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COOLING UNIT FOR REFRIGERATING SYSTEMS

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Fig. 1.

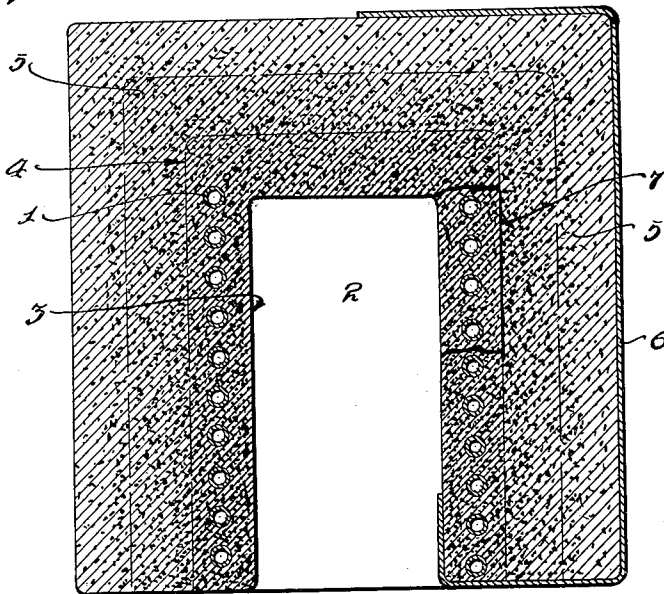
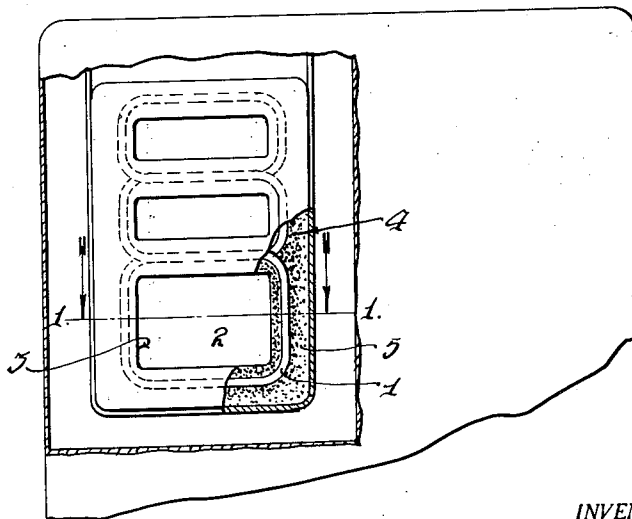


Fig. 2.



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COOLING UNIT FOR REFRIGERATING
SYSTEMS

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12 Claims. (Cl. 62—95)

This invention relates to cooling units for refrigerating systems, and has to do particularly with a method of controlling the heat exchange in cooling units or lowsides of the type embodying a hold-over as a part thereof.

Heretofore in the manufacture of cooling units of the type embodying one or more sharp freezing chambers, it has been the practice to embed the coils in a mass of brine and in some instances use has been made of artificial stone and cast aluminum as a hold-over medium in place of the brine. In use of such cooling units considerable difficulty has been experienced in the proper distribution of heat units both as to varying the hold-over properties and in the proper heat exchange relative to the sharp freezing chambers of the cooling unit and the chamber or chambers of the refrigerator surrounding the cooling unit.

It is the object of the present invention to provide a cooling unit which may be formed quickly and inexpensively from materials which have relatively high heat conductivity and also exceptionally good hold-over properties and ability to retain sensible heat; and to arrange such materials in such a manner as to vary the relative conductivity of different portions of the cooling unit. More specifically, I preferably form the greater part of the cooling unit of finely divided metallic powder preferably sponge iron, the density and the composition of which may be varied as to different cross sectional portions of the cooling unit with the result that the conductivity and hold-over properties of the unit may be localized and predetermined according to the capacity of the sharp freezing chambers and/or the refrigerating chambers and the relative temperatures desired.

In the drawing:

Fig. 1 is a sectional plan view of a cooling unit constructed in accordance with the present invention.

Fig. 2 is a front view, partly in section, of the cooling unit shown in Fig. 1 and also showing the same positioned in the standard manner in a refrigerator cabinet.

In carrying out the embodiment of my invention as illustrated in the drawing, I preferably position suitable refrigerating coils 1 or other refrigerant circulating means in predetermined relation to a sharp freezing chamber 2 which may be formed by any suitable core. The refrigerating coils or other means having been positioned around the core or cores 2, a mass of finely divided metallic powder such as sponge iron, for instance, may be filled in around the coils and if the conductivity of the unit is to be uniform throughout,

then such sponge iron, for instance, may be of uniform density.

It will be understood that the ability of iron to retain sensible heat or act as a hold-over is very high, in fact, almost as high as copper. The ability of various metals and ice to retain sensible heat may be compared as follows:

	Specific heat	Conductivity
Copper.....	56	1200
Iron.....	53	490
Aluminum.....	33	1151
Ice.....	30	15
Lead.....	22	245

It will thus be seen that iron has relatively good heat conductive properties as well as the ability to retain sensible heat and this property of iron as a conductor and as a retainer of sensible heat will vary according to its density.

Thus, in forming the cooling unit, the metallic powder or sponge iron may be first packed around the coils of the refrigerating means in cold condition and compressed to increase the density and such compressed material may, if desired, be subjected to a sintering temperature. In the case of sponge iron a sintering temperature may be used up to approximately 2200° F., but of course, this temperature will change considerably in accordance with other metals or oxides which may be mixed with the sponge iron. The sintering of metallic powder, such as sponge iron, will bring it to a compact integral mass which will hold its own shape and will bring the grains of metallic powders closer together so as to give a final article having relatively great density and heat conductivity. By this method, it will be seen that I am able to form a cooling unit, having both high hold-over and heat conductive properties, directly from cold finely divided metallic powder such as sponge iron, without in any case reaching the melting point of such sponge iron. The sintering temperature may vary considerably but in any event the temperature is not sufficient to affect the refrigerating coils.

The main point of the present invention, however, resides in the ability to vary the heat conductivity of various cross sectional parts of the cooling unit, and in this case I may use different methods. One method may comprise the surrounding of the refrigerating coils with a mixture of sponge iron and other metallic elements having a greater or less conductivity and ability to retain sensible heat than sponge iron. Such elements may be carefully mixed so as to extend

from a point 3 next to the wall of the sharp freezing chamber to a point 4 within the cooling unit. In the remaining portion 5 of the cooling unit I may insert pure sponge iron or mix the

5 sponge iron with various oxides so that this portion 5 will have a lower heat conductivity than the portion between the points 3 and 4.

The physical properties of different cross sectional portions of the cooling unit being thus
10 predetermined, the materials forming the cooling unit may be subjected to pressure and/or sintered. If it is desired to change the metallic materials around the coils 1 into an alloy then the temperature of the entire mass is preferably
15 brought to the alloying temperature of the alloying elements but less than the melting temperature of the sponge iron. When at this temperature the mass may be subjected to pressure and the interlocked grains of sponge iron and alloying elements closed in to complete the final dense
20 article.

A modified method of forming a cooling unit having a varying cross sectional heat conductivity would be to insert the coils 1 in a suitable
25 metal container 6, as best shown in Fig. 1, such container 6 defining the walls of the cooling unit as well as those of the sharp freezing chamber or chambers 2. Into this container the varying metallic powders may be placed so that pure sponge
30 iron or a mixture of pure sponge iron and other metals of high heat conductivity may be placed around the coils 1 so as to provide for rapid heat conductivity between the coils and the sharp freezing chambers; whereas metallic powders of a
35 coarser texture or of lower heat conductivity such as metallic oxides may be so placed as to be positioned adjacent the outer walls of the cooling unit. Such finely divided metallic powders may or may not be packed and may or may not
40 be sintered depending upon the density and conductivity required.

It will be also understood that I may sinter from the inside of the cooling unit only with the result that the materials immediately adjacent
45 the walls of the sharp freezing chambers will be sintered to a predetermined depth. Such sintering temperature applied from the inside may be such that practically all of the mass of material is sintered but to a proportional degree or the sintering temperature may be applied so that the
50 walls around the sharp freezing chambers may be sintered to only a small extent while the remainder of the mass of material remains unsintered. Inasmuch as iron and other metallic
55 powders conduct and retain their sensible heat according to their density it will be obvious that this application of sintering temperature from the inside out will vary the physical properties of different cross sectional parts of the cooling unit.

A further modified method of obtaining this variation in density and physical properties is by compressing and/or sintering the sponge iron and/or other metallic powders in the form of a
60 fixed plate or shell 7 around the refrigerant coils. Such shell or plate may, of course, vary considerably in thickness and the complete unit then positioned within a suitable container and the remaining space filled in with metallic powders which may be sponge iron and/or other
65 metallic mixtures. Such filled in powders may be left loose or may be compressed and/or sintered according to the density desired.

It will thus be seen that I have provided a novel method or methods of forming a cooling
75 unit directly from finely divided iron and/or

other metals. The use of the finely divided metals makes it possible to vary the density and physical properties of localized parts of the cooling unit; that is, the density may be gradually varied from the inside to the outside of the unit or there may be distinct lines of demarkation as to the density at different localized points. Furthermore, it will be seen that I have made it possible not only to vary the density but also the materials used and that irrespective of the density the heat conductivity may be changed or varied as to different localized parts of the unit. I prefer to use sponge iron as the main element in the finely divided mass of metals and it will thus be seen that regardless of the varying density or varying heat conductive properties of various parts of the unit that the entire unit will, because of the iron, present a mass having relatively great hold-over properties or ability to retain sensible heat.

Thus, in addition to greatly increasing the efficiency of any refrigerating unit because of the remarkable hold-over properties, it will also be possible, because of my novel unit, to obtain any relative temperatures desired; that is, the sharp
100 freezing chambers may be maintained at any temperature desired while the space around the cooling unit may be maintained at any different temperature desired.

It will be understood that the position of the coils or other refrigerant circulating means may be varied in accordance with different conditions to be met but that in general the refrigerant circulating means is preferably spaced from the walls of the sharp freezing chamber or chambers
110 and the conductivity taken care of by varying the density of the materials surrounding said refrigerant circulating means.

It will be understood that the metallic walls of my novel unit may be formed by any suitable
115 container such as at 6 or that the outside of the compressed or sintered unit may be coated with any suitable moisture preventative to seal the same.

What I claim is:

1. A cooling unit for refrigerating systems having a refrigerant receiving and circulating means and walls in heat conducting relation with said means and formed solely of a sintered mass of compressed finely divided metallic particles.
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2. A cooling unit for refrigerating systems having a refrigerant receiving and circulating means and walls in heat conducting relation with said means and formed of a mass of finely divided metallic particles, the density of said metallic
125 particles varying as to certain localized portions of said cooling unit.

3. A cooling unit for refrigerating systems of the type having one or more sharp freezing chambers and a refrigerant circulating means positioned adjacent said chamber or chambers, comprising walls formed largely of finely divided iron shaped without melting, said material defining the walls of the sharp freezing chamber or chambers and surrounding the refrigerant circulating
130 means, the density of said walls varying between the surfaces of the sharp freezing chamber or chambers and the outer surface of the unit.

4. A cooling unit for refrigerating systems, comprising a sintered mass of finely divided metallic particles and refrigerant circulating means positioned in heat conducting relation to said sintered mass, said particles being directly sintered to each other by the application of heat.
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5. A cooling unit for refrigerating systems,
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comprising a sintered mass of finely divided metallic particles and refrigerant circulating means embedded in said mass.

6. The method of forming a cooling unit of the type having sharp freezing chambers and refrigerant circulating means embedded in the walls thereof, which comprises surrounding the circulating means and forming the walls with finely divided metallic particles and then sintering said metallic particles to control the density thereof.

7. The method of forming cooling units for refrigerating systems, which comprises building up the walls of the unit of finely divided metallic particles the greater portion of which consists of finely divided iron, and then sintering said particles to form an integral mass, said sintering temperature being less than the melting point of the iron.

8. The method of forming cooling units for refrigerating systems, which comprises building up the walls of the unit of finely divided metallic particles, the greater portion of which consists of finely divided iron, and then sintering and compressing said particles to form an integral mass, said sintering temperature being less than the melting point of the iron.

9. A cooling unit for refrigerating systems formed largely of iron and having a predetermined

amount of other materials mixed therewith at localized points whereby to reduce the conductivity of said mass of iron at such points.

10. As a new article of manufacture, a heat exchange unit having walls formed solely of a sintered mass of finely divided metallic particles.

11. A unitary solid cooling unit of the type having a sharp freezing chamber and refrigerant circulating means positioned in the walls thereof and surrounding the chamber, comprising a wall containing finely divided particles having relatively great heat conductivity surrounding the circulating means, the density of said finely divided particles in localized portions of the cooling unit being varied to control the heat conductive and hold over properties at such localized portions.

12. A unitary solid cooling unit of the type having a sharp freezing chamber and refrigerant circulating means positioned in the walls thereof and surrounding the chamber, comprising a wall containing finely divided metallic particles surrounding the circulating means, the relative density of said particles in lateral directions from said circulating means being predetermined to control the heat transfer in such lateral directions.

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