drop in pressure during peak load hours as so often happens in city installations.

With the present accumulator system between the source and points of consumption, such as a group of houses, the reserve of gas in the accumulators will cover the difference in quantity needed during such peak hours. To obtain the necessary accumulations or chamber storage at each individual point of use, it is necessary to have not only in storage before the accumulators and in the accumulators themselves a higher pressure than at the consumption point. At the outlet point of each accumulator the pressure regulator 22 will maintain an even pressure between the accumulator and the point of use, but at a pressure smaller than that in the accumulator.

Being obliged to increase the gas pressure in the main lines, the diameter of the pipes will for that reason also be smaller. As an example, the diameter of the pipes may be smaller because a quantity of gas five times less and at a pressure at least twice that heretofore used make a total difference of ten. If we take the square root of 10 then the diameter of the pipe will be approximately $3\frac{1}{2}$ times less than the diameter necessary for normal distribution. Thus the entire system is very much cheaper to install for instead of using a five inch pipe, a pipe $1\frac{1}{2}$ inches in diameter will be sufficient, other things being equal, and a material reduction in cost of installation will necessarily follow.

As for the cold storage or refrigerating chamber 13, it may be noted that liquefied petroleum gases, such as those above-mentioned, are transformed from liquid to gas by reducing the pressure with a subsequent absorption of heat. This heat for gas conversion can be taken from the surrounding atmosphere and corresponds to

the latent heat, that is, approximately 806 B. t. u. per gallon for propane. In other words, for each gallon of propane used in this distributing system a certain quantity of refrigeration can be produced without any additional fuel expense because the transformation of propane liquid into gas absorbs the heat from the surrounding air and in this way produces refrigeration at a rate which is the approximate equivalent of five pounds of ice per gallon of propane. This refrigeration would be impractical for the quantity of gas needed except for the distributing system described. By applying the branch accumulator system for gas distribution there results substantially constant supply of gas taken from the storage tank to supply and replenish the accumulators which were drawn upon extensively during peak hours and in this way the refrigerating effect will be substantially constant because of the slow flow at intermediate times thus allowing a practical realization of refrigerating effect.

The arrangement of check valves and reduction valves in the system together with the accumulators, permits a full utilization of practically all of the gas in the various accumulators, and permits these accumulators which are connected in series to drop substantially equally and constantly. This in turn causes a substantially constant withdrawal of the gas from the storage tank thus maintaining a substantially constant refrigerating temperature within the chamber 13.

The method and use of operation of the apparatus is clear from the above description. It may be stated however, that after the storage tank is filled with liquid gas at the proper pressure, it is first delivered to the cold storage or refrigerating chamber where it is converted into gas with consequent reduction in temperature of the surrounding atmosphere. This reduction is used for refrigerating purposes whereupon the gas at greatly reduced pressure is transmitted to a series of connected accumulator tanks adjacent the points of individual use when its pressure is further reduced for household use.

The system, by reason of the various valves, both shut-off and reduction, permits any part of the system to be repaired to the exclusion of the rest of the system but without affecting the use of the remaining parts of the system in any way.

It is thus seen that the invention comprehends a simple and practical system and method particularly suitable for community use for gas distribution and refrigeration purposes. The installation can be made at greatly reduced costs and in considerably less time than would be required to put in the usual gas distribution and separate refrigerating plants heretofore contemplated.

I claim:

1. An apparatus of the character herein described comprising, a storage tank adapted to contain petroleum liquefied gas under pressure, a refrigerating coil, a reduction valve between the refrigerating coil and the storage tank, a plurality of accumulators connected in series and with the outlet of the refrigerating coil, a reduction valve between each accumulator and the refrigerating coil, a plurality of points of use one adjacent each accumulator, and a reduction valve between the accumulator and the point of use.

2. An apparatus of the character herein described comprising a storage tank for propane liquefied gas or the like, a refrigerating cham-

ber, a coil in said chamber and communicating with the storage tank, a reduction valve between the storage tank and refrigerating coil, a plurality of accumulators connected with each other and with the outlet end of the refrigerating coil, a plurality of points of use of the gas, and valves between the accumulators and the points of use.

3. An apparatus of the character herein described comprising, a storage tank adapted to contain petroleum liquefied gas under pressure, a refrigerating coil connected therewith, a reduction valve between said coil and tank, a plurality of accumulators connected with the outlet of the refrigerating coil, a reduction valve between each accumulator and the refrigerating coil, a plurality of points of use, one adjacent each accumulator, a reduction valve between the accumulator and the point of use and shut-off valves between each accumulator and the one next thereto thereby to permit any accumulator and the point of use to be disconnected without disturbing the remainder of the system.

4. The herein described method of refrigeration and gas distribution which consists in the steps of reducing the pressure on liquefied gas between a place of storage and a refrigerating zone, collecting the gases after having passed through the refrigerating zone in a plurality of connected accumulators adjacent each point of use, and further reducing the pressure of the gas between the individual accumulators and the points of use.

5. The herein described method of refrigeration and gas distribution which consists in the steps of storing liquefied gas under pressure, reducing the pressure on the gas, passing the gas to a plurality of connected individual accumulators adjacent specific points of use, and further reducing the pressure on the gas between any accumulator and its adjacent point of use.

6. The herein described method of refrigeration and gas distribution which consists in the steps of storing liquefied gas under pressure, reducing the pressure on the gas between the place of storage and a refrigerating zone, collecting the gas after having passed through the refrigerating zone in a plurality of connected individual accumulators adjacent specific points of use, and further reducing the pressure on the gas between any accumulator and its adjacent point of use.

7. An apparatus of the character herein described comprising, a storage tank adapted to contain liquefied gas under pressure, a plurality of accumulators connected with the outlet, a reduction valve between each accumulator and the tank, a plurality of points of use, one adjacent each accumulator, a reduction valve between the accumulator and the point of use and shut-off valves between each accumulator and the one next thereto thereby to permit any accumulator and the point of use to be disconnected without disturbing the remainder of the system.

VIRGIL STARK.