May 30, 1967 R. D. ORPHEY, JR 3,321,932

ICE CUBE TRAY FOR PRODUCING SUBSTANTIALLY CLEAR ICE CUBES

Filed Oct. 21, 1965

FIG. 1

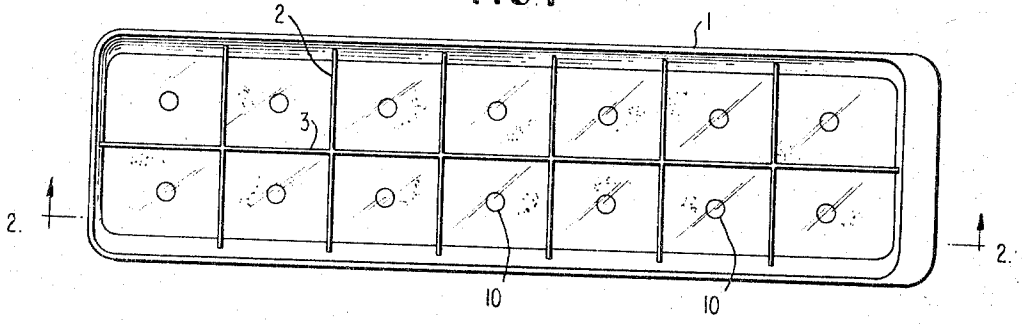


FIG. 2

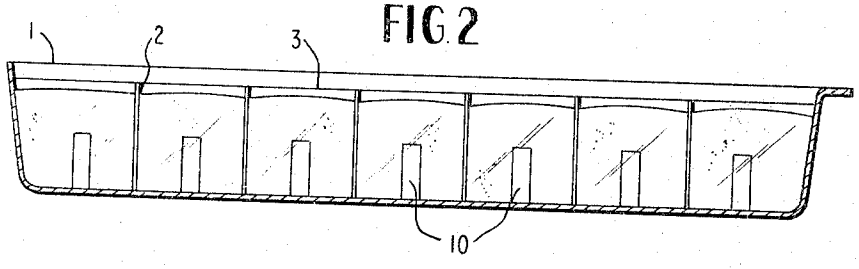


FIG. 3

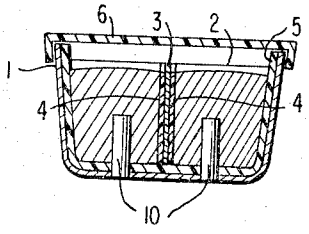


FIG. 4

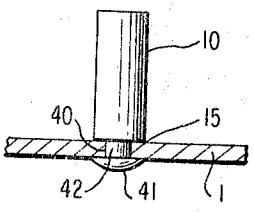


FIG. 6

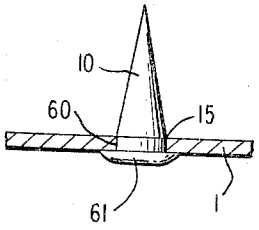
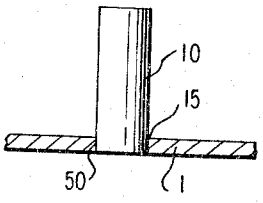


FIG. 5



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ICE CUBE TRAY FOR PRODUCING SUBSTANTIALLY CLEAR ICE CUBES

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14 Claims. (Cl. 62—340)

This invention relates to means and process for producing substantially clear ice cubes. More particularly, it relates to a means and process for producing substantially clear ice cubes in a conventional domestic refrigerator or freezer. Even more particularly, the invention relates to a means and process for producing substantially crystal-clear ice cubes by controlling the heat conduction in the cubes during the freezing process.

Heretofore, in the prior art ice cube trays, freezing of the water to form ice cubes takes place from the outside thereof toward the inside on all of the faces of the cube, the last portion thereof to be frozen being in the center. Hence, air or other gases are trapped or entrained in the center portion of the cube, thereby causing the formation of a white opaqueness therein.

It is apparent that it would be a great advantage to be able to produce substantially clear ice cubes in the home without the need for elaborate equipment. Clear ice cubes have a pleasing appearance and an aesthetic quality which is desired by many housewives, and particularly by people who entertain.

One of the objects of the present invention is to provide a means and process for producing substantially crystal-clear ice cubes.

Another object of the present invention is to provide a means and process for producing substantially clear ice cubes which may be carried out in an efficacious manner.

A further object of the invention is to provide an ice cube tray means for producing substantially crystal-clear ice cubes.

A still further object of the invention is to provide a process for the preparation of substantially clear ice cubes which avoids the need for elaborate equipment and which may be carried out simply in a conventional domestic refrigerator or freezer.

These and other objects and advantages of the present invention will become apparent to those skilled in the art from a consideration of the following specification and claims and with special reference to the accompanying drawings wherein:

FIGURE 1 is a top view of an ice cube freezing tray in accordance with the present invention;

FIGURE 2 is a view, partially in cross-section, taken along line 2—2 of FIGURE 1;

FIGURE 3 is a transverse view, partially in cross-section, of another embodiment of the ice cube tray in accordance with the present invention;

FIGURE 4 is a detailed view of a heat conducting post, in accordance with the present invention, showing a possible means of fastening the post to the bottom of the tray;

FIGURE 5 is another detailed view of a heat conducting post, in accordance with the present invention, showing another possible means of fastening the post to the bottom of the ice cube tray; and

FIGURE 6 is yet another detailed view of a heat conducting post, in accordance with the present invention, showing yet another means of fastening the same to the bottom of the ice cube tray and showing a possible variation in the structure of the post itself.

FIGURE 1 shows a top view of an ice cube tray in accordance with the present invention. Tray **1** contains in combination therewith transverse ice cube partitions **2** and the longitudinal ice cube partition **3**. Transverse partitions **2** and longitudinal partition **3** may be integrated to form a one-piece partition combination, or transverse partitions **2** may be separate elements which interlock with longitudinal partitions **3**, as desired. In accordance with the present invention, heat conducting posts **10** provide a means for conducting heat away from the interior of the cube to be formed so that the water first crystallizes on said post means with the consequence that the water first freezes within substantially the center portion of the cube, giving an ice cube of superior clarity.

The partition combination comprising elements **2** and **3** must be non-movable in the lateral direction; otherwise, whole substantially clear ice cubes, the object of the present invention, will not be obtained. Thus, the partition means is laterally fixed, however, the partition means may be removable in the vertical direction if it is desired to employ a partition means and tray combination wherein the partition means is to be taken out of the tray.

Tray **1** may be made of any conventional or suitable material, such as anodized aluminum, but it is preferably made of an iusulating material, for example, a polymeric material or plastic such as polyethylene or polytetrafluoroethylene (Tefly). Also, tray **1** may constitute a metal covered or coated with an insulating material on the surface thereof (FIGURE 3.) Partitions **2** and **3** must be made such that the faces of the ice cube contiguous therewith are in contact with an insulating material, such as polyethylene, or they may be made of, for example, anodized aluminum provided with a layer of insulating material **4**, such as polyethylene or a foamed plastic such as a foamed polyurethane, on the faces thereof (FIGURE 3). For example, the conventional ice cube tray combination of an anodized aluminum tray with an integral polyethylene partition means may be used as a basic unit to which the heat conducting posts are added in accordance with the present invention.

The preferred embodiment of the present invention comprises having tray **1** made of an insulating material such as polyethylene, with partitions **2** and **3** being an integral insert of an insulating material such as polyethylene or polytetrafluoroethylene. Hence, all of the faces of the cube are in contact with an insulator, except the top face thereof, while the inner portion of the cube is in contact with heat conducting post means **10**. This preferred embodiment also includes one-piece plastic ice cube trays having a compartment for each cube. Heat conducting posts **10** are then provided within each ice cube compartment.

Although not absolutely necessary, the ice cube tray of the present invention may be provided with an insulator layer **6** covering the tray during the freezing of the cubes, thus giving an even more effective insulation of the faces of the cubes while they are being frozen. This cover can readily be made to fit over the top of the tray and is placed thereon after filling the tray with water, prior to the insertion thereof into a refrigerator or freezer.

Post means **10** may be made of any suitable conducting material. Examples thereof include metals such as copper, brass and aluminum. The insulating material making up or covering the tray **1** and/or partitions **2** and **3** or the top insulator layer mentioned above may be any conventional or suitable insulating material. Examples thereof include plastics such as polyethylene, polytetrafluoroethylene, polystyrene, polyurethane and synthetic rubbers.

FIGURE 2 shows a side view of an ice cube tray in accordance with the present invention. The heat conducting posts **10** are preferably centered within each ice cube compartment, however, the position thereof may be var-

ied within the ice cube compartments within a small distance from the exact center thereof, as desired. The height of the heat conducting posts **10** is not critical, although they must extend up from tray **1** sufficiently so that heat may be conducted away from the center portions of the cubes. Thus, the height of posts **10** may range from about 30 to 70% of the height of the partitions themselves, although the posts may extend upward so as to be even with the top of the partitions, however, this is not necessary. A convenient height for the posts ranges from about one-half to one inch. The diameter of heat conducting posts **10** also is not critical, so long as it is large enough to conduct heat away from the center of the cubes. A convenient diameter is in the range of about one-eighth to three-eighths of an inch.

FIGURE 3 shows an embodiment of the invention wherein tray **1** is provided with a layer of insulating material **5**. Any suitable bonding agent, such as an epoxy glue, may be used to bond insulating material **5** to tray **1**. Insulating material **5** may also be provided as a coating on partitions **2** and **3**, although this is not necessary if partitions **2** and **3** are themselves made of an insulating material.

FIGURES 4, 5 and 6 show various embodiments of the heat conducting posts **10** which may be employed in accordance with the present invention. In accordance with the embodiment shown in FIGURE 4, heat conducting post **10** is firmly fastened to the bottom of tray **1** by means of a stud **42** extending through hole **40** in the bottom of the tray. Head **41** of the stud **42** fits flush against the underside of said tray **1**.

Another mode of attaching heat conducting posts **10** to tray bottom **1** is shown in FIGURE 5. This embodiment may be employed when tray **1** is made of an easily meltable or softenable material such as polyethylene. Posts **10** may either be inserted into the softened tray bottom **1** or softened tray **1** may be pressed down onto posts **10** such that the posts push their way through the softened material, for example, through hole **50**.

A variation of the embodiment shown in FIGURE 5 would be to have post **10** provided with a head or flange which would be completely imbedded in plastic tray **1**, thus ensuring a firm attachment of each post **10** in tray **1**. This could be accomplished by providing tray **1** with grooves into which posts **10** could be snapped or by imbedding the headed or flanged posts into tray **1** while it is in a softened condition. The head or flange of the posts would be nearly flush with the underside of tray **1**, although being completely imbedded therein. Thus, most of the plastic advantageously would be on top of the head or flange to ensure a rigid and firm attachment thereof.

Another embodiment for providing tray **1** with heat conducting posts **10** is shown in FIGURE 6. Herein, a heat conducting post **10** containing head **61** may be pushed through tray bottom **1** within hole **60**.

The ice cube trays may also be manufactured so that heat conducting posts **10** are an integral part of the tray. In this case, a sheet of the desired metal is placed over a form containing pegs which conform to the desired shape of the heat conducting posts. The sheet is then pressed down onto the form by, for example, a hydraulic press, giving a one-piece tray containing hollow heat conducting posts as an integral part thereof. If desired, the tray may then be covered with an insulating material (FIGURE 3). Partition means conforming thereto may then be added.

In every case, heat conducting posts **10** may be provided with a groove in area **15** thereof which is then enclosed with a tight-fitting ring. It may be desirable to employ a sealant such as a polysulfide coating, around the bottom of heat conducting posts **10**, and such a measure is intended to be included within the scope of the present invention.

The shape of the heat conducting posts **10** is not critical, however, the greater the surface area provided, the more efficiently will the heat be conducted away from the center area of the cubes. Heat conducting posts **10** may be cylindrical as shown in FIGURES 2–5, or they may be, for example, cone-shaped or conical as shown in FIGURE 6.

The ice cubes may be removed from the ice cube tray in any convenient or suitable manner, depending on the type of tray employed. If an anodized aluminum tray is used, for example, it may be turned upside down under hot running water to loosen the ice cubes. Such a loosening will be effected since the heat from the water will be readily carried to the surface of the cube contiguous to the heat conducting posts. If a metal tray is used together with a plastic partition means, the sides of the tray may be flexed, thereby loosening the insert to facilitate its entire removal from the tray. The cubes may then be removed one at a time by flexing of the insert. If a plastic tray together with a plastic partition is used, the tray may be flexed to pop the ice cubes free. Or, if a one-piece molded plastic ice cube tray is used, the whole tray may be slightly twisted to pop the cubes up. The conventional all-plastic ice cube trays with rectangular or with rounded bottoms are quite satisfactory. In any event, it may be advantageous to use cone-shaped heat conducting posts **10**, as shown as FIGURE 6, in order to facilitate the removal of the cubes.

Coatings such as are described in U.S. Patent 2,575,141 of Smith-Johannsen (silicon-containing coatings) as well as those disclosed in U.S. Patent 3,033,008 to Davis, including the coatings disclosed in the prior art cited therein, may be employed on the metallic surface of the tray, if one is used, or on the heat conducting posts to facilitate the removal of the ice cubes from the tray.

The invention being thus described, it will be obvious that the same may be varied in many ways. Such variations are not to be regarded as a departure from the spirit and scope of the invention and all such modifications are intended ot be included within the scope of the following claims.

I claim:

1. An ice cube tray for producing substantially gas-free ice comprising, in combination, a tray and a laterally fixed partition means, the faces of said partition means being constituted by a thermal insulator material, said partition means fitting into said tray and defining, together with said tray, a plurality of ice cube compartments, and a plurality of rigid heat conducting posts disposed on the bottom surface of said tray and extending through the bottom of said tray, said posts being made of a heat conductor material, each of said posts extending into one of said ice cube compartments to a height substantially above the bottom surface of said tray, whereby ice will be formed from the posts outwards, thereby preventing entrapment of gases in the formed ice.

2. The ice cube tray combination of claim **1**, wherein said thermal insulator material is polyethylene.

3. The ice cube tray combination of claim **1**, wherein said heat conductor material is a metal.

4. The ice cube tray combination of claim **1**, wherein said rigid heat conducting posts are each positioned substantially at the center of said ice cube compartments.

5. The ice cube tray combination of claim **1**, wherein said partition means is metallic and has a thermal insulator material covering the faces thereof.

6. The ice cube tray combination of claim **5**, wherein said thermal insulator material is polyethylene.

7, An ice cube tray for producing substantially gas-free ice comprising, in combination, a plastic tray and a plastic laterally fixed partition means, said plastic being a non-conductor of heat, said partition means fitting into said tray and defining, together with said tray, a plurality of ice cube compartments, and a plurality of rigid heat conducting posts mounted on the bottom surface of said tray and extending through the bottom of said

tray, said posts being made of a heat conductor material, each of said posts extending into one of said ice cube compartments to a height substantially above the bottom surface of said tray, whereby ice will be formed from the posts outwards, thereby preventing entrapment of gases in the formed ice.

8. The ice cube tray combination of claim 7, wherein said plastic is polyethylene.

9. The ice cube tray combination of claim 8, wherein said heat conductor material is a metal.

10. An ice cube tray for producing substantially gas-free ice comprising a one-piece plastic tray and partition means, said plastic being a nonconductor of heat, said partition means defining, together with said tray, a plurality of ice cube compartments, and a plurality of rigid heat conducting posts mounted on the bottom surface of said tray and extending through the bottom of said tray, said posts being made of a heat conductor material, each of said posts extending into one of said ice cube compartments to a height substantially above the bottom surface of said tray, whereby ice will be formed from the posts outwards, thereby preventing entrapment of gases in the formed ice.

11. The ice cube tray combination of claim 1, wherein each of said heat conducting posts extends above the bottom surface of said tray to a plane coextensive with the top of said partition means.

12. The ice cube tray combination of claim 3, wherein said metal is selected from the group consisting of copper, brass and aluminum.

13. An ice cube tray for producing substantially gas-free ice comprising, in combination, a tray and a laterally fixed partition means, the top of said tray being covered with a thermal insulator material and the faces of said partition means being constituted by a thermal insulator material, said partition means fitting into said tray and defining, together with said tray, a plurality of ice cube compartments, and a plurality of rigid heat conducting posts disposed on the bottom surface of said tray and extending through the bottom of said tray, said posts being made of a heat conductor material, each of said posts extending into one of said ice cube compartments to a height substantially above the bottom surface of said tray, whereby ice will be formed from the posts outwards, thereby preventing entrapment of gases in the formed ice.

14. An ice cube tray for producing substantially gas-free ice comprising, in combination, a tray and a laterally fixed partition means, the faces of said partition means being constituted by a thermal insulator material, said partition means fitting into said tray and defining, together with said tray, a plurality of ice cube compartments, and a plurality of rigid heat conducting posts disposed on the bottom surface of said tray, said tray and said posts being one integral piece and being made of a heat conductor material, each of said posts extending into one of said ice cube compartments to a height substantially above the bottom surface of said tray, whereby ice will be formed from the posts outwards, thereby preventing entrapment of gases in the formed ice.

References Cited

UNITED STATES PATENTS

911,238	12/1909	Havenstrite	62—344 X
2,704,928	3/1955	Curry	165—46 X
3,170,308	2/1965	Cucuzza	62—320 X

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