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G. VARNEY

2,021,971

REFRIGERATION SYSTEM

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Fig. 1

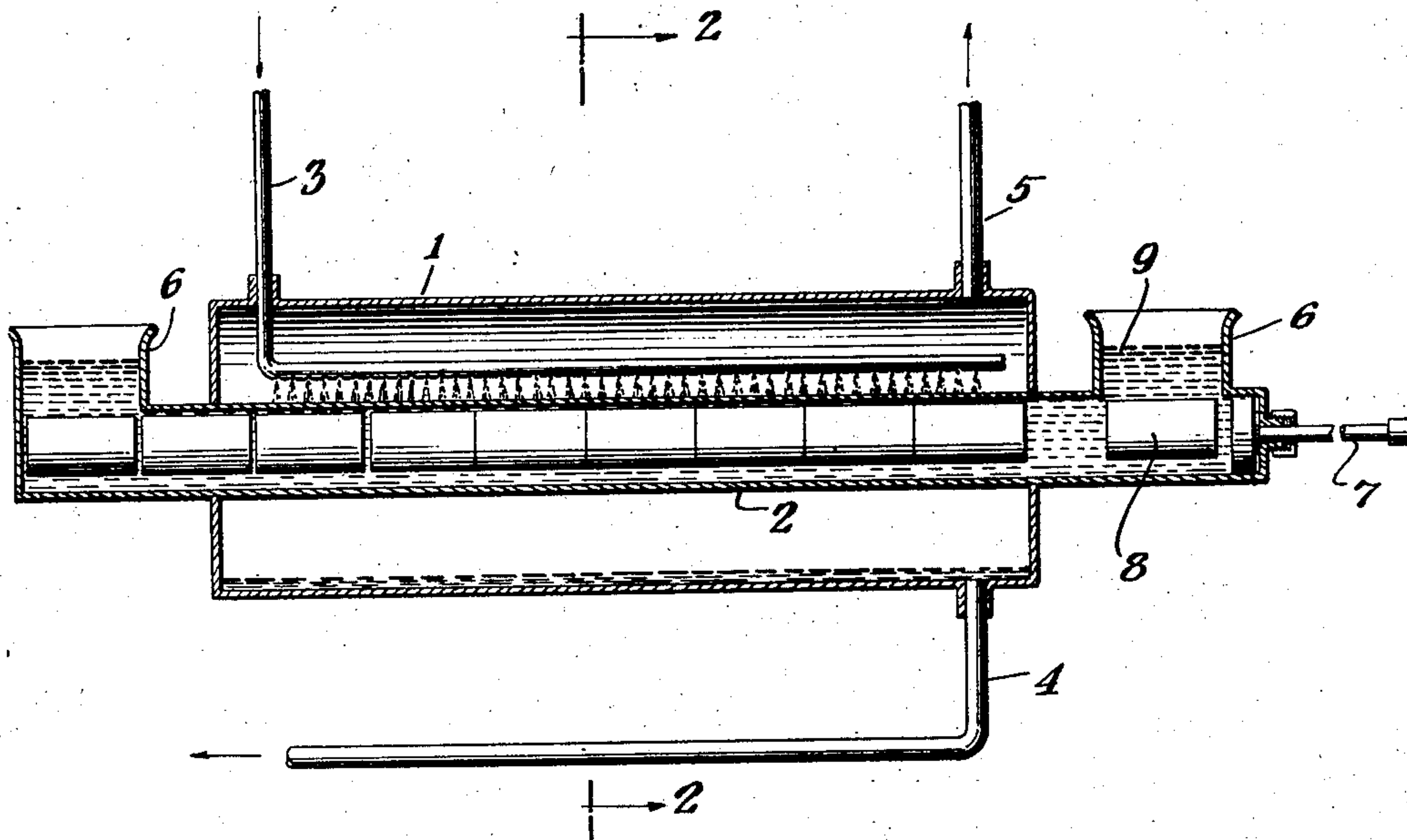


Fig. 2

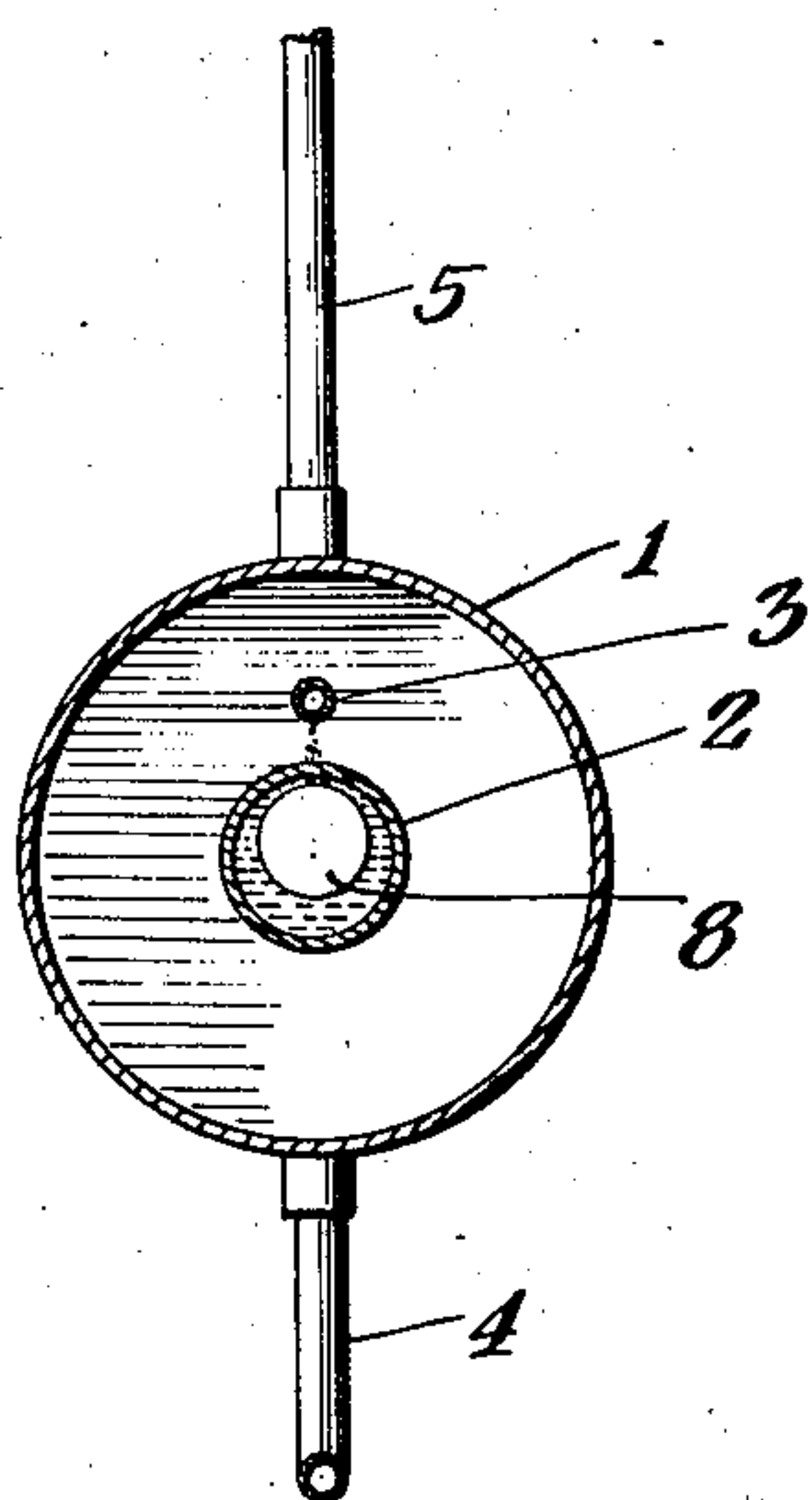
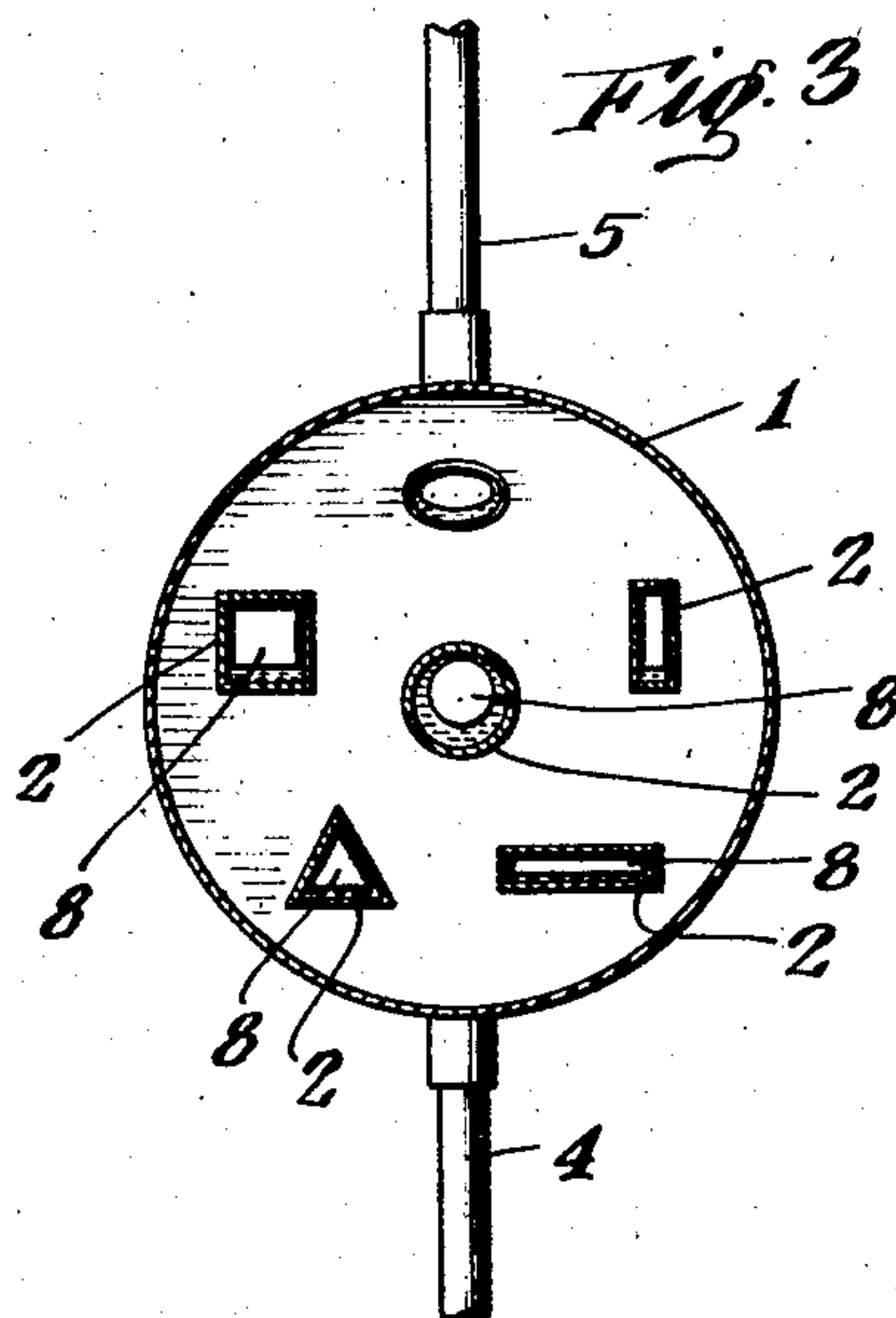


Fig. 3



Gordon Varney

INVENTOR

Emmet E. Harmon

BY ATTORNEY

UNITED STATES PATENT OFFICE

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REFRIGERATION SYSTEM

Gordon Varney, Bradenton, Fla.

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25 Claims. (Cl. 62—104)

This invention relates in general to the art of refrigeration, and more particularly to that phase of refrigeration relating to chilling and freezing of perishable commodities, and is most specifically directed to that phase of refrigeration designed to produce such freezing with sufficient rapidity to prevent the breaking down of cellular structures or the segregation of the component parts of such commodities.

I am aware that the problem of quick freezing is not a new one and that others have endeavored, in various ways, to accomplish the results desired. However, I have devised a method of, and means for, providing for such quick cooling which I believe to be novel and to be a distinct improvement over any method of which I am, at present, aware.

It is the prime object of my invention to provide a means for and a method of rapid chilling and/or freezing of perishable commodities, the rapidity of action of refrigeration being sufficient to prevent disintegration or deterioration of the commodity in consideration.

It is a further object of this invention to provide, in a refrigeration system, means for insuring a more intimate and efficient heat exchange between the refrigerant and the article to be refrigerated.

With the above in mind, it is a further object of my invention to provide a quick refrigeration system which can be economically operated with the minimum amount of apparatus and refrigerants and which will, by its very nature, insure rapid and sure refrigeration.

It is a further object of my invention to use a liquid to fill the spaces between the inner walls of the refrigeration chamber and the article to be refrigerated as a means for reducing friction between said article and said walls.

Another object of my invention is the use of such a heat conductive fluid as will insure intimate contact with and ready thermal exchange with the inner walls of the refrigerating chamber.

Further objects of this invention will be found in the following specification and claims and will be disclosed in the accompanying drawing, in which:

Figure 1 is a somewhat diagrammatical view of my apparatus viewed in vertical longitudinal cross section.

Figure 2 is a transverse section on the lines 2—2 of Figure 1.

Figure 3 is a view similar to that shown in Figure 2 of a modification of my device showing

a plurality of refrigeration tubes of varying shapes and cross sectional areas.

Referring now to the drawing, it will be seen that the apparatus which I have illustrated may be comprised, as follows:

At 1 I have indicated a refrigeration shell through which a refrigeration tube 2 passes. The shell 1 is adaptable for use with any type of refrigerant but, for purposes of illustration only, has been disclosed as using the circulating liquid ammonia system, a liquid inlet tube 3, a drain 4 and a gas outlet 5 to a condenser. Exteriorly of the shell I have provided the tube with integrally formed hoppers 6 and 6' for insuring the maintenance of a proper level of the liquid 9 within the tube 2. At 7 I have illustrated merely for purposes of disclosure, a plunger as the means for providing for the progression of the articles 8 through the refrigerating tube 2. In the drawing the inlet 3 terminates in a perforated pipe adapted to drop liquid ammonia directly upon the refrigerating tube 2.

In Figure 3 I have disclosed the shell as enclosing a plurality of tubes 2 of varying dimensions and configurations to conform to the shapes and sizes of the packages 8.

The liquid employed may be any suitable heat conductive fluid, such as "Prestone", brine, or mercury, the choice of liquid depending largely upon the nature of the package and whether it is wrapped in metal or some such container as sealed cellophane or card board, or the like.

Having described one form of my apparatus, the operation of my invention will be more clearly understood from the following description of its operation and advantages.

All inventions of this general nature of which I have hitherto been aware have striven for an intimate contact between the refrigerant and the article to be refrigerated and have resorted to mechanical means for accomplishing this result. I have disclosed a method in which the article to be refrigerated is passed through a refrigeration tube approximating in size and shape that of the article to be refrigerated. This provides for an initial fairly close thermal contact of the article with the refrigerating tube. The additional feature of adding a liquid of high thermal conductivity to fill the refrigerating tube provides four additional advantageous features; first, it prevents the existence of insulating air gaps between the article and the walls and provides ready heat transfer; secondly, it prevents frosting with resulting heat insulation; thirdly, it provides a lubricating effect promoting the ready progress of a

succession of articles through the tube; and fourthly, the liquid, by the principle of displacement, insures the intimate contact of a large portion of the article with the refrigerating tube itself.

Having thus described my invention, I claim:

1. In a refrigeration apparatus, a refrigerated surface, a relatively slidable surface to be refrigerated, said two surfaces being in intimate thermal relation with each other, and a film of heat conductive fluid filling the void between said surfaces.

2. In a refrigeration apparatus, a refrigerated surface, a relatively slidable surface to be refrigerated, said two surfaces being in intimate thermal contact with each other, and a film of substantially static heat conductive fluid filling the void between said surfaces.

3. A refrigerating apparatus consisting of a refrigerated surface in intimate thermal relationship with another surface to be refrigerated, and a film of heat conductive fluid filling the space between the said two surfaces, and means for maintaining said film of fluid as a relatively thin film so that the surface of the article to be refrigerated may be as proximate as possible to said refrigerated surface without actual contact therewith.

4. A refrigerating apparatus consisting of a refrigerated surface in intimate thermal relationship with another surface to be refrigerated and in relative sliding relationship with said refrigerated surface, and a film of substantially static heat conductive fluid filling the space between the said two surfaces.

5. A refrigeration apparatus consisting of a refrigerated surface in intimate contact with another surface to be refrigerated and in relative sliding relationship with said refrigerated surface, the surfaces thus contacted being wetted with a film of heat conductive fluid therebetween.

6. A refrigeration apparatus consisting of a refrigerated surface in intimate contact with another surface to be refrigerated and in relative sliding relationship with said refrigerated surface, the surfaces thus contacted being wetted with a film of substantially static heat conductive fluid therebetween.

7. A refrigerating surface, a surface to be refrigerated, and means for providing and maintaining a film of fluid between said surfaces.

8. A refrigerating surface, a surface to be refrigerated, and means for providing and maintaining a film of highly heat conductive fluid between said surfaces.

9. A refrigerating surface, a surface to be refrigerated, said surfaces being positioned very close in thermal relationship with each other, and a relatively thin film of liquid interposed between said surfaces and wetting both and means for maintaining said thermal relationship and said thin film of liquid between said surfaces.

10. In an apparatus for rapid refrigeration, a refrigerating surface, a surface to be refrigerated, and a relatively thin film of heat conductive fluid wetting both of said surfaces, and means for maintaining the thin film between said surfaces.

11. In a cooling apparatus, a cooling means including a refrigerated surface of substantial length, and a surface to be cooled, said surfaces being relatively movable and spaced in intimate thermal relationship, and a thin film of heat conductive fluid interposed between and wetting

said surfaces, and means for maintaining said thermal relationship and said film between said surfaces throughout substantially the length thereof.

12. A refrigerating apparatus including a heat conductive liquid substantially surrounding the article to be refrigerated, said liquid in turn being surrounded by a refrigerated tube of such dimension as to closely approximate the cross sectional dimension of the article passing through the liquid, and a refrigerating chamber surrounding said tube.

13. A refrigerating apparatus including a heat conductive liquid substantially surrounding the article to be refrigerated, said liquid in turn being surrounded by a refrigerated tube of such dimension as to closely approximate the cross sectional dimension of the article passing through the liquid, and a refrigerating chamber surrounding said tube on all sides throughout substantially its entire length.

14. A refrigerating apparatus including a heat conductive liquid substantially surrounding the article to be refrigerated, said liquid in turn being surrounded by a refrigerated tube of such dimension as to closely approximate the cross sectional dimension of the article passing through the liquid, and a refrigerating chamber surrounding said tube throughout substantially its entire length.

15. The method of refrigerating an article which consists in passing the article through a refrigerating chamber, maintaining the inner walls of said chamber in intimate thermal relationship with the article to be refrigerated, leaving a space between said article and said walls and filling said space with a relatively thin film of fluid of high heat conductivity.

16. The method of refrigerating an article which consists in passing the article through a refrigerating chamber, maintaining the inner walls of said chamber in intimate thermal relationship with the article to be refrigerated, leaving a space between said article and said walls and filling said space with a substantially static relatively thin film of fluid of high heat conductivity.

17. As a quick freezing apparatus, a refrigerating chamber, a heat conduction tube extending through said chamber, said tube being filled with a heat conducting fluid for receiving objects to be refrigerated and for forcing and maintaining a surface thereof in intimate thermal relationship with the walls of said tube filling the space between said article and said walls with a relatively thin film of said fluid.

18. As a quick freezing apparatus, a refrigerating chamber, a heat conduction tube extending through said chamber, said tube being filled with substantially static heat conducting fluid for receiving objects to be refrigerated and forcing and maintaining the surface thereof in intimate thermal relationship with the inner surface of said tube and for filling the space between said article and said walls with a relatively thin film of said fluid.

19. As a quick freezing apparatus, a refrigerating chamber, a heat conduction tube extending through said chamber, said tube being filled with substantially static heat conducting fluid for receiving objects to be refrigerated and forcing and maintaining the surface thereof in intimate thermal relationship with the inner surface of said tube and for filling the space between

said article and said walls with a relatively thin film of said fluid, and means for lowering the temperature of said chamber.

20. As a quick freezing apparatus, a refrigerating chamber, a heat conduction tube extending through said chamber, said tube being filled with substantially static heat conducting fluid for receiving objects to be refrigerated and for forcing a surface of said object into close thermal relationship with the inner surface of said tube and for filling the space between said article and said walls with a relatively thin film of said fluid, means for lowering the temperature of said chamber, and means for maintaining a proper liquid level in said tube.

21. A quick freezing apparatus including a heat conductive liquid substantially surrounding the article to be refrigerated, said liquid in turn being surrounded by a refrigerated tube of substantial length, and means for insuring the suspension of said article in said liquid, an intimate thermal relationship between the outer surface of said article and the inner surface of said tube and a relatively thin film of said fluid between said surfaces substantially throughout the length of said tube.

22. A refrigerating apparatus including a substantially static heat conductive liquid substantially surrounding the article to be refrigerated, said liquid in turn being surrounded by a refrigerated tube of substantial length, and means for insuring the suspension of said article in said liquid, an intimate thermal relationship between the outer surface of said article and the inner

surface of said tube and a relatively thin film of said fluid between said surfaces substantially throughout the length of said tube and a refrigerating chamber surrounding said tube throughout substantially its entire length.

23. The method of refrigerating an article which consists in passing the article through a refrigerating chamber the inner walls of which approximate in cross sectional dimensions those of the article to be refrigerated and substantially filling the spaces between the inner walls of said chamber and said article with a substantially static body of mercury.

24. That method of refrigerating an article which consists in refrigerating a separate surface, interposing a heat conductive fluid between the refrigerated surface and the adjacent surface of said article to be refrigerated, and bringing said surfaces into close proximity to each other, leaving only a relatively thin film of said fluid separating said surfaces thus placed in intimate thermal relation with each other.

25. That method of refrigerating an article which consists in refrigerating an article which consists in refrigerating a separate surface, interposing a heat conductive fluid between the refrigerated surface and the adjacent surface of said article to be refrigerated, floating said article toward said refrigerated surface to bring said surfaces into close proximity to each other, leaving only a relatively thin film of said fluid separating said surfaces thus placed in intimate thermal relation with each other.

GORDON VARNEY.