Sept. 1, 1964 E. F. COX 3,146,600

THERMOELECTRIC IMMERSION COOLER

Filed May 28, 1962

Fig. 1.

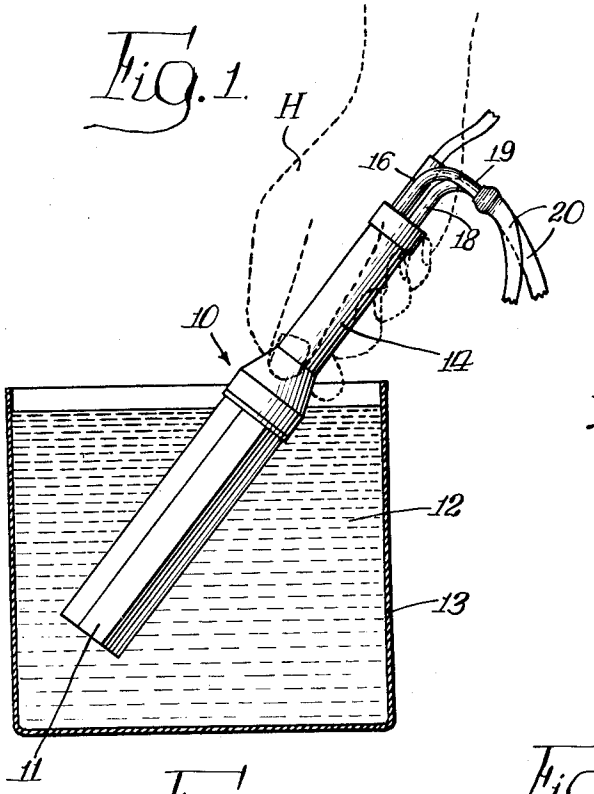


Fig. 2.

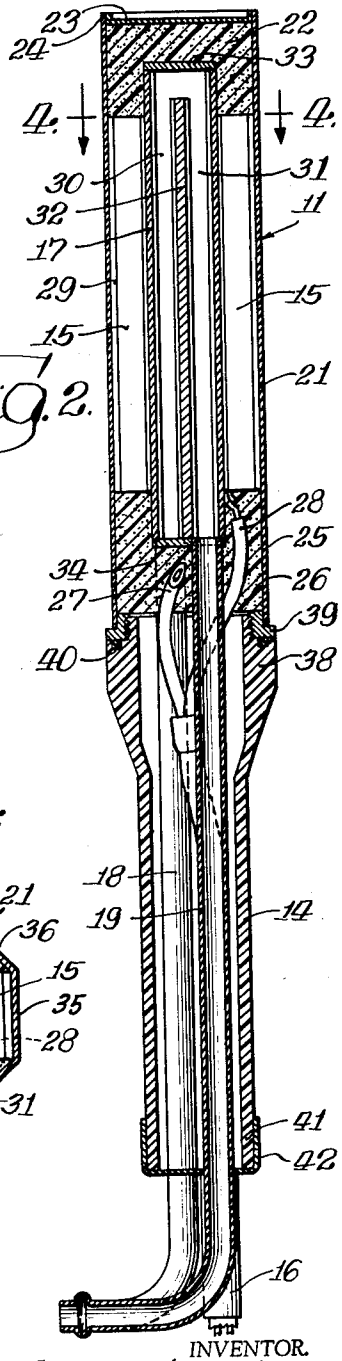


Fig. 3.

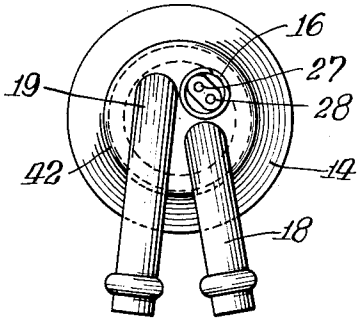
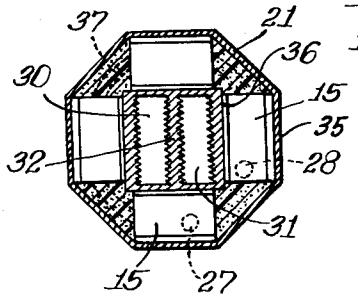


Fig. 4.



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United States Patent Office 3,146,600 Patented Sept. 1, 1964

3,146,600

THERMOELECTRIC IMMERSION COOLER

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Filed May 28, 1962, Ser. No. 198,117
7 Claims. (Cl. 62—3)

This invention relates to refrigeration apparatus, and in particular, to portable refrigeration apparatus for refrigerating a body such as a body of liquid.

At times it is desirable to refrigerate a small quantity of liquid such as water or beverage without resorting to use of conventional refrigeration apparatus such as a refrigerator or the like. Thus, for example, it is desirable at times to refrigerate quickly and efficiently a quantity of beverage in a portable receptacle, such as a pitcher or cup. The present invention comprehends a novel refrigerating device manipulatable for ready selective immersion in the body of liquid, thereby to produce the desired refrigerating effect in the liquid carried in the receptacle.

A principal feature of the present invention is, therefore, the provision of a new and improved refrigeration apparatus.

Another feature of the invention is the provision of such apparatus arranged for facilitated efficient refrigeration of a body of liquid or the like as by immersing the refrigeration apparatus within the body of liquid.

A further feature of the invention is the provision of such apparatus arranged for facilitated hand-held utilization.

Still another feature of the invention is the provision of such refrigeration apparatus including a novel arrangement of thermoelectric modules within an enclosure for cooling a liquid within which the enclosure is immersed, and means for conducting heat from the hot portions of the thermoelectric modules away from the refrigerating apparatus for improved efficient refrigeration of the liquid.

Still another feature of the invention is the provision of such a refrigeration apparatus having an improved handle structure through which the conductors for energizing the thermoelectric modules extend and through which suitable conduit means for delivering heat transfer fluid into and from thermal transfer association with the thermoelectric modules extends.

Other features and advantages of the invention will be apparent from the following description taken in connection with the accompanying drawings wherein:

FIGURE 1 is an elevation of a refrigeration apparatus embodying the invention in association with a receptacle containing a body of liquid to be refrigerated by the apparatus;

FIGURE 2 is an enlarged diametric section of the refrigeration apparatus;

FIGURE 3 is an enlarged end view thereof, looking toward the handle end of the apparatus; and

FIGURE 4 is an enlarged transverse section taken substantially along the line 4—4 of FIGURE 2.

In the exemplary embodiment of the invention as disclosed in the drawing, a refrigeration apparatus generally designated **10** is shown to comprise an elongated device having an immersible portion **11** adapted to be removably inserted into a body of liquid **12** carried by a suitable receptacle **13**. The refrigeration apparatus **10** further includes a handle portion **14** adapted to be grasped by the hand H of a person for facilitated manipulation to effect the desired immersion of the portion **11** in the liquid. The immersible portion **11** is arranged to house a plurality of conventional thermoelectric modules **15** which are energized by a suitable wire cable **16** extending longitudinally through the handle **14**. The immersible portion **11** further includes a heat transfer means in the form of a hollow metal member **17** through which heat transfer fluid may be circulated by means of a pair of conduits **18** and **19** also extending longitudinally through the handle **14**. The electrical cable **16** is adapted to be connected to a suitable conventional D.C. power source (not shown) and the conduits **18** and **19** are adapted to be connected by means of suitable flexible hoses **20** to a suitable conventional source of heat transfer fluid such as a household water supply (not shown) and to a drain.

More specifically, the immersible portion **11** of the refrigeration apparatus comprises an outer enclosure **21** formed of a suitable conductive material such as steel and, as best seen in FIGURE 4, may be arranged to define an octagonal transverse cross section. The distal end of the enclosure **21** is preferably closed by means of a plug **22** formed of a suitable sealing material such as foam insulation, and a metal cap **23** preferably welded in the end **24** of the enclosure. The opposite end **25** of the enclosure is similarly fitted with a sealing plug **26** through which the individual conductors **27** and **28** of cable **16** and tubes **18** and **19** extend. The hollow metal member **17** extends between plugs **22** and **26** axially through the space **29** within the enclosure **21**. It will be apparent that insulation plugs **22** and **26** may be provided by insulation foamed-in-place after the modules **15** and hollow metal members **17** are inserted within the outer enclosure **21**.

As best seen in FIGURES 2 and 4, the hollow metal member defines a pair of longitudinal passages **30** and **31** on opposite sides of a central dividing wall **32** for circulating coolant fluid therethrough, the dividing wall **32** terminating short of the distal end wall **33** of the member **17** to provide a connection between the passages **30** and **31** at the distal end of the member. As shown in FIGURE 2, conduit **18** is connected through a closure **34** at the opposite end of the member **17** to the passage **30**, and conduit **19** is connected through the closure **34** to the passage **31** whereby the coolant fluid such as water may be passed from conduit **18** through passage **30** around the distal end of the dividing wall **32** into passage **31**, and from passage **31** to conduit **19** to complete the circulatory path through the device **10**.

As best seen in FIGURE 4, the thermoelectric modules **15** comprise elongated assemblies having rectangular cross-sections adapted to extend respectively between planar portions **35** of the enclosure **21** and confronting planar portions **36** of the metal member **17** in intimate heat transfer contact therewith. Thus, by suitably electrically energizing the thermoelectric modules, the outer portion thereof, as seen in FIGURE 4, may function as a heat absorbing device for receiving heat from the liquid **12** through the enclosure **21**. The inner portion of the modules may comprise heat passing means for passing heat energy from the thermoelectric modules through the metal member **17** to the coolant fluid circulated through the passages **30** and **31**. In the illustrated embodiment four such modules are provided, the metal member **17** being generally square in cross section and the modules having a width substantially equal to the planar portions **35** of the octagonal-section enclosure **21**. Obviously, other cross-sectional configurations of the enclosure and member **17** may be employed including cylindrical configurations and polygonal configurations other than the octagonal illustrated configuration. As shown in FIGURE 4, the thermoelectric modules **15** may be suitably interconnected within the enclosure **21** by suitable interconnecting wires **37** to complete the electrical circuit between conductors **27** and **28**.

Handle **14** may comprise a tubular plastic member having an end **38** secured to the end **25** of enclosure

21 by means of a threaded connector 39 fixed to enclosure end 25. Handle end 38 may be suitably threaded to the connector 39 and provided with an O-ring 40 for sealing the handle to the connector. The opposite end 41 of the handle is closed by a suitable cap 42 through which the conduits 18 and 19 and cable 16 extend.

In operation, the refrigeration apparatus 10 is utilized as indicated in FIGURE 1 by immersion of the portion 11 within the body of fluid to be refrigerated, the user effecting the immersion by grasping the handle portion 14 as shown. The cable 16 is connected to a suitable power source (not shown) for energizing the thermoelectric modules and the conduits 18 and 19 are connected to suitable hoses for circulating coolant such as water through the metal member 17. Heat is absorbed by the thermoelectric modules from the water 12 and passed into the coolant water circulated through the member 17 for removal from the apparatus 10. Refrigeration of the liquid 12 may be facilitated by utilization of the portion 11 to effect a stirring of the liquid concurrently with the cooling thereof.

Thus, apparatus 10 provides an economical, simple structure affording facilitated refrigeration of liquids and the like being particularly advantageously employed in connection with refrigerating small quantities of liquids such as cups of beverage and the like.

While I have shown and described one embodiment of my invention, it is to be understood that it is capable of many modifications. Changes, therefore, in the construction and arrangement may be made without departing from the spirit and scope of the invention as defined in the appended claims.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. Apparatus for withdrawing heat from a body to be cooled, comprising: an enclosure having a thermally conductive wall portion and a handle portion spaced from said wall portion; thermoelectric means in said enclosure having heat absorbing means in thermal transfer association with said wall portion and heat passing means spaced from said wall portion; and heat transfer means having an inner portion in thermal transfer association with said heat passing means to withdraw heat energy from said thermoelectric means, said heat transfer means iniluding an outer portion extending through said handle portion of said enclosure to without said enclosure.

2. The apparatus of claim 1 wherein said heat transfer means includes a conduit for circulating a fluid therethrough to receive the heat energy from said heat passing means, and said conduit passing through said handle portion.

3. Apparatus for withdrawing heat from a body to be cooled, comprising: an enclosure having a thermally conductive wall portion and a handle portion spaced from said wall portion; thermoelectric means in said enclosure having heat absorbing means in thermal transfer association with said wall portion and heat passing means spaced from said wall portion; heat transfer means having an inner portion in thermal transfer association with said heat passing means to withdraw heat energy from said thermoelectric means, said heat transfer means including an outer portion extending through said handle portion of said enclosure to without said enclosure; and electrical conductor means extending through said handle into said enclosure for energizing said thermoelectric means.

4. Apparatus for withdrawing heat from a body to be cooled, comprising: an enclosure having a thermally conductive wall portion and defining a chamber; a handle extending from said enclosure; thermoelectric means in said enclosure having heat absorbing means in thermal transfer association with said wall portion and heat passing means spaced from said wall portion; heat transfer means including an inner portion extending axially through said chamber and in thermal transfer association with said heat passing means to withdraw heat energy from said thermoelectric means, said inner portion of the heat transfer means comprising a hollow metal member defining a fluid flow passage, said heat transfer means further including an outer portion comprising a duct means extending through said handle for conducting a heat transfer fluid to and from said metal member; and electrical conductor means extending through said handle into said enclosure for energizing said thermoelectric means.

5. The apparatus of claim 1 further including a body of sealing insulation disposed between said thermoelectric means and said handle portion.

6. The apparatus of claim 1 further including a plug formed of sealing insulation material at the end of the enclosure remote from the handle portion.

7. The apparatus of claim 1 including an annular connector carrying the thermally conductive wall portion of the enclosure and threadedly secured to the handle portion.

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