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METHOD OF REFRIGERATION.

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To all whom it may concern:

Be it known that we, PAUL H. BUCH and HOWARD M. GROFF, citizens of the United States, and residents of Trenton, in the county of Mercer and State of New Jersey, have invented certain new and useful Improvements in Methods of Refrigeration, of which the following is a specification, this application being in part a continuation of an earlier application filed by us on the 31st day of August, 1920, Serial No. 407,251.

Our said invention relates to a method or process of refrigeration of the type in which a gaseous refrigerant is compressed and condensed or liquefied and thereafter expanded to secure the cooling or refrigerating effect.

One of the greatest obstacles to economic automatic refrigeration has been the provision of means for effectively lubricating the compression chamber in apparatus of the compressor-condenser-expander type. In many instances the excess lubricant, and in fact even more or less of the lubricant which was found to be required, has been conveyed with the refrigerant from the compression chamber to a point of restricted or reduced area in the refrigerant passages where it will find lodgment. This usually occurs at the expansion valve or in such portions of the refrigerant passage where the compressed and condensed refrigerant is expanding thereby reducing the temperature of the surrounding objects to such an extent that the lubricant lodging thereon is congealed. The result of this congelation is faulty valve action or complete clogging of the system at the spot where successive amounts of the lubricant are deposited and congealed. Some method of overcoming this obstacle has long been desired but never wholly accomplished, and therefore advancement in the art of automatic refrigeration has been delayed.

The present invention aims to avoid this objection by selecting a refrigerant which, when used in the manner hereinafter described, will develop a by-product having lubricating properties which will be deposited upon the interior of the compressor and effectually lubricate the same and which will not have any detrimental effect upon other parts of the system.

The invention further aims to provide a method which will be more economical and efficient than methods heretofore used of which we are aware, and which may be economically carried out on a small scale, thus adapting it for household plants.

In proceeding according to the preferred form of our invention we use chloric ether as a refrigerant, and effect the refrigeration by compressing and condensing the chloric ether and thereafter expanding it directly into a body of non-congealable fluid such as brine.

Preferably we form the chloric ether directly in the brine by introducing into a brine tank, say, for a hundred and fifty pound machine, five gallons of calcium chlorid brine, 80 salometer, and two quarts of denatured alcohol, and thereafter pass into and through the brine two hundred grams of pure ethyl chlorid. This absorbs enough alcohol to produce chloric ether leaving a residue of some alcohol in the brine.

The chloric ether passes to the surface of the brine and is withdrawn and compressed or condensed and is thereafter returned to and expanded directly into the brine, abstracting heat therefrom.

While we have given certain specific proportions for the ingredients mentioned we do not limit ourselves to these, it being important only to have sufficient alcohol to form the chloric ether, and preferably a slight excess of alcohol. With an excess of alcohol a certain amount of this will circulate through the system and act as a secondary refrigerant.

We have discovered that by using chloric ether in the manner hereinbefore set forth, there is formed a by-product, with lubricating properties, which is deposited upon the interior of the compression chamber. This by-product or lubricant is only deposited upon certain substances such as cast iron, brass and steel, and it only remains to select such material or materials for the remaining portion of the refrigerant passages, other than the compression chamber, upon which this by-product will not be deposited. By so doing the dangerous points in the refrigerant passages, such as the expansion valve, and that portion of the passage which lies in a reduced temperature zone, are kept free from clogging and interfering with proper operation of the mechanism of which they are a part.

We believe the formation of this by-product to be hastened by the presence of zinc in the brine tank or system such as would be

the case where a galvanized brine container is used (or where zinc is inserted), the chloric ether, after hydrolizing, producing such a hydrocarbon by-product having lubricating properties, which we have found sufficient to lubricate the compression chamber without the introduction of any other or additional lubricant.

We do not desire to limit ourselves exclusively to chloric ether as other materials might be used for producing a lubricating by-product, though chloric ether, used in the manner set forth, produces the best results of anything of which we are aware.

For example, we have found that if ethyl chlorid alone is used and expanded directly into calcium chlorid brine, where zinc or some other substance forming the more common reactions with organic compounds is present, a lubricating by-product is formed, but more slowly than when alcohol is present in the brine to form chloric ether.

By the use of our new refrigerant and method all necessity for supplying lubricant from an external source as heretofore practiced is avoided and the attendant objections removed.

Any suitable apparatus may be used for carrying out the method, such for example as that disclosed in an application filed by us on the 23rd day of July, 1921, Serial No. 487,020.

Having thus described our invention, what we claim is:

1. The hereindescribed method which consists in expanding into a body of non-congealable liquid a volatile liquid refrigerant of such a character that a lubricating by-product will be formed, compressing and condensing said expanded refrigerant and repeating the operation in a continuous cycle.

2. The hereindescribed method which consists in expanding into a body of non-volatile non-congealable liquid in the presence of zinc, a volatile liquid refrigerant of a composition such that a hydrolizing and polymerizing action takes place, resulting in the formation of a hydrocarbon by-product of a lubricating nature, compressing and condensing the expanded refrigerant and depositing the by-product on the walls of the compressor, and again expanding the condensed refrigerant into the body of non-congealable liquid.

3. The herein described method of refrigeration which consists in compressing chloric ether and thereafter expanding the same directly into a body of non-congealable liquid to abstract heat therefrom.

4. The herein described method of refrigeration which consists in compressing and condensing chloric ether, expanding said compressed and condensed chloric ether directly into a body of non-congealable liquid, collecting the expanded chloric ether from over the surface of said liquid, and repeating the operation.

5. The herein described method of refrigeration which consists in introducing ethyl chlorid into a non-congealable liquid containing alcohol to mingle with the alcohol to form chloric ether, collecting the gaseous chloric ether from the surface of the liquid and compressing and condensing it and thereafter expanding said compressed and condensed chloric ether directly into said non-congealable liquid.

6. The herein described method of refrigeration which consists in compressing ethyl chlorid, expanding the same directly into a non-congealable liquid containing alcohol to mingle with the alcohol to form chloric ether, collecting the gaseous chloric ether from the surface of the liquid and compressing and condensing it and thereafter expanding said compressed and condensed chloric ether directly into said non-congealable liquid.

7. The herein described method of refrigeration which consists in introducing ethyl chlorid into brine containing alcohol to mingle with the ethyl chlorid to form chloric ether collecting the gaseous chloric ether from the surface of the brine and compressing and condensing it and thereafter expanding it directly into said brine.

In testimony whereof, we affix our signatures.

PAUL H. BUCH.
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