July 4, 1939. E. W. KRETSCHMER 2,164,656

REFRIGERANT COIL

Filed Jan. 26, 1938

Fig. 1.

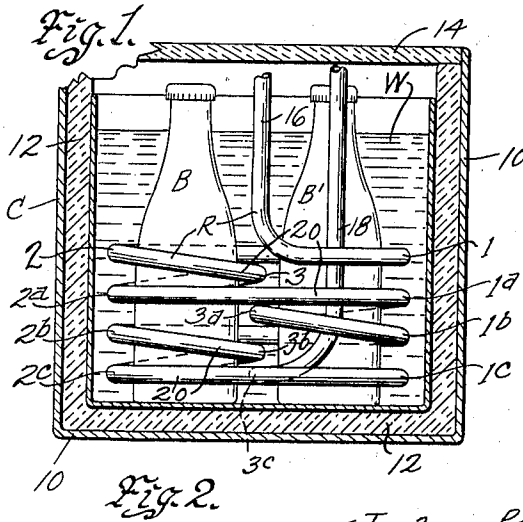


Fig. 4.

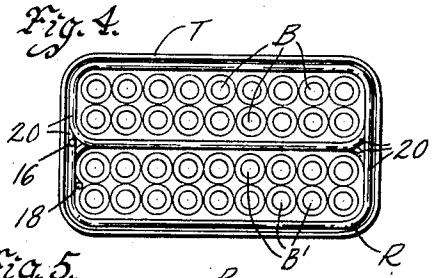


Fig. 5.

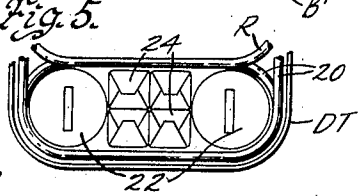


Fig. 2.

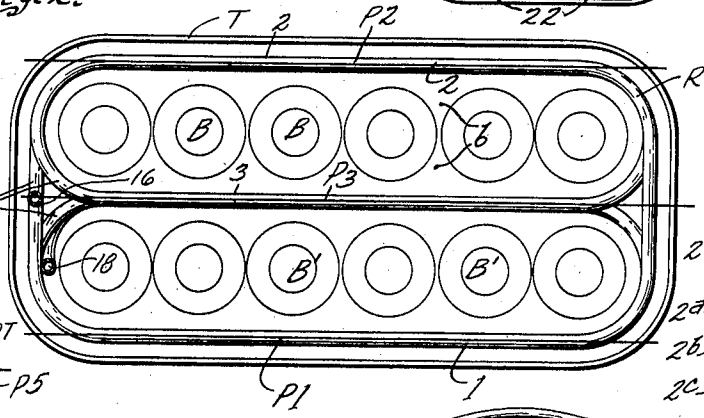


Fig. 6.

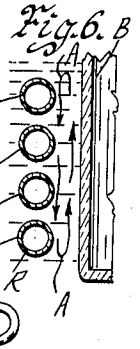


Fig. 7.

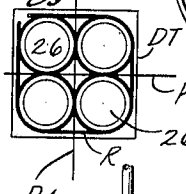
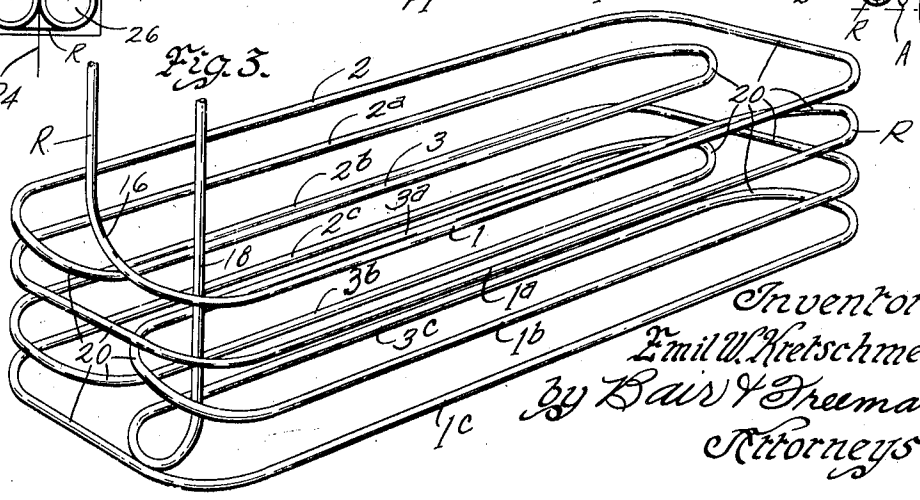


Fig. 3.



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2,164,656

REFRIGERANT COIL

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Application January 26, 1938, Serial No. 187,003

3 Claims. (Cl. 62—126)

An object of my invention is to provide a refrigerant coil adapted for cooling beer bottles, beverage bottles or the like or for cooling containers of commodities such as ice cream, the coil being comparatively simple and easy to manufacture and being so wound that there are substantially equal distances for heat travel between the bottles or containers and various portions of the coil.

Another object is to provide a coil for refrigerant which can be used either for a water bath for cooling bottles of liquid or for a dry compartment for cooling commodities in other containers, the coil being so arranged that the path of refrigerant therethrough is such that heat units are extracted uniformly from all parts of the bottles or other containers.

Another object is to provide a refrigerant coil which can be economically formed with a saving in tubing as compared to the types of coils heretofore developed and including mainifolds for the purpose of getting even cooling throughout a water bath or dry compartment, my coil further having the advantage of eliminating all soldered joints which are especially objectionable where they occur under the surface of the water.

Still another object is to provide a coil so arranged that there is substantially equal cooling of all parts of the commodities to be cooled without the necessity of mechanical means for agitating the water or air in the cooling compartment.

Still a further object is to provide a coil which is so wound and arranged in a cooling compartment that a single coil without joints secures the very desirable result of uniform cooling throughout the compartment and consequently uniform cooling of the commodities placed therein without the danger of certain portions of the commodities being chilled below the desired temperature before the temperature of other portions thereof reaches the desired degree or in some cases undesirably freezing some portions while other portions remote from the refrigerant coil remain unfrozen.

With these and other objects in view my invention consists in the construction, arrangement and combination of the various parts of my device, whereby the objects contemplated are attained, as hereinafter more fully set forth, pointed out in my claims and shown by way of illustration in the accompanying drawing, in which:

Figure 1 is a vertical sectional view through a water bath type of cooler for bottled beverages or the like showing my improved refrigerant coil in end elevation therein and its association with two rows of bottles.

Figure 2 is a plan view of the tank, my refrigerant coil and the bottles of Figure 1.

Figure 3 is a perspective view of the coil per se.

Figure 4 is a plan view similar to Figure 2 showing how the coil can be arranged for plural rows of bottles between the different portions of the coil.

Figure 5 is a similar view showing the arrangement of the coil for commodities other than bottled beverages such as containers of bulk ice cream or the like.

Figure 6 is a diagrammatic view showing the circulation of water between the refrigerant coils and the adjacent surface of a bottle; and

Figure 7 is a diagrammatic view showing a further modification in which individual containers are each surrounded by portions of the refrigerant coil instead of the portions of the coil extending along opposite sides thereof as in Figure 2.

On the accompanying drawing I have used the reference character T to indicate a tank of a bottled beverage cooler. The tank T is adapted to contain water W and is itself contained in a cabinet C of suitable construction.

By way of illustration I show the cabinet as comprising an outer wall 10 spaced from the tank T with heat insulating material 12 filling the space between the tank and the outer wall 10. A slidable lid 14 of insulating material is positioned on the top of the cabinet C and serves in conjunction with the cabinet as an enclosure for the tank T and my refrigerant coil which is designated as R.

Heretofore there have been provided cooler cabinets for bottled beverages and also dry compartment coolers wherein the coil has been wound around the inner or outer surface of the tank T. The entire space within the coil is left open for receiving bottles or the like, but the drawback to this type of cooler cabinet resides in inefficient and non-uniform cooling of the bottles. The coils furnish the desired temperature in their immediate vicinity, but the center of the tank would range from six to twelve degrees higher temperature than adjacent the refrigerant coil. Mechanical means have been used to agitate the body of the water or to circulate the air in order to overcome this drawback. My refrigerant coil R is so wound and related to the tank T that it is unnecessary to provide mechanical agitation and yet uniform cooling is secured with more rapid cooling of the contents of the bottles than possible with a mechanical agitating means and

the prior types of refrigerant coils. As a result, there is greater efficiency of operation of the refrigerating apparatus and the various advantages just pointed out will become obvious as the description of my invention proceeds.

My refrigerant coil R comprises a single tube of copper or suitable material having portions wound in at least three planes. These planes are preferably vertical and are indicated in Figure 2 as P1, P2 and P3. The planes P1 and P2 are adjacent opposite sides of the tank T, while the plane P3 is intermediate the planes P1 and P2. It is illustrated as being adjacent the center of the tank. In the plane P1, the refrigerant coil R has four runs of tubing indicated as 1, 1a, 1b and 1c. Likewise the tubing in planes P2 and P3 have runs of tubing indicated at 2, 2a, 2b, 2c and 3, 3a, 3b, 3c respectively.

Referring to Figures 1 and 3, the refrigerant coil or the tubing forming it has a pair of terminal ends 16 and 18. Either of these may be the inlet for the refrigerant, while the other is the outlet therefor. The tubing is wound to fall in the three planes P1, P2 and P3, crossing from one plane to the other at the ends of the tank T as indicated at 20. The coil is wound preferably in the following order of rotation: 1, 2, 3, 2a, 1a, 3a, 1b, 2b, 3b, 2c, 1c and 3c. This provides a substantially uniform flow of refrigerant from top to bottom or from bottom to top of the refrigerant coil.

Assuming the refrigerant to flow downwardly, it will flow first along one side of the tank through the run 2, then through the center of the tank through run 3, then along the other side of the tank through run 2a, then along the first side of the tank through the run 1a, then through the center of the tank through the run 3a, after which it returns to the first side of the tank and passes through run 1b and the cycle of passage is then repeated as many times as necessary to build up a coil of the desired height. This obviously will give maximum uniformity of flow of refrigerant through the water W in the tank T without the necessity of providing any manifolds or soldered joints under the surface of the water.

By having the runs 3, 3a, 3b and 3c of the tubing brought through the area or field of location of normal inefficiency, I am able with my coil to cool the center of the tank to the same degree as the sides thereof. This arrangement provides two spaces in which two rows of bottles B and B' may be placed. There will be substantially equal distance from opposite sides of the bottle B to the planes P2 and P3 instead of one side of the bottle becoming chilled excessively or frozen while the other side remains too warm as where prior types of coils are used. As illustrated in Figure 6 there will be a circulation of water between the refrigerant coil R and the bottle B as indicated by the arrows A as distinguished from the prior types of construction in which there is water circulation adjacent the walls only of the tank.

In my arrangement there is circulation along opposite sides of the bottle and this circulation extends to the spaces indicated at b (see Figure 2) between the bottles, thus substantially evenly cooling the entire contents of the bottles. As shown in Figure 4, my coil arrangement can be somewhat modified for containing a plurality of rows of bottles between the center and side runs of the coil. The cooling efficiency is not as great in this type of arrangement, but it does have the advantage of substantially increasing the efficiency of coolers in which four or more rows of bottles are placed, as the center runs of the refrigerant coil cools the center rows of bottles which are otherwise in an area where cooling is substantially less than desired.

I have illustrated in Figure 5 how my refrigerant coil can be used in a dry compartment type of cooler. A dry tank DT is illustrated in which the refrigerant coil R is arranged, the coil being of suitable size to receive between the intermediate and side wall runs thereof containers 22 of bulk ice cream or packages 24 of ice cream or other commodities to be cooled.

I have illustrated in Figure 7, the cooling of containers 26 of bulk ice cream or the like in a manner even more uniform by having intermediate portions of the refrigerant coil arranged in general planes P4 and P5 between the individual containers so that each container is surrounded by successive portions of the refrigerant coil substantially equally spaced from the walls of the containers.

My refrigerant coil prevents the water in a bottled beverage cooler or the air in a dry compartment cooler from taking a course resulting in a dead area or one of no circulation and which accordingly would have a higher temperature than adjacent the coil where thermally induced circulation takes place. My arrangement has the further advantage of not taxing the refrigerating unit to its full capacity, thus economizing on power consumption and minimizing operation of the compressor unit.

The coil is so arranged that no one portion of the box receives the benefit of inflowing refrigerant to the detriment of another portion which would be subject to a higher temperature because of being adjacent the outgoing end of the refrigerant tubing. By winding the tubing so that it follows one side of the box, then the other, then an intermediate portion of the box, etc., all portions of the box in any horizontal plane are substantially uniformly cooled. There will be a slight difference in temperatures of portions in the vertical plane but what slight circulation is induced by rise of the water or air adjacent the relatively warm commodities and down flow of the water or air adjacent the refrigerant coil as in Figure 6 will remove any temperature differences as might result therefrom.

Some changes may be made in the construction and arrangement of the parts of my refrigerant coil without departing from the real spirit and purpose of my invention. I therefore intend to cover by my claims any modified forms of structure or use of mechanical equivalents which may be reasonably included within their scope.

I claim as my invention:

1. In a refrigerant coil of the character disclosed, a single tube wound to provide spaced rows of tubing between which containers of commodities to be cooled may be placed, said tube being so arranged as to conduct cooling medium along one row, from said one row to a second row, along said second row, then to a third row intermediate the first and second rows, along said third row, then to and along the second row, then to and along the first row and then to and along the third row, said tube being so arranged that spaces are left between the first and third row and between the second and third row for reception of containers, the contents of which are to be cooled by the refrigerant coil.

2. In a refrigerant coil of the character dis-

closed, a single tube wound to provide spaced portions arranged in three vertical planes between which containers of commodities to be cooled may be placed with substantially equal distance for heat travel from said containers to said tube portions, said tube being so arranged as to conduct cooling medium from one of said planes to a second one of said planes, then to the third plane, said third plane being intermediate the first and second planes, then to the second plane, then to the first plane and then to the third plane, said tube being so arranged that spaces are left between the first and third planes and between the second and third planes for rows of containers of commodities to be cooled by the refrigerant coil.

3. In a device for cooling commodities comprising a tank and a single continuous coil for refrigerant in said tank, said coil characterized by being so arranged as to conduct cooling medium successively in paths along one side of said tank, the other side of said tank, the center of said tank, said other side of said tank, said first side of said tank and the center of said tank and then to conduct the cooling medium in paths parallel to and vertically spaced from the foregoing paths.

EMIL WILLIAM KRETSCHMER.