United States Patent [19]

Karas

[11] **3,803,871**

[45] **Apr. 16, 1974**

[54] **ICE-MAKING APPARATUS**

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[22] Filed: **Sept. 20, 1972**

[21] Appl. No.: **290,467**

[52] **U.S. Cl.** **62/348,** 62/352

[51] **Int. Cl.** **F25c 1/04**

[58] **Field of Search** 62/352, 348, 347

[56] **References Cited**

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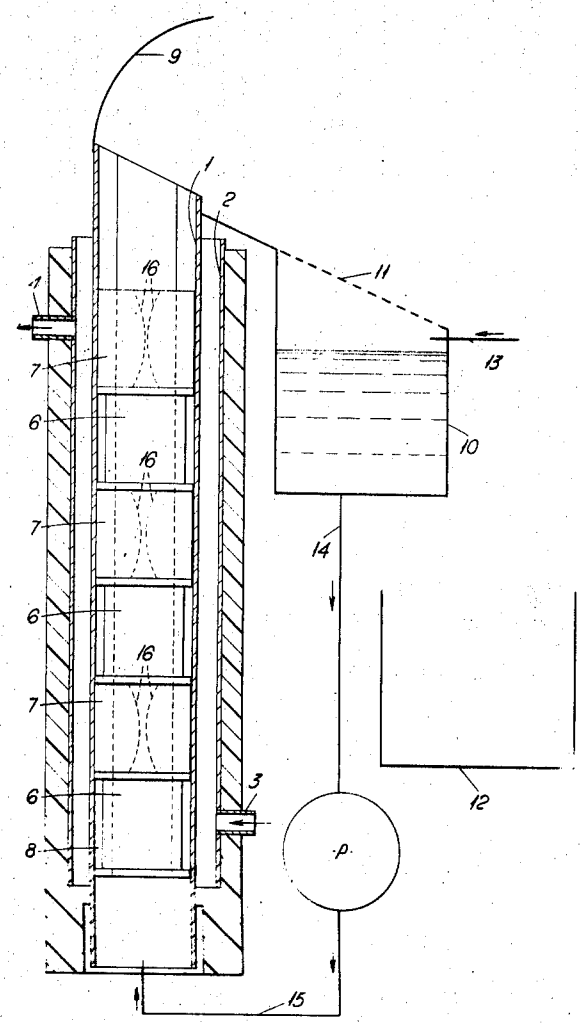
Primary Examiner—William E. Wayner

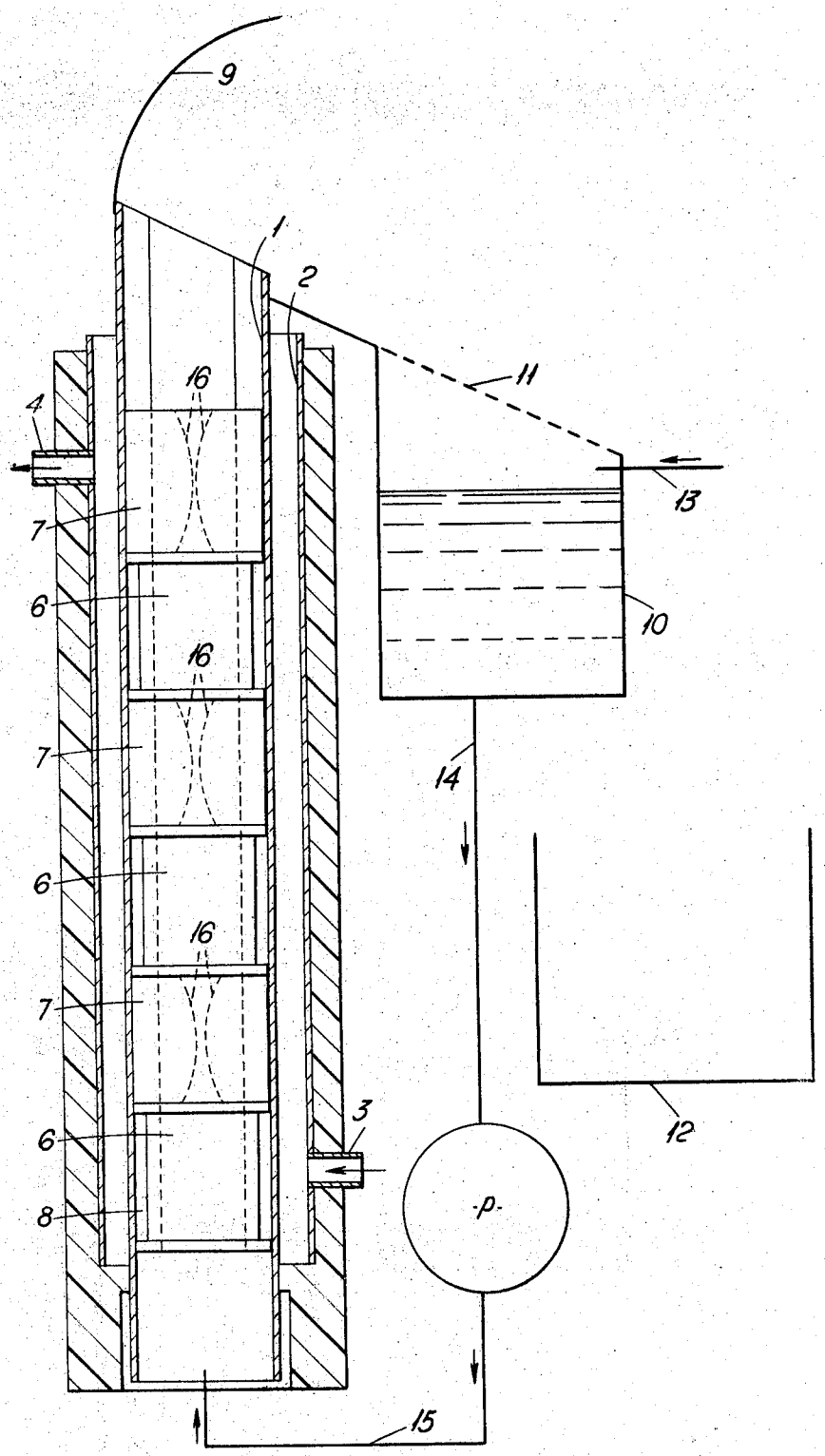
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[57] **ABSTRACT**

An ice-making apparatus comprises a tube of high thermal conductivity material surrounded by a jacket and enclosing successive rings or collars of low thermal conductivity and high thermal conductivity materials alternatively. Water flows through the tube and the jacket forms the evaporator of a refrigeration system. Ice blocks are thereby formed within the high thermal conductivity rings and are subsequently released by disconnecting the jacket from the refrigeration system and flushing the jacket with a hot gas supply, whereupon the released blocks are expelled by the water flow and are collected on a grid near one end of the tube. After expulsion of the blocks the cycle is repeated by re-connecting the jacket to the refrigeration system. Suitable materials for the rings are polypropylene and copper.

8 Claims, 1 Drawing Figure




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ICE-MAKING APPARATUS

BACKGROUND OF THE INVENTION

This invention relates to ice-making apparatus. More specifically, it relates to such apparatus which includes an ice-making container from which the heat is extracted nonuniformly so that separate or easily separable blocks of ice are formed.

The object of the invention is to provide an improved form of ice-making apparatus which is more efficient and reliable than hitherto existing apparatus for producing ice blocks of a size suitable for adding to drinks.

SUMMARY OF THE INVENTION

An ice-making apparatus in accordance with the invention comprises an open-ended tube within a jacket, the tube having therein successive spaced-apart heat conductive segments, means for directing a flow of water through the tube, and means for selectively supplying a flow of refrigerant and a flow of gas at a temperature above the freezing point of water through the jacket.

Preferably the tube is comprised of heat conductive and heat insulating segments alternately along its length.

In one construction the apparatus includes a tube with provision for supplying water to one end, the ice being delivered at the other end. Heat is extracted from the water in the tube by refrigerator "evaporator" tubing coiled around the ice-making tube. The term "evaporator" is to be understood to mean part of a refrigeration system which extracts heat from liquids, air or solids, by restricting condensed refrigeration gases through very fine orifices. This causes the condensed gas to expand at the end of restriction and consequently cools the required matter. With this arrangement, the nonuniform heat extraction may be achieved by interrupting the coil at intervals so that the coil sections are interconnected by a straight length of the tubing spaced from the ice-making tube. Although this construction has been found to be quite effective, it is preferred for ease of production and cost reasons to use an arrangement in which the evaporator is formed by a tubular jacket placed and sealed around a tube of highly conductive metal, and inside which high conductive, and non-conductive collars or rings are placed in alternative order along its length, forming a common surface of cylindrical shape.

With both such arrangements heat is extracted only through spaced-apart conductive regions or segments of the tube, thus allowing ice-blocks to be formed at intervals. It is desirable for the water to be continuously re-circulated through the tube as this gives clearer ice.

If re-circulation is affected by a low pressure pump the flow decreases as the ice is formed on the walls of the tube and provision is made for releasing the ice, e.g. by flushing the evaporator with hot gases from the condenser, approximately at the time the flow of water stops.

The discharge end of the tube is preferably placed by a grid or the like perforate structure which passes the water from the tube for re-circulation, e.g. into a header tank, but catches the ice blocks.

If the grid is inclined the blocks can roll down into a storage container.

BRIEF DESCRIPTION OF THE DRAWING

One form of invention will now be described by way of example with reference to the accompanying drawing which shows a diagrammatic cross-sectional side elevation of an ice-making machine according to the invention.

DESCRIPTION OF THE INVENTION

A copper ice-making tube **1** is arranged vertically within a secondary metal jacket **2** having an inlet **3** and outlet **4.** The jacket **2** is insulated by any readily available materials, e.g. polyurethane, to prevent heat losses into atmosphere, and condensation. Spaced inside the ice-making tube **1** are cylindrical rings or collars **6** and **7.** The collars **6** are plastic (e.g. polypropylene), and the collars **7** are made of highly conductive metal (e.g. copper).

It will be seen from the drawing that the collars **6** are recessed over most of their length to form closed annular air pockets **8** between the collars and the tube **1.** This has been found to provide very effective thermal insulation. Collars **7** are placed between collars **6** alternatively, and making good contact with inside of ice-making tube **1.**

A deflector **9** at the top end of the tube **1** leads ice and water discharged from the tube **1** over an insulated header tank **10** having an inclined plastic grid **11** over the top. Beyond and below the grid **11** is an insulated container **12** for the formed ice blocks. The header tank **10** is replenished through a line **13** and a ball valve (not shown). A low pressure electric pump P recirculates water from the header tank **10** to the bottom of the tube **1** through insulated lines **14** and **15.**

The jacket **2** forms the evaporator of a refrigeration system, refrigerant entering by the inlet **3** and leaving by the outlet **4.** Provision is made for flushing hot gas from the condenser of the system through the jacket when the ice has been formed. This flushing can be initiated for example either by a thermostat on the jacket **2** or an electronic conductivity device switch which measures the water flow through the deflector arrangement **9.** A further thermostat can be provided at the top of the container **12** to shut the machine down when the container **12** is full. More than one of the tubes **1** having common water, refrigerant and hot gas supplies can be provided in one apparatus as desired.

In operation water is circulated upwards through the tube **1** and the refrigerant in the jacket **2** progressively cools it. When the water temperature approaches freezing point ice forms in the tubes at the gaps between the collars **6** and progressively obstructs the tube **1** as shown by the dotted lines **16** representing the ice surface. The blocks of ice formed thus have approximately conical recesses in each end, since ice is formed to a limited extent inside the ends of the collars **6.** In other words, the blocks can be regarded as venturi-shaped conduits. The pump continues to operate so when the hot gas is flushed through the jacket **2** after the blocks are formed the blocks are released and driven out of the tube **1** and pass via the deflector arrangement **9,** and the grid **11,** into the container **12,** any water which accompanies them falling through the grid **11** into the tank **10.** The cycle is then repeated.

With two one inch diameter tubes, 2–3 ft. long, an output of the order of 50 lbs. per day may be achieved

in the form of blocks about 1½ inch long assuming a 10 minute cycle. Their venturi shape gives the advantage that the blocks have a greater surface area and thus melt more quickly when placed in water. Another advantage is that the contents of the tube would take several hours to freeze solid between the blocks and burst the tube if the hot gas flush should fail.

What I claim is:

1. An ice-making apparatus comprising:

an open ended tube;

a jacket surrounding said tube and forming a space therewith;

heat conductive and heat insulating lining segments alternately positioned inside said tube in end-to-end abutting relation to form an internal duct having a smooth cylindrical surface comprised of alternate contiguous heat conductive and heat insulating cylindrical areas;

means for directing a flow of water through said duct; and

means for selectively supplying a flow of refrigerant and a flow of gas at a temperature above the freezing point of water through said space.

2. An ice-making apparatus as claimed in claim **1**, wherein said water flow directing means operates to pass water upwardly through said duct.

3. An ice-making apparatus according to claim **1** in which the heat conductive segments are formed by lining collars of metal within the tube and the heat insulating segments are formed by lining collars of heat insulating material within the tube alternating with the metal collars, the ends of adjacent collars being in close abutment.

4. An ice-making apparatus according to claim **3**, wherein the outer surfaces of the heat insulating collars are recessed over a part of their lengths to provide annular air spaces between the collars and the tube.

5. An ice-making apparatus according to claim **3**, wherein the heat insulating collars are made of a plastic material.

6. An ice-making apparatus according to claim **1**, wherein the jacket has an inlet or outlet connectable into a refrigerating circuit to provide the flow of refrigerant through the spare and connectable to the circuit condenser to provide the flow of gas through the spare.

7. An ice-making machine according to claim **1**, including a water re-circulating system wherein the water supplied to the duct is returned after flowing therethrough to the said flow directing means.

8. An ice-making apparatus according to claim **7**, wherein the said flow directing means includes a tank to receive water returned from the duct, and means for replacing water lost from the re-circulation system as ice.

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