Dec. 1, 1942. H. Y. JENNINGS 2,303,938

SHARP FREEZING CONTAINER

Filed May 9, 1940

Fig. 1

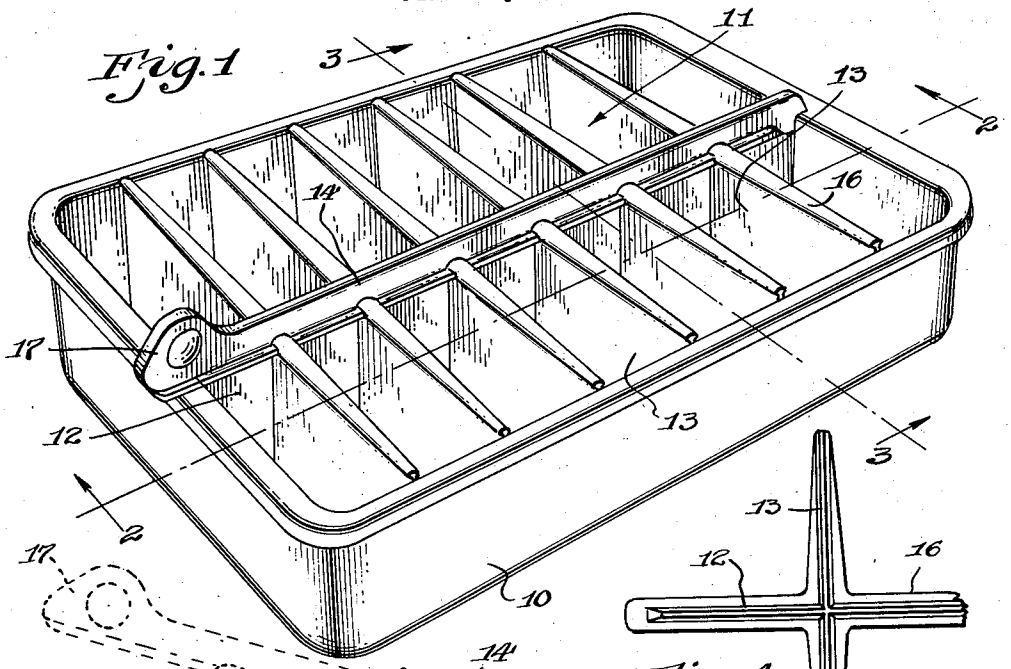


Fig. 4

Fig. 2

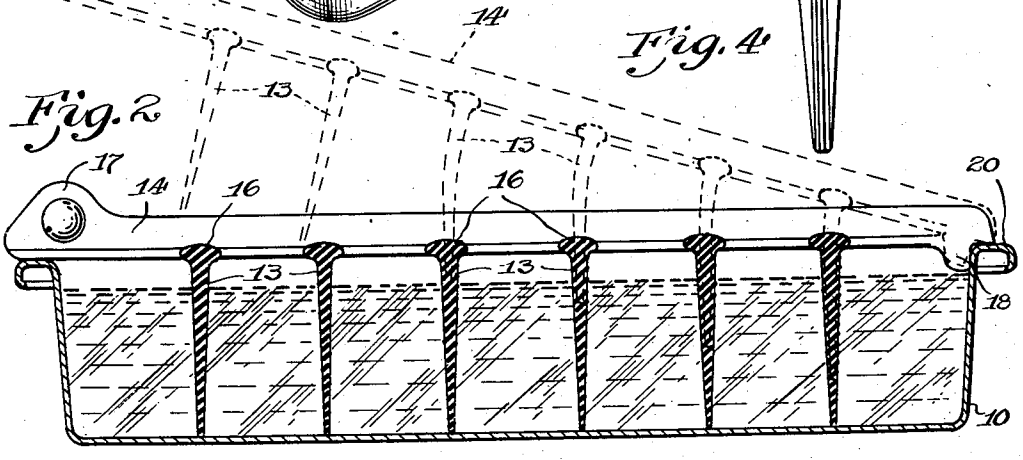


Fig. 6

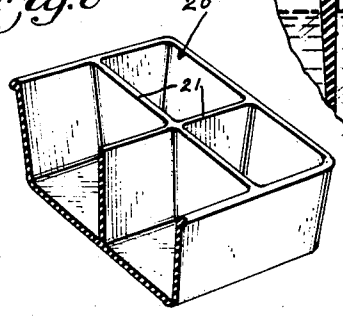


Fig. 3

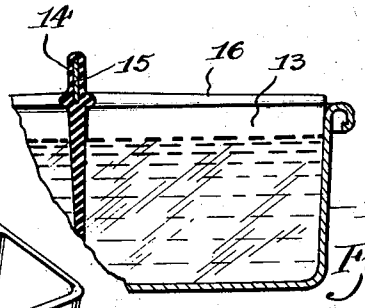
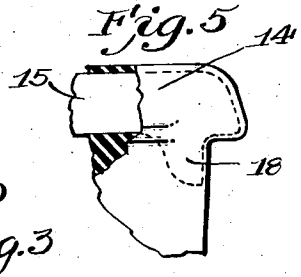


Fig. 5



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UNITED STATES PATENT OFFICE

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SHARP FREEZING CONTAINER

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Application May 9, 1940, Serial No. 334,293

15 Claims. (Cl. 62—108.5)

This application is a continuation in part of my prior application Serial No. 254,578 filed February 4, 1939.

This invention relates to sharp freezing containers for mechanical refrigerators and to grids therefor, and particularly to containers and grids of the flexible non-metallic type disclosed in Copeman Reissue Patents 17,278 and 17,279 and Copeman Patent No. 1,817,544.

Millions of devices made under these patents have been in use for many years and have given completely satisfactory service. Improvements have been made from time to time, as disclosed in the patented art, but such improvements have been along the lines of the shape and contours of the devices, and little attention has been paid to the physical characteristics of the rubber surfaces.

One of the most satisfactory embodiments of the invention in use today is the combination of a metal tray with a flexible rubber grid. The particular type of tray best suited to this combination is the so-called "Presto" tray, disclosed in Geyer Patent No. 2,122,937, in which the metal tray is constructed to permit a limited distortion thereof for separating the frozen ice blocks from the metal surfaces of the tray. The best results with a tray of this type are obtained by treating the ice-contacting surfaces of the tray with a non-metallic coating as disclosed in Hathorne Patent No. 1,932,731. Such a construction is particularly advantageous when the tray with its frozen contents is first flexed, as disclosed in the aforesaid Geyer Patent No. 2,122,937, to release the frozen mass of ice with the flexible rubber grid embedded therein, after which the individual cubes or blocks of ice are separated from the grid as needed.

I have found by repeated experiments that the combination of a distortable metal tray with a tapering or wedge-shaped rubber grid of the type disclosed in Gaugler Patent No. 2,035,543 has certain advantages, from the standpoint of the user, over the construction or manner of use disclosed in the Geyer patent aforesaid. In the Gaugler construction the rubber grid is first stripped from the mass of ice, leaving a plurality of spaced ice blocks adhering to the metal tray, after which the tray is flexed or distorted slightly to separate the cubes from the metal tray surfaces. Thus, in two simple operations, the user has immediately available a tray full of individual separate ice blocks which may be dumped into a storage compartment so that the tray and grid may again be used for the freezing function, whereas in the Geyer construction each cube must be individually picked from the rubber grid, and if all the cubes are not needed immediately, the usual practice is to leave the grid, with such cubes as have not been used, in the metal tray until they are needed. Thus, in the Geyer construction, the tray and grid are not immediately available for the freezing of additional cubes or blocks until the entire contents of the tray from the previous freezing have been used.

Obviously, in order that the Gaugler construction be successful, it is necessary that the adhesion of the ice blocks to the rubber grid be less than the adhesion of the same blocks to the metal tray, as otherwise the blocks would be separated from the tray when an attempt was made to strip the grid from the ice. This situation is helped somewhat if the metal tray is not coated with a water-repellent surface, or is slightly roughened, but even under these conditions I have found that the Gaugler construction is not absolutely reliable when the ordinary flexible rubber customarily used in grid construction is employed. This is due to the fact that, contrary to popular opinion, there is adhesion between rubber and ice when the ice is frozen in contact with a rubber surface, and the main reason rubber trays and grids are successful is that the inherent flexibility and resiliency of the rubber permits the rubber to be "peeled" from the ice and to resume its original shape after the ice has been separated from it.

In other words, ordinary soft rubber has a relatively rough or "non-slip" surface and the result is that the friction between the rubber and the ice, when an attempt is made to strip a rubber grid from a frozen mass as disclosed by Gaugler, is sometimes greater than the adhesion between the ice blocks and the metal tray, with the result that often some of the cubes cling to the grid as it is stripped, and thus defeat the object of the invention.

Moreover, even if the grid can be stripped from the ice mass without pulling some of the ice blocks from the tray, the force required to be exerted by the user is greater than should be required to make the device a practical article for everyday use.

I have found, however, that if the rubber used in making the grids is treated as by mixing certain ingredients, such as waxes or resins, with the usual rubber mix, which ingredients "bloom" or otherwise come to the surface after the grid is molded, or if certain surface treatments are given to the grid after it is made, I am able to

obtain a rubber grid, the surfaces of which are easily slippable, or relatively frictionless with respect to the ice formed around the grid and contacting the surfaces thereof and which are also considerably more water-repellent than that of the rubber mixes which have heretofore been used in making grids. Thus, when ice is frozen in contact with such a surface, the fact that the surface is water-repellent, as compared with ordinary rubber, prevents the adhesion of the frozen substance thereto so that no ice bond is formed between the surface of the grid and the frozen substance. This is an important feature of my invention and is a material factor in permitting the withdrawal of the grid without any material reduction in its cross-section.

When a rubber grid made according to the present invention is removed from the ice in the tray, leaving the ice cubes formed by the grid adhering to the metal tray surfaces, the grid, because of its relatively water-repellent and frictionless surface, really "slips" rather than peels from the ice as described in the aforesaid Gaugler patent. By this I mean that the reduction in the cross-section of the grid partition as the grid is being slipped from between the ice cubes is relatively small as compared with the reduction in cross section necessary for operation of the Gaugler construction, and the main reason for the easy removal of a grid constructed in accordance with my invention is the water-repellent and frictionless surface aforesaid.

The fact that the grid is made of a soft resilient material, such as rubber, enables it to "take up" the expansion produced by the changing of water to ice. This action compresses the rubber and of course causes some reduction in its cross-section during the freezing process. This is really an advantage as compared with a metal grid, because in the latter device the expanded ice binds the rigid walls of the grid firmly. However, even though the rubber grid made according to my invention may be compressed as the ice freezes, there is no material stretching of the grid sections as it is removed from the ice for the reasons previously explained; that is, its low adhesion to the ice and its relatively frictionless surfaces.

Another improvement of the Gaugler structure contemplated by the present invention is the provision of a rigid central bar in the grid to facilitate the removal thereof. When the bar is rigid one end may be pivoted on the edge of the tray to provide leverage.

Other objects and features of the invention having to do with detail of construction and with treatment of the grids will be further brought out in the following description and claims.

In the drawing:

Fig. 1 is a perspective view of an ice tray containing a rubber grid.

Fig. 2 is a sectional view on lines 2—2 of Fig. 1 showing, in dotted lines, the grid being removed from the tray and its frozen contents by elevating one end thereof.

Fig. 3 is a section taken on line 3—3 of Fig. 1.

Fig. 4 is a bottom plan view of a portion of a grid illustrating the tapered walls thereof.

Fig. 5 is an enlarged partial view of the pivot end of the removing bar of the grid.

Fig. 6 is a partial perspective view of a conventional rubber tray having surfaces produced according to my invention.

Referring to the drawing, 10 denotes a metal tray capable of limited distortion as disclosed in the aforesaid Geyer Patent No. 2,122,937. Although this type of tray is preferred I have found that any metal tray which can be twisted slightly will answer the purposes of my invention. Also preferably the interior surfaces of the tray should be untreated; or should be treated only slightly so that the ice cubes will always adhere to the walls of the tray when the grid is removed or "slipped" from the ice.

The grid 11 is preferably made of soft flexible rubber of high quality and comprises the usual longitudinal center strip 12 and a plurality of cross-pieces 13. It is desirable that the grid should extend a slight distance above the side walls of the tray so that the upper part of the grid shall not be enclosed by a layer of ice when the contents of the tray are frozen. Preferably the center 12 and the cross pieces 13 should taper, or in other words, be of gradually decreasing thickness from top to bottom to assist in the removal of the grid, and it is also desirable that the cross pieces 13 should taper or be of gradually decreasing thickness from the center strip toward the side walls of the tray. The general contour of the grid members is disclosed in detail in Fig. 4.

A relatively heavy reinforcing bead 14 is molded along the top of the center strip 12 and is preferably rigid; a reinforcing metal insert 15 may be molded into the bead to assist in stripping the grid from the tray. Further, it is possible and desirable to mold similar reinforcing beads 16 on the top of each of the cross pieces 13. A handle or finger grip 17 is molded integrally with the grid at one end of the center piece to afford a means for grasping the grid when it is being stripped from the tray and its frozen contents.

The other end of the center reinforcement is shown in detail in Figs. 2 and 5. This end is provided with a fin-like depending portion 18 which forms a notch to receive the edge 20 of the end wall of tray 10. The end of the tray then serves as a fulcrum for the center bar 14 and greatly facilitates the removal of the grid. As shown by the dotted lines of Fig. 2, the grids 13 are pulled aside from, as well as up from, their recesses so that the removal is easy.

In order to provide the highly desirable "slip" finish to the rubber grid, or in other words, a surface which is water-repellent and offers little frictional resistance to the ice when the grid is stripped therefrom, I have found that certain treatments may be applied to the rubber which greatly facilitate the removal of the grid from the frozen mass, with a minimum of effort and without pulling any of the cubes or blocks free from the tray during the stripping action.

For example, I have found that if the vulcanized rubber grids are treated with halogens, either in solution or in gaseous form for predetermined times, a highly satisfactory relatively frictionless surface is obtained.

For example, if a flexible rubber grid is inserted in a saturated water solution of chlorine for a period of from three to five minutes, a surface is produced which is soft and flexible and yet offers materially less frictional resistance than an untreated grid when they are rubbed across the same surface.

Excellent results have also been obtained by treating standard rubber grids with other halogens as follows:

(1) A rubber grid was immersed in a saturated water solution of bromine for ten minutes.

(2) A rubber grid was immersed in a saturated water solution of iodine for twenty minutes.

Likewise, rubber grids were exposed to the gaseous vapors of chlorine for one minute, bromine for three minutes and iodine for from two to three minutes, and in every instance the surfaces produced offer far less frictional resistance when the grid was stripped from a tray containing ice than did an untreated grid.

I have also found that solutions of halogens in organic solvents produce grids having surfaces superior to untreated rubber grids.

For example, a grid was immersed for two minutes in a solution of chlorine in carbon tetrachloride. Likewise another grid was immersed for five minutes in a solution of bromine in tetrachlorethylene, and a third grid in a five per cent solution of iodine in alcohol, and in every instance the grids produced showed less frictional resistance to ice than untreated grids of identical construction and composition.

In all the preceding examples the grids, after the halogen treatments, were dipped in a sodium thiosulphate solution to remove any excess free halogen, and then rinsed in clear water.

In further practicing the invention other solvents, as mentioned in British Patent No. 415,195, or mixtures of solvents, or mixtures of halogens with other solvents may be employed. Further, I have found that the invention comprehends the treatment not only of natural rubber and its compounds, but such rubber substitutes or substances having rubber-like properties, as "Neoprene" and "Thiokol" and wherever in the specifications and following claims the term rubber is used, it is intended to include not only rubber, natural or synthetic, but such rubber substitutes as are capable of reacting with the substances herein described or their equivalents, to produce similar results.

Another process for practising my invention comprises the immersion of a grid in a mixture of sulphuric acid and water or sulphuric acid and glycerol. For example, an excellent slippable surface was produced on a rubber grid by immersing it for five minutes in a mixture of 80% concentrated sulphuric acid and 20% glycerol.

Obviously my invention is not limited to tapering rubber grids, or grids of any particular configuration, or even to grids themselves. Conventional rubber trays of varying sizes and shapes have been successfully treated according to the foregoing method and have shown an ease of ice removal far superior to similar untreated devices.

For example, very satisfactory ice removal has been obtained from a flexible rubber tray such as is shown at **20** in Fig. 6, in which the grid members **21** are molded integrally with the side and bottom walls of the tray.

While all of the halogens give satisfactory results and form superior finishes, I prefer, at the present time, to use chlorine, because of its cheapness and the relatively short time required for processing with it.

Rubber trays and grids incorporating my improved surface have a characteristic velvety feel, and can be distinguished from the conventional untreated products by the relative ease with which they will "slip" over friction-resistant surfaces as compared with untreated trays and grids under the same conditions.

Another way of producing a desirable finish on rubber for easy ice removal is to incorporate with the usual rubber mix a suitable amount of wax or resin or mixtures of wax and resin. I have used "Heliozone" a mixture of waxes prepared and sold by E. I. du Pont and Company of Wilmington, Delaware, and I have also used "Nevillite No. 3," a synthetic resin having a melting point of about 145 degrees C. and made by The Neville Company of Pittsburgh, Penna. These substances are insoluble in rubber but form an intimate physical mixture therewith, and in use they tend to drive toward the surface of a tray or grid in which they are incorporated, to form a smooth water-repellent film. This particular property of surface migration is commonly referred to as "blooming."

Any suitable rubber mix may be used depending on the physical properties, such as resiliency and transparency, which are desired.

For example, I have made grids of the following compound:

	Parts
Pale crepe rubber	100
Zinc carbonate	5
Monex accelerator	0.50
Sulfur	1.50
Stearic acid	1.00
Heliozone	2.00

The Heliozone was milled into the mix and the whole was then vulcanized in a suitable grid mold for twenty minutes at twenty pounds steam pressure.

Likewise an identical mix was made with the substitution of Nevillite No. 3 for the Heliozone in the same proportion and grids were made from this mix.

Other fillers, such as zinc oxide and magnesium carbonate may be substituted for the zinc carbonate, and the proportion of the wax or resin "blooming" material may vary from 2 to 10 parts, depending on the physical properties of the material used. In any event, the finished product is a rubber tray or grid having a surface film of wax or resin for contacting the substance to be frozen, which film is constantly being replaced by surface migration.

It should be noted that the treatment of rubber trays and grids with the halogens or mineral acids is a true chemical reaction while the wax-rubber mixture is a physical mixture without any chemical action. However, in both cases a surface condition is produced which is different from that of ordinary rubber and in the appended claims I use the terms "treated surfaces", "chemically treated" and similar expressions to include both those surfaces which are produced by a true chemical reaction and those which are produced as the result of a physical mixture of selected substance.

While I have shown and described specific embodiments of the invention, it is readily apparent that other forms might be adapted, coming within the scope of the following claims.

I claim:

1. A sharp freezing container of a type adapted to be positioned in heat-conducting relation with the lowside of a mechanical refrigerating system comprising a container having good heat-conducting properties and a removable unitary grid structure formed of rubber having its exposed surfaces treated to provide smooth, relatively frictionless ice-contacting surfaces as compared with ordinary flexible molded rubber.

2. A sharp freezing container of a type adapted to be positioned in heat-conducting relation with the lowside of a mechanical refrig-

erating system comprising a distortable container having good heat-conducting properties and a removable unitary grid structure formed of rubber chemically treated to change its surface structure to provide smooth, relatively frictionless ice-contacting surfaces as compared with ordinary flexible molded rubber.

3. As a new article of manufacture, a sharp-freezing container for substances to be frozen, and partitions within said container for dividing the container into a plurality of ice cube molds, said partitions being formed of resilient, easily distortable rubber, the ice-contacting surfaces of said partitions being chemically treated so as to be relatively frictionless and easily slippable over the surfaces of the cubes in contact therewith as compared with the surface of ordinary flexible rubber.

4. As a new article of manufacture, a sharp-freezing container for substances to be frozen, and partitions within said container for dividing the container into a plurality of ice cube molds, said partitions being formed of resilient, easily distortable rubber having halogenated surfaces for contact with the frozen substance.

5. The combination with a metallic tray for containing a substance to be frozen and adapted to be placed in heat-conducting relation with the heat-absorbing portion of a refrigerating apparatus, of a removable grid comprising a single longitudinal partition and a plurality of transverse partitions formed integrally with and extending laterally from the sides of the longitudinal partition along the length thereof disposed within the tray and dividing the interior thereof into a plurality of molds, said grid being formed of a flexible rubber; the transverse partitions of said grid being of greater thickness at the top than at the bottom of said grid in its normal operation position, said grid being chemically treated to provide smooth and relatively frictionless surfaces as compared with ordinary molded flexible rubber, and said grid being movable upwardly of the tray from an end thereof away from substance congealed or frozen in the molds.

6. The combination with a metallic tray for containing a substance to be frozen and adapted to be placed in heat-conducting relation with the heat-absorbing portion of a refrigerating apparatus, of a removable grid comprising a single longitudinal partition and a plurality of transverse partitions formed integrally with and extending laterally from the sides of the longitudinal partition along the length thereof disposed within the tray and dividing the interior thereof into a plurality of molds, said grid being formed of a flexible rubber chemically treated to provide smooth and relatively frictionless surfaces as compared with ordinary molded flexible rubber, and said grid being movable upwardly of the tray from an end thereof away from substance congealed or frozen in the molds.

7. As a new article of manufacture, a sharp-freezing container for substances to be frozen, said container having partitions for dividing the container into a plurality of ice cube molds, said partitions being formed of resilient, easily distortable rubber having chlorinated surfaces for contact with the frozen substance.

8. As a new article of manufacture, a sharp-freezing container for substances to be frozen, and partitions within said container for dividing the container into a plurality of ice cube molds, said partitions being formed of resilient, easily distortable rubber having brominated surfaces for contact with the frozen substance.

9. As a new article of manufacture, a sharp-freezing container for substances to be frozen, and partitions within said container for dividing the container into a plurality of ice cube molds, said partitions being formed of resilient, easily distortable rubber having iodized surfaces for contact with the frozen substance.

10. As a new article of manufacture, a sharp-freezing container of the type adapted to be positioned in heat-exchange relation with the cooling unit of a mechanical refrigerating system, comprising molded walls for defining the size and shape of the substance to be frozen and formed of flexible rubber having a smooth and relatively frictionless chemically treated surface as compared with the rubber ordinarily used for such purposes, and from which a frozen substance will slide easily when the container is manipulated.

11. The combination with a metallic tray for containing a substance to be frozen and adapted to be placed in heat-conducting relation with the heat-absorbing portion of a refrigerating apparatus, of a removable grid comprising a plurality of transverse partitions disposed within the tray and dividing the interior thereof into a plurality of molds, and a stiff reinforcing member formed integrally with said grid whereby said grid may be removed from said tray by pivoting one end of said member on a portion of the tray and moving the other end manually away from the tray, said grid being formed of a flexible rubber treated to provide smooth and relatively frictionless surfaces as compared with ordinary molded flexible rubber.

12. The combination with a metallic tray for containing a substance to be frozen and adapted to be placed in heat conducting relation with the heat-absorbing portion of a refrigerating apparatus, of a removable grid comprising a plurality of transverse partitions disposed within the tray and dividing the interior thereof into a plurality of molds, and a stiff reinforcing member formed integrally with said grid whereby said grid may be removed from said tray by pivoting one end of said member on a portion of the tray and moving the other end manually away from the tray, said grid partitions being formed of resilient, easily distortable rubber having halogenated surfaces for contact with a frozen substance.

13. As a new article of manufacture, a sharp freezing container for substances to be frozen, and partitions for dividing the container into a plurality of ice cube molds, said partitions being formed of resilient, easily distortable rubber, said partitions having their ice-contacting surfaces formed of a material which is likewise readily distortable but comprises a material of a different nature than that of the main body of rubber forming the said partitions, said material providing a smooth water-repellent surface on said partitions.

14. A sharp freezing container for substances to be frozen, and partitions for dividing the container into a plurality of ice cube molds, said partitions being formed of resilient, easily distortable rubber, the exposed surfaces of said partitions being chemically conditioned to provide smooth, water-repellent surfaces for contact with the frozen substance.

15. A sharp freezing container for holding water to be frozen and of a type adapted to be positioned in heat-conducting relation with the

lowside of a mechanical refrigerating system and comprising a distortable, normally smooth metal tray of good heat conducting properties, and a removable unitary rubber grid structure capable of being stripped from water frozen into ice in said tray and in contact with the surfaces of said grid, said grid being characterized by the fact that its exposed surfaces are substantially unaffected by and relatively non-absorbent with respect to water, so that there is substantially no adhesion between the grid surfaces and the ice formed in the tray, and further characterized by the fact that the coefficient of frictional resistance between the grid surfaces and ice is so small that when an upward pull is exerted on said grid it will slip readily from the ice formed in the tray without material stretching of the grid sections and without breaking the bond between said ice and the walls of said metal tray.

HARLEY Y. JENNINGS.