Oct. 25, 1932. B. R. HARRIS 1,883,899

REFRIGERATING SYSTEM

Filed Sept. 11, 1929

Fig. 1

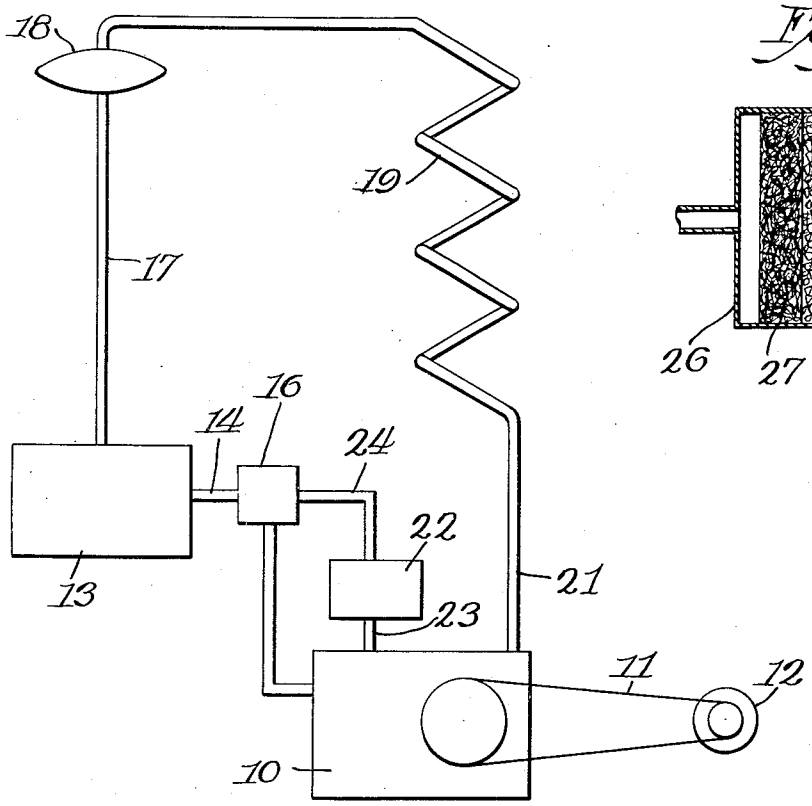


Fig. 2

Fig. 3

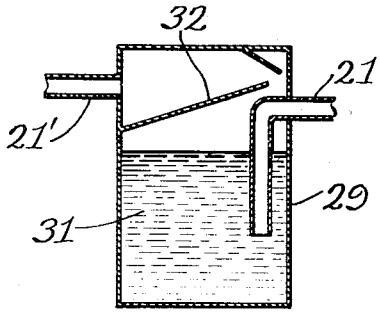
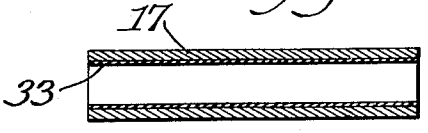


Fig. 4



Inventor
Benjamin R. Harris
By George E. Mueller Atty.

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UNITED STATES PATENT OFFICE

BENJAMIN R. HARRIS, OF CHICAGO, ILLINOIS

REFRIGERATING SYSTEM

Application filed September 11, 1929. Serial No. 391,712.

My invention relates to refrigerating systems. It relates more in particular to a method of and apparatus for operating a refrigerating system to minimize health hazards due to escaping refrigerants.

Refrigerating systems as now used often employ odorless refrigerants having certain toxic properties, and in the event of leakage in the refrigerating lines serious physical disorders, and occasionally death results to occupants of buildings in which the system is located. Suggestions have been made by others as well as myself, that a material having a distinct odor be introduced into the system so that in the event of leakage the odor of the added material will be detected by occupants and precautionary measures can be adopted. Due to certain chemical and mechanical difficulties, these suggestions not only have not been put into practice, but have been declared by experts to be valueless. Among the difficulties encountered, are that the available odorous materials either are of such nature that they can not be circulated readily with the refrigerant, or that they combine with the refrigerant chemically and so become ineffective, or that they effect the metal portions of the system in an undesirable manner. Accordingly, the principal object of my present invention is to put into use suggestions of the character set forth.

The refrigerant now in general use which has caused most of the trouble is methyl chloride. This gas is substantially odorless, invisible, and toxic.

Accordingly, a more specific object of my invention is the incorporation with methyl chloride of a substance which will warn occupants of the presence in a room of methyl chloride gas.

Another object is the use with a refrigerant, of such chemical compounds as mercaptans.

Another object is the incorporation with a refrigerant, of an odorous warning agent, which does not interfere with the normal operation of the refrigerating system.

Another object is the saving of losses of valuable refrigerant due to heretofore undetectable leaks.

Other objects and features of the invention will be apparent from a consideration of the following detailed description taken with the accompanying drawing, wherein Fig. 1 is a schematic view of a refrigerating system employing my invention.

Figs. 2 and 3 show modified ways of introducing the odorous materials.

Fig. 4 is a fragmentary sectional view taken through a pipe showing the effect of the use of one particular type of compound.

In order to make the details of my invention, particularly the method, clear to those skilled in the art, I shall first refer briefly to the apparatus employed.

Fig. 1 shows a refrigerating system including a compressor 10, which compresses the gas to liquid form driven by a belt 11, operated by a motor 12. The compressor delivers the refrigerant under pressure to a condenser 13 by means of a pipe 14, and an oil separator 16 being connected in the line at a suitable point to remove lubricant from the refrigerant. From the condenser 13 the now liquid refrigerant passes by means of a pipe 17 to an expansion valve 18, this valve being thermostatically controlled in the usual manner to discharge the fluid under pressure through a small orifice (not shown) into a cooling coil 19, which results in vaporization and expansion being utilized to refrigerate the coil and the container in which it is housed. The opposite side of the coil is connected at 21 to the intake side of the compressor. It is understood that in actual practice most systems operate a number of refrigerators, in which event a separate expansion valve and cooling coil is provided for each refrigerator, with a high pressure and low pressure line communicating with each refrigerator and with the power equipment, including the compressor located at a central point. The simple system shown, however, is adequate for the purpose of explaining my invention.

With most compressors an oil supply reservoir 22 is employed with an oil line 23 for supplying a lubricant to the compressor. The lubricant often becomes mixed with the re-

frigerant and when separated by the separator 16, the separated lubricant passes through a pipe 24, back to the reservoir 22.

In the matter of supplying an odorous substance to the refrigerant I may do this in several ways, one of which is to incorporate it with the lubricant, which may be an oil, glycerine, or other suitable substance. By introducing the odorous substance in the oil, it can be used in fairly large quantities, and the refrigerant will then pick up as much of this substance as it will carry, which is found to be satisfactory to accomplish the purpose. In this manner a very thorough dispersion of the substance is obtained and other valuable functions procured without making it necessary to treat the refrigerant directly or without shutting down the system.

Before referring to other means for introducing the odorous substance I wish to state that I may use with good results either gasses, liquids or solids, and I prefer the use of substances such as the mercaptans, which have a very strong, disagreeable odor even in small quantities, so that it will be impossible for occupants of a building to ignore its presence. Now I have found that the mercaptans can be used very nicely with methyl chloride providing the heavier mercaptans are employed, for example, such as butyl mercaptan. I have found that the results secured with, for example, ethyl mercaptans are not as satisfactory, and may be used with less successful commercial results. In actual experiments over several weeks time I have employed butyl mercaptans with methyl chloride and the results proved to be very gratifying. Other mercaptans with which I have experimented bear out my theories, but as far as my present investigations go, I prefer the butyl type.

One very great advantage which I find in the use of butyl mercaptans is that they retain their potency over a long period, even indefinitely as far as my experiments indicate, and that they are in no way injurious to the metal of the system. In fact, rather the reverse is true, because a very thin coating or stain is formed on the surface of the metal by the mercaptan compound, which acts as an inhibitor, preventing further action of the mercaptan and protecting the metal from contact with other substances.

I may also employ a solid material such as asafetida which has a disagreeable odor and by allowing the refrigerant in gas form to pass over the solid substance, enough of the volatile constituents of the solid is picked up to impart its odor to the refrigerant and so serve as a leak detector. I may also use solid iodoform in the same way. Fig. 2 shows one manner of obtaining this result wherein a container 26 is placed in the gas or low pressure line, having a strainer 27 formed of steel wool or a similar substance, with space for the solid material 28, so that the gas passes over the solid material before passing the screen or strainer. The member 27 allows the vapor to pass through but the solid substance will be left behind; however, the passage of the gas over this solid substance will cause it to gradually pick up more or less volatile ingredients thereof so that in a short time of continuous operation the odor of the solid substance will prevail throughout the refrigerant.

Fig. 3 shows still another way of introducing the odorous material, and makes use of a container 29 for holding liquid 31, the pipe 21 extending into the container and discharging under the liquid 31, an outgoing pipe 21′ being provided above the level of the liquid so that as the gas bubbles through the liquid it can pass out through the pipe 21′. Baffles 32 may be employed if required to prevent whatever spray may be present from passing directly into the pipe 21. With the methyl chloride bubbling up through the liquid 31 it will gradually pick up sufficient of this substance to serve as a warning in the event of a leak.

Referring briefly to Fig. 4, I illustrate on the inside of the pipe 17 a layer 33 formed by the reaction of the mercaptan, with the metal of the pipe. As previously described this film or compound is very thin and forms in such a way that it serves as an inhibitor of further attack of the metal.

I have also found that diamyl sulphide as well as other odorous sulphides, phenyl carbylamine and other odorous carbylamines may be used to impart an odor and that they do not interfere with the normal operation of the refrigerating system.

What I claim is new and desire to protect by Letters Patent of the United States is:

1. The method of introducing an odorous substance into a refrigerating system, which comprises placing the substance in relatively high concentration in the path of the refrigerant, and allowing the refrigerant to pass in contact with such substances to pick up such substance in sufficient amounts as to render the circulating fluid odoriferous, whereby leakage of such fluid will be readily detected.

2. The method of introducing an odorous substance into a refrigerating system making use of a circulating refrigerant and a lubricant, which consists in introducing the odorous substance in relatively high concentration into the lubricant, whereby sufficient amounts of the odorous substance are picked up by the refrigerant to render the same odoriferous, and whereby leakage of the refrigerant can be detected by its odors.

3. In a refrigerating system employing a compressor and expansion valve with high and low pressure lines respectively between the compressor and expansion valve, the high pressure line carrying a substantially liquid

refrigerant and the low pressure line carrying a refrigerant in gas form, means in the low pressure side of the system for supporting an odorous substance, and means for passing the gas refrigerant in contact with the odorous substance whereby small amounts of said odorous substance become incorporated with the refrigerant.

4. In a refrigerating system employing a compressor and an expansion valve with high and low pressure lines respectively between the compressor and expansion valve, means for holding an odorous substance for the refrigerant to come in contact with whereby small portions of the odorous substance will be picked up by the refrigerant to impart the characteristic odor thereof to the refrigerant whether in gas or liquid condition.

5. In a refrigerating system employing a compressor and expansion valve with high and low pressure lines respectively between the compressor and expansion valve, the high pressure line carrying a substantially liquid refrigerant and the low pressure line carrying a refrigerant in gas form, a container for a quantity of odorous substance, and means for passing the refrigerant in gas form through said container, whereby the gaseous refrigerant will pick up the characteristic odor of said odorous substance.

6. In a refrigerating system employing a compressor and expansion valve with high and low pressure lines respectively between the compressor and expansion valve, the high pressure line carrying a substantially liquid refrigerant and the low pressure line carrying a refrigerant in gas form, means for supporting a solid odorous substance in finely divided form, and means for passing the refrigerant in contact with said solid odorous substance.

7. In a refrigerating system employing a compressor and expansion valve with high and low pressure lines between the compressor and expansion valve, the high pressure line carrying a substantially liquid refrigerant and the low pressure line carrying a refrigerant in gas form, means for supporting a body of odorous liquid, and means for passing the refrigerant in gas form through said liquid, whereby the characteristic of such liquid is picked up by said gas.

8. In a refrigerating system employing a compressor and expansion valve with high and low pressure lines between the compressor and expansion valve, the high pressure line carrying a substantially liquid refrigerant and the low pressure line carrying a refrigerant in gas form, means for supporting a body of odorous liquid, means for passing the refrigerant in gas form through said liquid whereby the characteristic of such liquid is picked up by said gas, and baffling means for preventing the liquid odorous substance from passing in a liquid state out of said supporting means.

In witness whereof, I hereunto subscribe my name this 3rd day of September, 1929.

BENJAMIN R. HARRIS.