

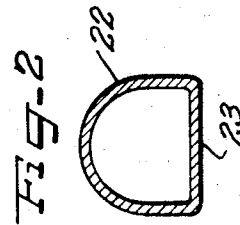
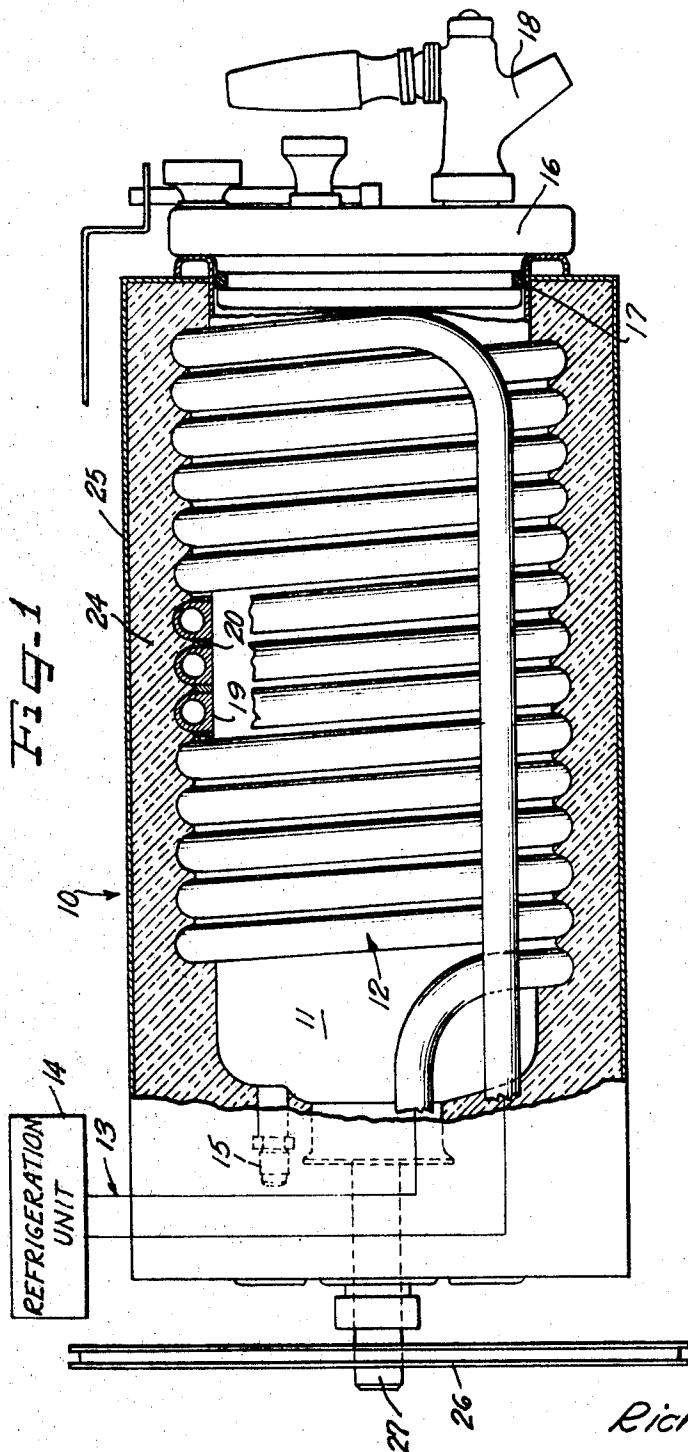
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HEAT EXCHANGER FOR A BEVERAGE DISPENSING MACHINE

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HEAT EXCHANGER FOR A BEVERAGE DISPENSING MACHINE

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2 Claims

ABSTRACT OF THE DISCLOSURE

A beverage dispensing device has a heat exchanger including a product cylinder surrounded by a cooling coil of D-shaped cross-section, the flat side of the coil being bonded as by a tin-solder to the outside of the cylinder.

BACKGROUND

Field of the invention

This invention relates to the construction of a heat-exchanger employed in a beverage dispensing device.

Prior art

There are three prior known types of construction, the first of which involves an aluminum block casting into which a coil has been embedded at the time of casting. The block could form part of a container. On the basis of my investigation, this type of construction has performed quite poorly. On the basis of information and belief, differential shrinkage between the cast aluminum and the material of the coil creates a surface condition through which heat transfer is poor.

The second type of prior art known to me involves winding a coil of tubing of circular cross-section, or substantially circular cross-section about a cylinder and then soldering the coil to the cylinder. On the basis of my investigation, it appears that this type of construction performs about twice as well as the previously described construction.

A still better prior construction is one which involves a hollow shell disposed around the cylinder so that the refrigerant gas can expand directly in the cavity that is immediately adjacent to the exterior of the cylinder. According to my investigation, for a particular size of cylinder, this construction is capable of suitably processing 18 ounces of product per minute per horsepower.

SUMMARY OF THE INVENTION

The dispensing device includes a heat-exchange device having a cylinder encircled by a coil of D-shaped cross-section whose flat side is disposed against the cylinder and is bonded thereto by a capillary-type of bond of solder.

Accordingly, it is an object of the present invention to provide a beverage dispensing device having improved refrigeration capacity.

A further object of the present invention is to provide a heat-exchange device for use in a refrigerant system where the heat transfer will be particularly efficient.

Another object of the present invention is to provide a heat-exchange device, as for a beverage dispensing system, which will provide a relatively large refrigerating capacity for a relatively large quantity of product.

Yet another object of the present invention is to provide a heat-exchange device requiring no internal baffles whereby trapping of oil which creates insulated spots is avoided.

A still further object of the present invention is to provide a heat-exchange device which can withstand rel-

atively high internal pressures, at least as high as 600 p.s.i., which may arise due to use of hot cleaning solutions.

Many other advantages, features and additional objects of the present invention will become manifest to those versed in the art upon making reference to the detailed description and the accompanying sheet of drawings in which a preferred structural embodiment incorporating the principles of the present invention is shown by way of illustrative example.

On the drawing:

FIG. 1 is a side elevational view, partly broken away and in cross-section, of the heat-exchange device of a beverage dispensing system provided in accordance with the principles of the present invention; and

FIG. 2 is a fragmentary enlarged cross-sectional view of a modified coil for use in the structure of FIG. 1.

As shown on the drawing:

The principles of this invention are particularly useful when embodied in a beverage dispensing device having a heat-exchanger for refrigerating a beverage to a partially frozen or slush state such as illustrated in FIG. 1, generally indicated by the numeral 10. The dispensing device 10 includes a cylinder 11 of round cross-section encircled by a cooling coil 12 which forms part of a refrigeration system 13 having a refrigeration unit 14. Refrigerant gas expanding in the coil 12 draws heat from the external side of the cylinder 11 to thereby cool the beverage or other fluid contents.

To this end, the cylinder 11 has an inlet 15 which is adapted to be connected to a source of beverage or other fluid, disposed at one end thereof, and at the opposite end, the cylinder 11 is closed by a faceplate 16 secured by screws (not shown) to the end of the cylinder 11, an O-ring 17 forming a seal therebetween. The faceplate 16 carries a withdrawing means in the form of a dispensing valve 18 which communicates through the faceplate 16 to the interior of the cylinder 11. As the product that is to be refrigerated and to form ice therein as a slush is considered a food from a sanitation standpoint, the cylinder 11 constitutes stainless steel, the outer surface of which has a layer of copper plating thereon.

The cooling coil 12 preferably comprises an extrusion of aluminum, the same being extruded to have a D-shaped cross-section as illustrated in cross-section, with the flat side of such cross-section disposed against the cylinder 11. The cooling coil 12 is also copper plated, at least on the flat side 19. The coil 12 is of such configuration that the flat side 19 of the coil 12 is disposed against the outside of the cylinder 11 with a close fit, thereby creating a capillary gap therebetween. Subject to the application of conventional flux, when a quantity of tin solder 20 is applied liberally, there is certainty that the capillary gap between the flat side 19 and the cylinder 11 will fill with such solder and form a bond between the copper surface on the coil 12 and the copper surface on the cylinder 11. I have found that solder having a high tin content, for example at least 95%, is particularly well suited for this purpose.

If desired, the coil 12 may be made of copper tubing of conventional type that has been modified as by rolling so as to have a flattened side. Such a construction is shown in FIG. 2 where a coil 22 has a flat side 23 which corresponds in all respects dimensionally to the flat side 19. In this embodiment, the wall thickness is uniform, or substantially so for all practical purposes. Where the coil 22 is formed of copper, no external plating needs to be applied.

The operational results obtained by this structure are most unusual. On the basis of prior teaching, as explained above, it would appear that as a direct expansion type of

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construction performs better than one having an external cooling coil, it would seem to be unlikely that better performance could be obtained by use of a coil. However, according to my discoveries, it appears that there are voids created which solder cannot adequately fill, the number of such voids being extremely indefinite. However with the present construction, the problem of voids is entirely eliminated, thereby producing a dramatic increase in quality or efficiency of performance. Moreover, tin is considered to be a poor heat-transfer substance, but owing to the extremely thin layer thereof which is provided by the capillary-type of seal, its resistance to heat transfer becomes low. By actual test, all other things being equal, I have found that the structure here disclosed is capable of processing about 37 ounces per minute per horsepower, which is at least double that given in the abovestated for the best prior known prior art. With this construction, there is thus provided negligible resistance to heat transfer, no structure which traps oil, no solder voids, and high heat-exchange areas, both considering the area to which refrigerant is exposed, and considering the area of coil that is in contact with the cylinder.

With the present invention, I have been able to achieve a given net performance or useful production using less refrigeration capacity, and have been able to give or produce a higher performance for the same refrigeration capacity as prior art, or both. Moreover, the structure is mechanically extremely strong so that when hot water is used to clean the interior of the cylinder 11, the increase in refrigerant pressure is readily withstood without having to build heavy massive constructions.

The temperature of the evaporator coil 12 directly affects the compressor efficiency dramatically. The smaller the temperature of the evaporator coil 12 directly affects the temperature of the product, the greater the thermal efficiency of the device. This particular construction is especially advantageous in that it produces a low temperature difference between the two fluids that are contained in the coil 12 and the cylinder 11.

As is conventional, the assembly of the cylinder 11 and the coil 12 is enclosed by insulation 24 contained within a suitable housing 25, there being a pulley 26 which drives a shaft 27 to rotate an internal scraper or stirrer if desired.

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Although various minor modifications might be suggested by those versed in the art, it should be understood that I wish to embody within the scope of the patent warranted hereon all such embodiments as reasonably and properly come within the scope of my contribution to the art.

I claim as my invention:

1. A device for dispensing a refrigerated beverage comprising:

- (a) a cylinder of stainless steel arranged to be connected to a source of the beverage;
- (b) a continuous layer of copper plating having a plating-bond with the outer surface of said cylinder;
- (c) a refrigeration system having a cooling coil of tubing encircling said cylinder, said tubing having a cross-section with a flat side disposed toward said cylinder;
- (d) a copper surface on said cooling coil forming a helical capillary gap with said copper plating;
- (e) a quantity of tin solder filling said helical capillary gap and bonded to said copper plating and said copper surface, and also bonding the copper surface of adjacent turns of said coil together; and
- (f) means for withdrawing beverage from said cylinder.

2. A device for dispensing a refrigerated beverage according to claim 1, in which said tin solder is at least 95% tin.

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U.S. Cl. X.R.

165—169; 29—157.3, 492; 62—399, 515

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,469,415 Dated September 30, 1969

Inventor(s) Richard T. Cornelius

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Col. 3, line 34, delete "of the evaporator coil 12 directly af-" and insert -- difference between the temperature of the --;

Col. 4, line 11, change the colon to a semicolon.

SIGNED AND
SEALED
JUN 23 1970

(SEAL)

Attest:

Edward M. Fletcher, Jr.

Attesting Officer

WILLIAM E. SCHUYLER, JR.
Commissioner of Patents