ABSTRACT

Men working outdoors, such as in the oil fields, ordinarily have a cylindrical "milk can" or other container filled with water and ice. The ice is usually placed in the container at an ice plant before going to the field. By the present invention a small portable compact electrical compressor refrigeration unit is specially adapted to fit into such a container to cool the contents thereof. Because the container is cylindrical, the device for cooling the contents should also be cylindrical. The invention resides in the particular construction of a cylindrical evaporator of such a unit. It has a number of nesting tubes, some of which are concentric, and all of which are disposed vertically in the container.

Because oil is necessarily used in the compressor, care must be taken to avoid some collecting in the evaporator. The present invention solves this problem and also provides for an efficient distribution of the refrigerant evenly throughout the entire evaporator.

5 Claims, 3 Drawing Figures
3,867,819

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REFRIGERATION APPARATUS FOR COOlingen liquid

SUMMARY OF THE INVENTION

Most oil field equipment nowadays has a source of electricity available for auxiliary devices. Many tracks also have a source of electrical energy available.

It is an object of the present invention to make use of such sources to provide cool water or other liquid for the workmen, and to do so with a compact and efficient arrangement for that particular purpose.

The idea of cooling a jug of water by compression refrigeration mechanism out in the field far away from an ice plant is very old. See U.S. Pat. to Muller, No. 477,987 issued Jan. 3, 1893 for "Ice Machine."

The heat exchanger of U.S. Pat. No. 1,801,693 issued to Ruff Apr. 21, 1931 is adapted to cool a milk can, but does not make ice therein.


Only the preferred embodiment of the present invention is shown and described herein.

Referring to the drawing:

Fig. 1 is a side view of an elongated cylindrical water container with a refrigerating unit constructed in accordance with the invention applied thereto, a portion of the container and a portion of the housing being cut away to show the elements therein;

Fig. 2 is an enlarged cross-sectional view of the evaporator of the combination shown in Fig. 1, the long vertically disposed tubes being shown truncated so as to illustrate the parts more clearly; and

Fig. 3 is a flow diagram of a refrigerating unit constructed in accordance with the invention.

An ordinary compression refrigerator consists of a pump or compressor driven by an electric motor, a condenser, an expansion device, and an evaporator. These parts are connected by tubing and contain a refrigerant such as Freon 12.

This combination is used in the present invention and is illustrated in the drawing. The parts of the combination may be of conventional design except for the evaporator. This element is of special design to accomplish the purpose of the present invention. Thus the drawing shows a pump or compressor P, driven by a motor M, connected to a condenser C and an evaporator.

As particularly shown in Fig. 2, the evaporator consists of a number of nested tubes, all of which are vertically disposed, and these are numbered 1 to 5. The inner of these tubes is a capillary tube numbered 1. It is connected to the condenser C, as shown in Fig. 2. It feeds into a larger tube 2 but terminates some distance above the bottom of Tube 2.

Tube 1 serves as an expansion device. The refrigerant fed into it from the condenser is under pressure and in liquid phase. Tube 1 is so small that it serves as an orifice to hold the pressure until it discharges into the tube 2.

Tube 2 extends downwardly through a plate 6. It is open at the bottom. The refrigerant flows downwardly through tube 2 and discharges into the outer concentric tube 5 and flows upwardly therein, evaporating as it does so. The bottom of tube 5 is closed by a plate 7.

There is an overflow or spill-over tube 3 concentrically disposed between tubes 2 and 5, and it is closed at the bottom by the plate 6. The refrigerant, mostly in vapor phase by the time it reaches tube 3, flows downwardly and then is picked up by the suction tube 4 and brought up to the compressor P, as shown in Fig. 3.

If oil is in the compressor, it is believed to be impossible to operate it without some oil passing with the refrigerant through the condenser and then into the evaporator. Eventually this oil would cause the unit to stop operating if enough oil collected in the evaporator. Heretofore, where the evaporator has been located below the compressor and condenser, the evaporator has consisted of a small tubing coil so that the oil is entrained in the refrigerant and moves right along with it until it gets back into the compressor.

In order to cool water in an ordinary container, which is the main purpose of the present invention, the evaporator must necessarily be located between the compressor. On the other hand, a conventional tubing coil is not feasible because ice formed in the coil would have little effect in cooling water in the container. Also, it would be hard to remove this ice when defrosting the evaporator.

Actually, a conventional small tubing coil is not the most efficient way to construct the evaporator of any compression refrigerating unit because it simply dumps the liquid refrigerant in one place in the evaporator and exerts no control of its distribution.

The present invention solves these difficulties.

It will be observed that the annular space between concentric tubes 3 and 5 is small, as shown in the drawing. As actually constructed, this annular space is even smaller than can be conveniently illustrated.

Likewise, the distance between the plates 6 and 7 is very small.

With these dimensions two results are accomplished.

(1) Any oil coming into the evaporator with the refrigerant will be entrained with it and carried over into the spill-over tube 3. (2) There is a gradual reduction of pressure all the way from the bottom of the tube 1 clear up to the top of the spill-over tube 3. Because of this reduction of pressure, there is a gradual evaporation of the refrigerant. Thus the tube 5 has no spot particularly colder than another. Even cooling throughout the length of the tube 5 is accomplished.

As shown in Fig. 1, the evaporator, as described, may be mounted in a water container 10 and will cool the water therein when the refrigerator is in operation.

The container will ordinarily have a spigot 11 near the bottom thereof.

There is a housing 12 for the motor M, compressor P and condenser C of the refrigerator, and this housing 12 is provided with a handle 13. The housing 12 is permanently and integrally attached to the evaporator by a plate 14. Electricity is supplied to the motor M through the plug 16.

The plate 14 serves as a lid for the container 10. It is so constructed as to fit snugly into the container 10, preferably being air-tight, except for a small hole (not shown) allowing air to enter the container when water is discharging from the spigot 11. A fine screen (not shown) may cover the hole to prevent bugs from getting into the container 10.

Some means must, of course, be provided for discharging heat from the motor M, the compressor P and the condenser C. Preferably all, or at least the upper part of the housing 12 is made of expanded metal, or is provided with louvers 15, or holes to permit the free
circulation of air therethrough. Because the refrigeration is designed for use out in the open air, it may not be necessary to provide means for additional air flow through the housing 12, but, of course, a small fan (not shown) may be provided without changing the invention.

Also, it is evident that the motor-compressor unit may be of various designs now conventional in the refrigeration industry, and that various known controls may be employed to regulate the size of the ice bank that will form on the evaporator in the container 10.

A cycle time for defrosting the evaporator is also well known and may be added if desired.

It will be apparent that the arrangement shown and described provides a portable, compact refrigeration unit which can be fitted to suitable container to cool water therein and that the shape and construction of the evaporator provides for efficient operation.

While only one embodiment of the invention has been shown and described, it is obvious that many changes may be made without departing from the spirit of the invention or the scope of the appended claims.

We claim:

1. A device for effecting evaporation of compressed refrigerant input thereto consisting of a first tubing enclosure, a second concentric tubing enclosure rigidly affixed therein in closely spaced relationship and having the upper end open in communication with the interior of said first enclosure, hollow tubular means extending concentrically along the central axis of said second concentric tubing enclosure for releasing refrigerant under pressure between the lower closed ends of said first and second tubing enclosures and means for conducting the expanded refrigerant from the interior of said second tubing enclosure.

2. A device as set forth in claim 1 which is further characterized to include: capillary tubing means in communication with and conducting the compressed refrigerant for release and entry into the space between the lower ends of said first and second tubing enclosures.

3. The combination with a water container of a refrigeration unit having an electric motor-driven compressor adapted to circulate refrigerant fluid through a condenser and evaporator, wherein the improvement comprises an evaporator for insertion downward within said water container, said evaporator consisting of an outer air tight tubing enclosure, a concentric tubing open at the upper end and having the lower end closed and spaced from said enclosure, inner tubing communicating with said condenser and extending into the space between said concentric tubing lower end and outer tubing enclosure, and conduit means extending from adjacent concentric tubing lower end to the compressor.

4. The improvement defined in claim 3 wherein the annular space between the outer tubing enclosure and the concentric tubing is relatively small in relation to the distance across said tubing enclosure to effect gradual pressure reduction of said refrigerant to effect ice formation along the outer length of the tubing enclosure.

5. The combination and improvement defined in claim 3 which is further characterized to include: a small diameter tubing extending from communication with said condenser into sealed entry within said inner tubing and terminating downward within said inner tubing to effect pressure sustaining orifice output of the refrigerant into the inner tubing.