

Sept. 15, 1931.

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REFRIGERATING APPARATUS

1,823,079

Filed March 31, 1927

2 Sheets-Sheet 1

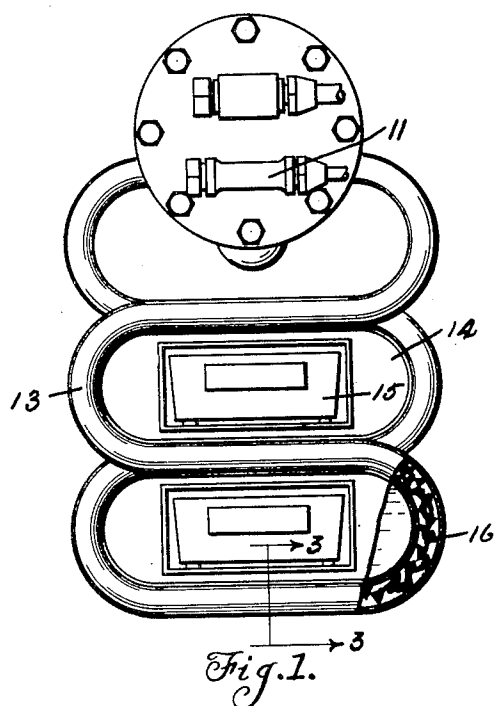


Fig. 1.

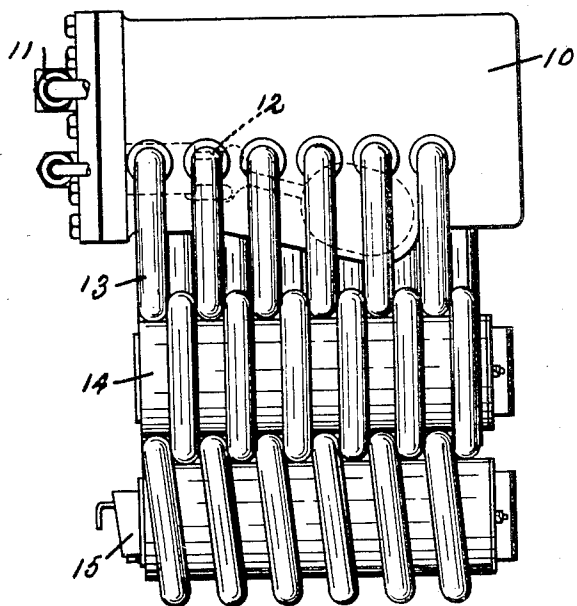


Fig. 2.

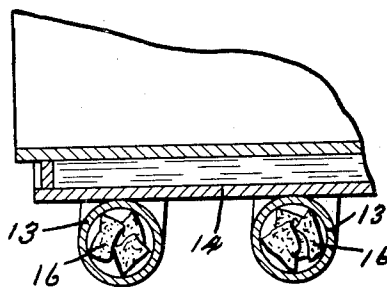


Fig. 3.

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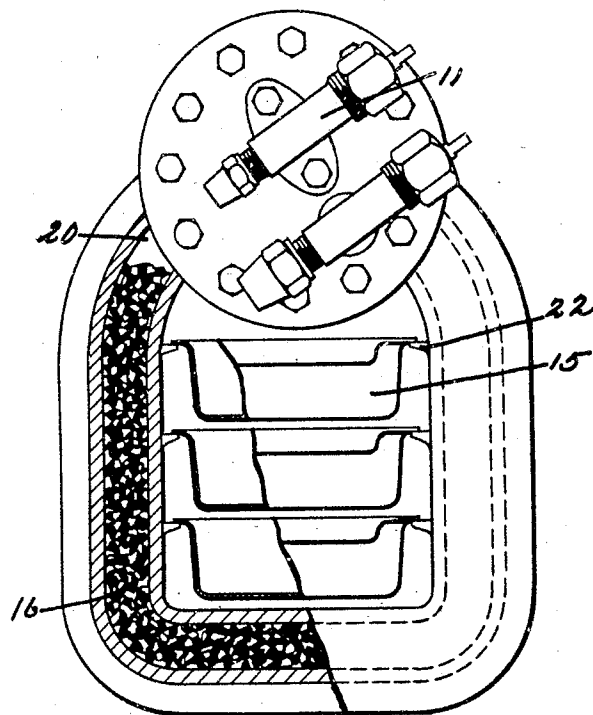


Fig. 4.

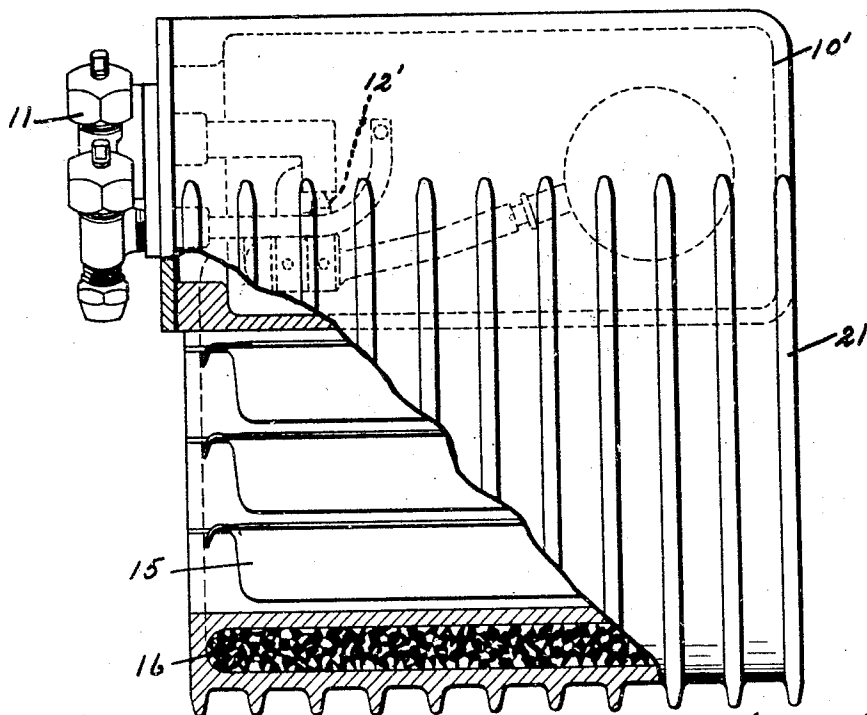


Fig. 5.

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UNITED STATES PATENT OFFICE

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REFRIGERATING APPARATUS

Application filed March 31, 1927. Serial No. 179,983.

This invention relates to evaporators for refrigerating apparatus and is particularly useful in refrigerating cabinets of the household type.

- 5 It is among the objects of the invention to provide an improved evaporator having a relatively large heat transfer surface in contact with a relatively small volume of refrigerant; to provide an evaporator having
10 a large holdover capacity; and to generally simplify and improve the construction of evaporators of this type.

In the drawings:

- 15 Figs. 1 and 2 are front and side elevations respectively, partly in section, of one form of evaporator embodying my invention;

Fig. 3 is an enlarged section of a portion of the evaporator shown in Figs. 1 and 2;

- 20 Fig. 4 is an end elevation partly in section of a modified form of evaporator; and

Fig. 5 is a side elevation partly in section of the evaporator shown in Fig. 4.

- Referring to the drawings, 10 indicates a header forming a reservoir for liquid refrigerant which is admitted thereto thru a conduit connection 11 under the control of a float valve 12. Connected to the header are a number of refrigerant circulating conduits 13 for cooling a surrounding medium
30 for example air, and which as shown in the drawings, are slender pipes or tubes formed into loops. The loops may be formed in the manner of a figure 8 to form enclosures for brine tanks 14 which in turn form enclosures for ice making pans 15. Liquid refrigerant is supplied to the evaporator by
35 any suitable refrigerating apparatus, for example, as described in the patent to Joy, 1,367,266, February 1, 1921. The liquid is
40 kept at a constant level in the header and evaporates in the tubes producing refrigeration in the well known manner.

- The rapidity with which the refrigerant evaporates, and consequently the amount of
45 heat which can be absorbed from the surrounding medium by a given evaporator, depends upon the area of the surface available for the transfer of heat between medium and the refrigerant. Therefore to have
50 large capacity, an evaporator should have a

large heat transfer surface. This is usually effected by providing the evaporator with a large number of conduits. But this arrangement is open to two objections: first, a large number of joints between conduits and the header makes a high manufacturing cost and
55 second, the volume of refrigerant which such an arrangement contains may be objectionally large. This is true particularly in the case of units of large capacity where local ordinances or shipping regulations limit
60 the quantity of refrigerant which may be placed in any one unit.

In accordance with my invention I reduce the quantity of refrigerant which is necessary in a given evaporator without appreciably reducing the heat transfer area by filling some or all of the conduits with granular material, indicated in the drawings by 16. The granules considerably reduce the free
70 volume of the conduits, that is, the volume which may contain refrigerant, the space between the granules being able to contain all the refrigerant which can be evaporated by the heat transferred thru the walls of the
75 conduits. If the granular material is irregular such as sharply broken stone or the like, it will be in contact with the surfaces of the tubes only at sharp points or corners and thus the presence of the granular material will not appreciably reduce the amount
80 of surface in contact with the refrigerant. I may use any material of proper size to take up the desired space, such as crushed stone or metallic scraps or punchings, shot, 85 or the like. However, I prefer to use a substance having high specific heat, such as granite, in order to provide a storage or holdover for the evaporator in case the refrigerating system should be temporarily out
90 of operation.

The presence in the refrigerant ducts of this broken granular material having a multitude of sharp corners, points, and projections has another important advantage. In
95 cooling units of the flooded type, much trouble is had with oil logging. Lubricant is carried from the compressor by the refrigerant and is carried to the evaporator. The lubricant is ordinarily somewhat soluble 100

in the liquid refrigerant. When the liquid refrigerant vaporizes it leaves most of the lubricant behind and some of the lubricant floats on top of the liquid refrigerant in the header and some of the lubricant tends to collect in the horizontal portions of the refrigerant ducts connected to the header. The presence of this lubricant retards the formation of bubbles of gaseous refrigerant due to the capillary effect of the lubricant and thus retards the evaporation of the liquid refrigerant in the ducts. This retardation of evaporation lowers the capacity of the cooling unit since it causes the duct to be kept at a higher temperature and also lowers the efficiency since a lower back pressure must be maintained in order to provide the required amount of refrigeration.

It has been found that minute bubbles of gaseous refrigerant tend to form upon the sharp points, projections, and corners which are submerged in the liquid refrigerant. This aids evaporation in my refrigerant ducts and thus increases both the efficiency and the capacity of the cooling unit. The small bubbles, which form upon the sharp projections of the material within the refrigerant ducts, grow larger and then leave the projections on which they have formed and rise through the refrigerant ducts into the header and carry the slugs of lubricant along in to the header. This continuous bombardment of the bubbles has a tendency to break up the capillary effect in the ducts and sometimes prevents it entirely by stirring the lubricant with the liquid refrigerant. Because of the multitude of sharp points, projections and corners and the removal of the capillary effect, the formation of the bubbles is continuous and not spasmodic. By removing the lubricant and thus preventing the oil logging, the efficiency and capacity of the cooling unit is further increased.

Another feature which assists materially in bringing the lubricant slugs to the header is the fact that the horizontal portions of the refrigerant ducts tend to hold the bubbles until they grow to a larger size than they would reach if forming in a vertical portion of the duct. The bubbles are thus prevented from rising until they have reached a large size and these large bubbles are more effective to carry the lubricant slugs up into the header than are the small bubbles, which would form if the granular material were only the vertical portions of the ducts. Thus the horizontal portions of the ducts, together with the multitude of sharp points, corners and edges on the granular material form effective means for removing the lubricant from the refrigerant ducts.

In Fig. 4 I have shown a modified form of evaporator in which there is a single narrow conduit 20 for circulating refrigerant

connected to the header. As shown in the drawings I may make the conduit integral with the header, for example by casting, and providing fins 21 on the outside of the conduit to increase its surface. If desired, the evaporator may be provided with supports 22 for receiving trays 15 in which ice may be frozen.

The evaporator above described may be used in any refrigerating system in which evaporators of this type are ordinarily suitable for example, household cabinets as described in the application of Jesse G. King, S. N. 149,745, filed November 20, 1926.

While the forms of embodiment of the present invention as herein disclosed, constitute preferred forms, it is to be understood that other forms might be adopted, all coming within the scope of the claim which follows.

What is claimed is as follows:

An evaporator comprising header means, a plurality of ducts connected in parallel circuit relation and containing liquid refrigerant and having ends thereof connected with the header means for discharging vaporized refrigerant thereto, portions of said ducts beneath the normal level of the liquid lying substantially horizontal, and means within the ducts for accelerating the formation of gas bubbles in said ducts, said means comprising material having a plurality of sharp corners on which said bubbles will readily form.

In testimony whereof I hereto affix my signature.

FRANK W. ANDREWS.