

[54] **DEFROST EVINCING DEVICES**

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[58] Field of Search **73/358; 116/114 Y, 114.5; 99/192 TT; 13/356**

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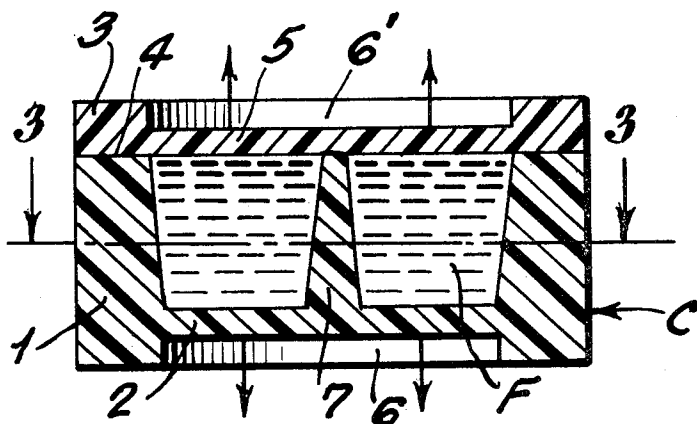
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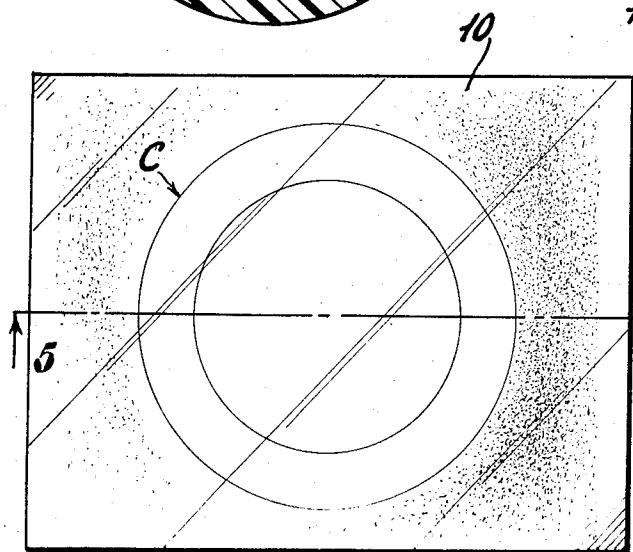
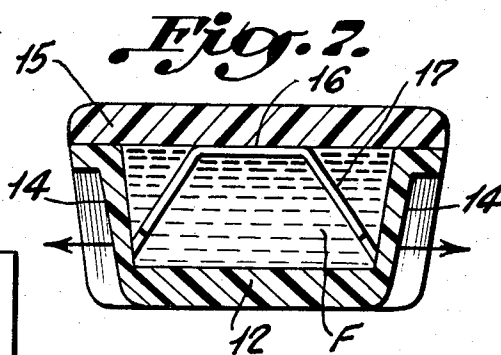
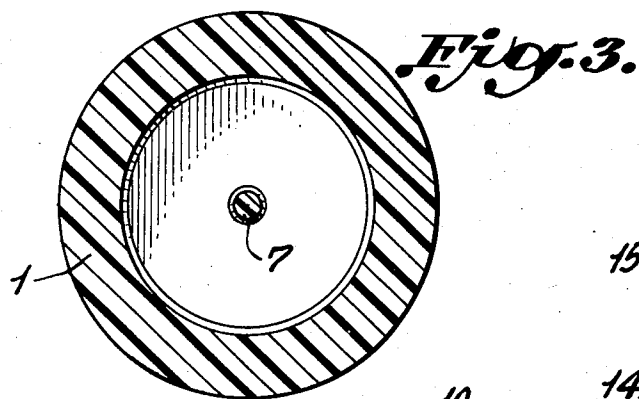
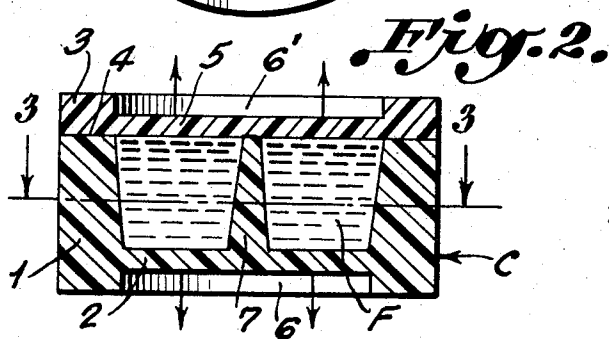
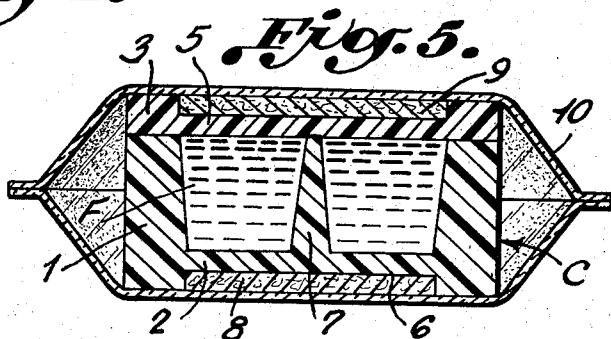
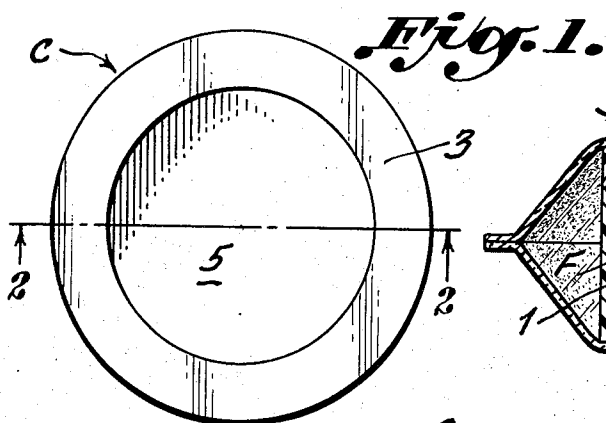
[57] **ABSTRACT**

A defrost evincing device, which operates as a telltale temperature indicator for frozen packages or spaces maintained at low temperatures to indicate reliably the occurrence of even a transient thawing temperature which may have been followed by a re-freezing cycle. Such telltale indicating assemblies have been in-

cluded for this purpose in frozen food packages and the like, and these generally comprise a capsule filled with a colored liquid such as colored water, which capsule ruptures upon the initial freezing of the package, leaving free the frozen coloring fluid for eventual flow upon the thawing of the frozen package. When this occurs, the flowing liquid may permeate an absorbent piece of paper or the like disposed in proximity to the capsule, which imparts distinctive color to the absorbent indicator, which is permanent and irreversible, to constitute evidence of the package having gone through at least one thawing cycle even if it was re-frozen subsequently. The instant invention aims to provide a rugged container for the colored fluid capable of sustaining heavy loads so that the same is fractured only upon freezing of the container rather than by any weight loadings to which the same may be subjected. Thereby assurance is had that when the absorbent indicator becomes distinctively colored, it is the result of the flow of the colored fluid upon the thawing of the frozen package, and not as a result of the fracture of the container in its initial state by the loadings imposed thereon. To ensure the fracture of the container by the expansive force of the freezing fluids, at least one of the walls thereof is of thinner cross-section than the load-bearing walls. Furthermore, a tension member is provided in the container, acting against the frangible wall, to assure an adequate fissure in the ruptured receptacle through which the colored fluid may flow towards the absorbent indicator.

16 Claims, 11 Drawing Figures





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Fig. 8.

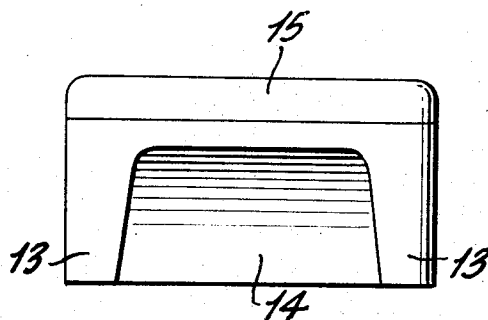


Fig. 9.

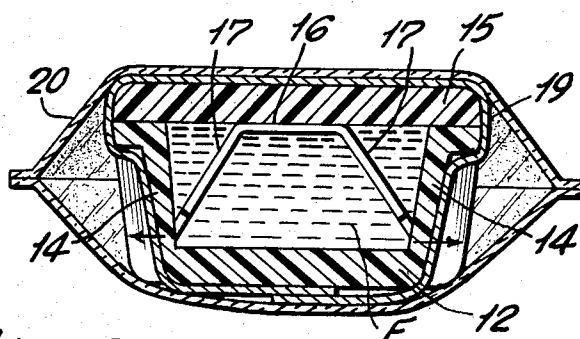


Fig. 10.

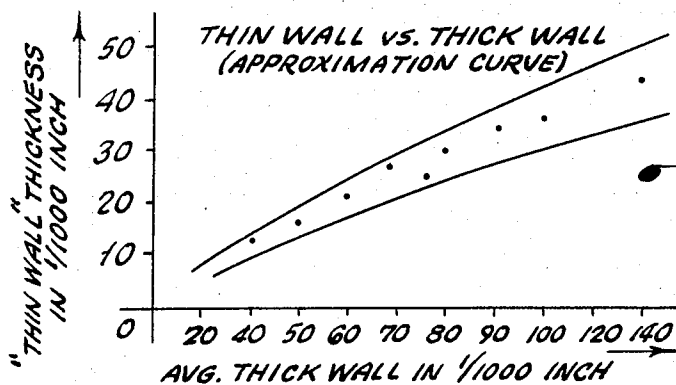
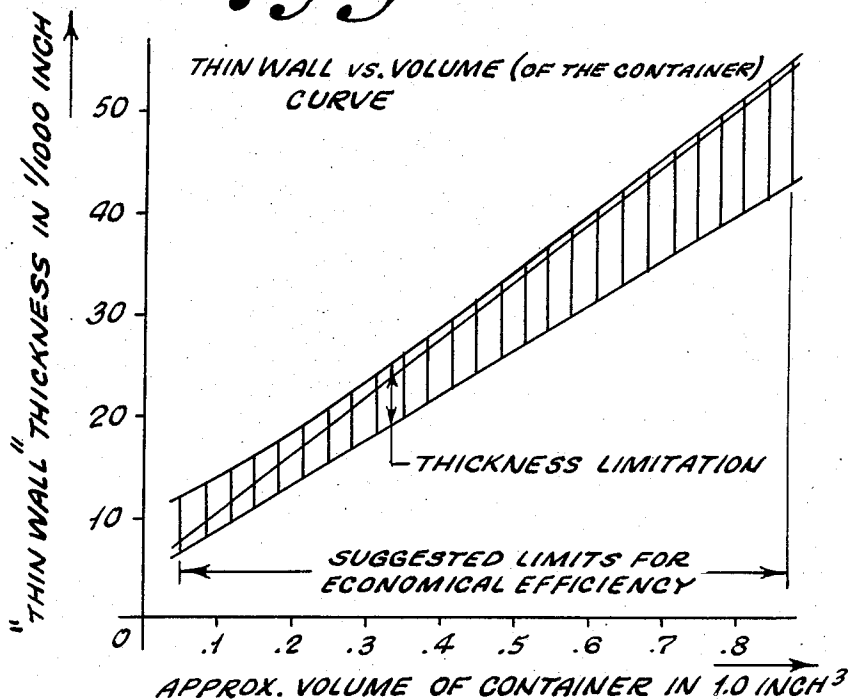


Fig. 11.

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DEFROST EVINCING DEVICES

This invention relates to a defrost evincing device which may be used in conjunction with frozen packages of all types as well as refrigerated chambers such as freezing boxes, refrigerated railway cars and trucks, etc. More particularly, the device is adapted for use in conjunction with packages subjected to heavy loadings which, nevertheless, does not affect its capability of affording a fine and sensitive indication of any thawing which may have taken place between the time of the original freezing of the package and the time of use by the consumer.

It is the object of the present invention to provide highly rugged and economical telltale indicators for frozen packages or containers maintained under sub-freezing conditions, which respond to a lowering of the temperature to a predetermined level for indicating reliably the incidence of said temperature level which may affect deleteriously the contents of the packages which may be food, such as frozen meats or fish, chemicals, pharmaceuticals or other materials which are desired to be maintained at freezing temperatures until they are ultimately used.

It is the aim of the present invention to improve upon such frozen food indicators of the type disclosed in U.S. Pat. No. 3,177,843, Apr. 13, 1965, which makes use of a frangible capsule filled with a colored liquid medium which, upon freezing, results in the rupture of the capsule and which, upon lowering of the temperature permits the colored liquid to melt and to provide a permanent indication that it has gone through a melting stage, despite the fact that the package may have been re-frozen subsequently.

It is another object of the invention to render readily visible the occurrence of a thawing cycle no matter where the indicator might be located. Its capability of withstanding high pressures and loadings precludes false indications arising from initial ruptures attributable to heavy loading pressures, before the freezing of the goods with the indicators therein is executed.

Other objects and purposes will appear from the detailed description of the invention following hereinafter, taken in conjunction with the accompanying drawings, wherein

FIG. 1 is a top plan view of one embodiment of the defrost evincing device in accordance with the invention;

FIG. 2 is a vertical sectional view along line 2—2 of FIG. 1;

FIG. 3 is a horizontal sectional view along line 3—3 of FIG. 2;

FIG. 4 is a top plan view of a second embodiment of the device encased in a transparent water-repellent envelope;

FIG. 5 is a vertical sectional view along line 5—5 of FIG. 4;

FIG. 6 is a top plan view of a third embodiment of the device, partly in section;

FIG. 7 is a vertical sectional view along line 7—7 of FIG. 6;

FIG. 8 is an end view of FIG. 7;

FIG. 9 is a vertical sectional view of the device shown in FIGS. 6 to 8, encased in a water-repellent jacket, similar to FIG. 5;

FIG. 10 is a graphical representation of the thickness of the thin walls relative to the volumetric capacity of the containers, to attain reliable ruptures of the walls as the containers filled with colored water pass through the freezing point; and

FIG. 11 is a graphical representation of the optimum ratios of the average thicknesses of the thin walls to the thick walls of the containers.

In the drawings are shown several embodiments of defrost evincing devices which may be embedded with material to be frozen, such as meats and fish, or which may be inserted in packages containing such material, to provide a reliable indication that once the material has been frozen it is maintained in this frozen state until it reaches the consumer. Such indicators may be used in conjunction with F.D.A. or U.S.D.A. inspection stamps, to guarantee the maintenance of the quality of products which are packaged for shipment by a producer for ultimate consumption by the consumer, with no possibility of deterioration in consequence of a thawing of the material or the packages in the course of their transit from the producer to the consumer.

The defrost indicating device in accordance with the invention makes use of water tinted with a certified food coloring to assure the maintenance of freezing temperature of approximately 32° F. If other temperatures are to be guaranteed, the solutions may be varied to control the point at which the indicating mass passes from the solid frozen state to the liquid state.

The indicators in accordance with the invention are characterized by their capability of withstanding high pressures and heavy loads, so that there is no possibility of rupture of these containers in the course of piling the packages on top of each other in the course of their initial assembly for freezing, as might be the case by the use of indicators for frozen food packages as shown in the above-mentioned U.S. Pat. No. 3,177,843. However, the containers are provided with at least one thin wall that is affected by the expansive force of the freezing water to cause the wall to fracture, so that upon the thawing of the indicator the liquid may flow from the container to produce a visible indication of the occurrence of the thawing condition. While the load-bearing supporting walls of the indicating container are sufficiently heavy to withstand pressures of 500 pounds or thereabouts, produced by the piling up of packages of unfrozen products such as meats or sea foods, the container must include at least one wall of lesser thickness which is shielded from any substantial load-bearing function so that it may be fractured by the expansive force of the liquid which fills the container, which in the case of water expands about 11 to 12 percent, when it passes through the freezing cycle. Therefore, it is necessary that the thin walls be at least half the thickness of the load-bearing walls.

In the light of the above requirements, FIG. 1 shows a cylindrical container C which preferably is molded of a rigid transparent synthetic plastic material such as polystyrene having a relatively thick peripheral wall 1 and a thin circular base wall 2. The container is adapted to be filled completely with a tinted fluid medium F, which preferably may be water colored with an edible and certified food coloring. A cover 3 for the cylindrical container is sealed to the top 4 of the lateral wall 1 of the fluid filled container, preferably by means

of heat generated by ultrasonic energy. The cover 3 is provided with a central thinner wall portion 5 which overlies the body of liquid F within the container.

A tension rod 7 may be molded integrally with the base 2 of the container. This tension rod may be of frusto-conical formation with the free end thereof extending to the inner surface of the cover. The rod 7 is preferably of a height slightly greater than the lateral wall 1, so that when the cover 3 is sealed upon the container, a slight outward bulge is formed in the wall 5 of the cover. Thus, when the indicator assemblies are combined with fresh food to be frozen, such as meat, fish, fruit, vegetables, drugs or other materials, the packages thereof, with the indicators combined therewith, may be piled indiscriminately, without fear that such indicators will be fractured by the heavy loadings on the packages. Thereafter, when the material is frozen, including the indicators combined therewith, the expansion of the fluid medium such as the tinted water, causes one or both walls 2 and 5 to be fractured in consequence of the freezing of the body of water within the container. The rupture of the walls permits the passage of the fluid medium from the interior of the container if the fluid goes through a melting cycle. The provision of the tension rod 7 assures a sufficiently distinct fissure in the fractured wall of thinner cross-section when the fluid melts.

In some instances the flow of the tinted fluid from within the container may be detected readily by the presence of an irregular amount of the tinted material in the vicinity of the indicator amidst the material which had been frozen. Thus, a green tinted liquid would be readily visible in a package of meat. Conversely, a crimson tinted liquid would be readily visible in a package of frozen vegetables. In some instances the intermixture of the frozen material and the indicating medium would not be objectionable. However, in order to define the indication more accurately, the base 2 and cover 3 may be provided with recesses 6 and 6' for receiving discs of absorbent material such as filter paper 8 and 9, respectively, which serve to absorb the tinted fluid F when the same is melted.

In order to preclude any possibility of contamination of the frozen material by the indicating substance, the container C, with or without the absorbent discs 8 and 9, resting within the recesses 6, 6' of the base and cover, may be encased within a flexible envelope 10 of thin plastic sheeting such as polyethylene, cellophane, or the like. The envelope 10 would serve to contain the indicating fluid both in the frozen state with the ruptured thin walls, or in the thawed state after the fluid is absorbed totally or only partially by the indicating discs 8 and 9. The envelope may also include an instruction card or advertising material.

An alternative construction of a defrost evincer is illustrated in FIGS. 6 to 9. In this case, the indicator unit is constituted by a molded receptacle of generally rectangular contour having a bottom wall 12 of substantial thickness and lateral supporting walls 13 on opposite sides thereof, with transversely extending end walls 14 extending between the lateral walls 13. The transverse walls 14 are of thinner cross-section than the bottom and lateral walls 13.

The container is completely filled with a tinted liquid F and is sealed with a cover 15, preferably by the appli-

cation of ultrasonic energy to the marginal edges of the cover. In this case as well, the indicating units are capable of withstanding high weight loadings, so that the inclusion thereof in packages gives rise to no danger of them rupturing accidentally before the freezing operation. After the material to be frozen, with the indicators interspersed therethrough, pass through the freezing cycle, the block of tinted liquid F exerts its expansive forces against the end walls 14 of the container to fracture them and to provide a path for the flow of the tinted liquid should it ever pass through a melting stage.

In order to assure the provision of distinct openings for the passage of the tinted fluid, a tensioning strap T may be inserted within the container prior to the application and sealing of the cover thereon. This tensioning strap, which may be of spring metal, is provided with a mid-portion 16 which is pressed against the lower face of the cover 15 and divergent arms 17, the ends of which press outwardly against the lower edges of the thin walls 14. Thereby, the formation of a distinct crevice in the thin walls of the container is assured.

In order to confine, as well as to render more distinct the flow of the tinted fluid F following its melting, a sheet of absorbent material 19 may be wrapped around the container between the walls 13. Furthermore, the entire indicating assembly may be confined within a transparent envelope 20 in order to prevent any intermixture of the indicator components with the material in which the indicator assemblies may be interspersed.

Of course, it is understood that the tension devices, such as the rod 7 shown in the first embodiment, or the spring in the second embodiment, may be designed in many different ways, in dependence upon the specific contours and arrangements of the walls of the indicator.

The defrost evincers in accordance with the invention may assume many different shapes as long as they are provided with walls of differential thickness which, on the one hand will impart sufficient strength to the container to withstand high pressure loadings, and on the other hand, will have the capability of being ruptured by the expansive force of the fluid within the container when it passes through the freezing cycle.

The size of the indicators may vary in dependence upon the specific applications in which they may be used. The smallest practical unit shown in FIG. 1 may have a diameter of about three-eighths inch, and a thickness of one-fourth inch. These units can be molded economically by injection molding procedures from various types of rigid plastic materials, for example polystyrene. FIG. 10 graphically illustrates the different volumetric capacities of the indicating containers which may be molded to contain nearly one cubic inch of liquid. In the case of indicators of small capacity, the thin walls, of necessity, must be of smaller dimension, so that the limited quantity of liquid may exert a sufficient expansive force to effect the rupture of the container at the thin wall thereof. On the other hand, the thin walls may be of substantially greater thickness when larger volumes of liquid are going through the freezing stage within containers of larger sizes. As indicated in FIG. 10, tests have shown that reliable indicators may be produced economically when the volumetric capacity of these range from 0.05 to 0.9 cubic inches, in which case the thin walls may vary in

thickness from approximately 10/1,000 to 58/1,000 of an inch.

FIG. 11 graphically illustrates the optimum ratios of thicknesses of the thin walls which will render them rupturable by the expansion of the freezing liquid to the average thicknesses of the thick walls which are capable of bearing the required loads. The thin walls are at least half the thickness of the thick walls and tests have proven that most satisfactory results are had when these ratios approximate 1 to 3.

I claim:

1. A defrost evincing device comprising a cylindrical cartridge container of hard synthetic plastic material filled with a fluid indicating medium consisting of an aqueous solution of food coloring material, said container having walls of differential thickness of high load-bearing capabilities and comprising a thick peripheral wall and end walls of small cross-section adapted to be ruptured by the expansive force of the frozen mass of said aqueous solution as it passes through the freezing cycle, a tension rod molded integrally with one of said end walls and extending at least to the same height as said peripheral wall with said opposite end wall ultrasonically heat-welded to the free edge of said peripheral wall.

2. A device as set forth in claim 1, wherein said tension rod is molded centrally of said base wall and is of tapered conical section and terminates slightly above the level of said peripheral wall.

3. A device as set forth in claim 1, wherein said end walls are provided with recesses on the exterior thereof, and a sheet of absorbent material within said recesses adapted to absorb the colored solution flowing from said ruptured container when the solution passes through a thawing cycle.

4. A defrost evincing device comprising a container of substantially rectangular contour provided with a pair of opposed lateral supporting walls and transversely extending walls of smaller cross-section than said supporting walls, said container being filled with a colored aqueous solution, which upon freezing, experiences expansion and gives rise to an expansive force sufficient to rupture said walls of smaller cross-section, and means adjacent to said last-mentioned walls for maintaining the rupture distinct to enable the free flow of the solution from the container in its defrosted state to indicate definitely the flow of the solution from said filled container, said last-mentioned means comprising a bowed spring extending between said transverse walls for forcing them outwardly upon their rupture by said expansive force.

5. A device as set forth in claim 4, wherein said spring is bowed in a downward direction with its mid-portion pressing against the inner face of the top of said container while its edges press against the lower margins of said transverse walls.

6. A device as set forth in claim 5, including a sheet of absorbent material wrapped around the top, bottom and end walls of said container between said lateral supporting walls.

7. A device as set forth in claim 6, including a moisture-impermeable transparent envelope of flexible plastic sheet material encasing said filled container.

8. A defrost evincing device highly resistant to physical shocks and heavy weight loadings, comprising a uni-

tary integrally sealed container of only rigid molded synthetic plastic material, ranging in volume from 0.5 to 0.9 cubic inches and filled completely with a fluid indicating medium, said container comprised of walls of differential thickness including wall portions of great strength and at least one weaker wall portion responsive to the expansive forces exerted thereon by the freezing of said medium to effect the fracture of said container at said last-mentioned wall portion, to permit the free flow of said fluid indicating medium following the thawing thereof, said weaker wall portion ranging in thickness from approximately 10 to 58 thousandths of an inch, and the thickness of the wall portions of great strength being at least twice the thickness of said weaker wall portion.

9. A device as set forth in claim 8, including means adjacent to said weaker wall portion for maintaining the rupture distinct to enable the free flow of the fluid medium from the container in its thawed state to indicate definitely the flow of the fluid medium from said filled container.

10. A device as set forth in claim 8, wherein said container is of cylindrical contour having a strong and thick lateral wall with at least one of the end walls constituting the weaker wall portion.

11. A device as set forth in claim 10, including means adjacent to said weaker wall portion for maintaining the rupture distinct to enable the free flow of the fluid medium from the container in its thawed state to indicate definitely the flow of the fluid medium from said filled container.

12. A device as set forth in claim 10, wherein said weaker end wall portion is provided with a recess on the exterior thereof, and a sheet of absorbent material within said recess adapted to absorb the fluid indicating medium flowing from said ruptured container when said medium passes through a thawing cycle.

13. A device as set forth in claim 8, wherein said container is of rectangular contour provided with a pair of opposed lateral supporting walls of great strength and transversely extending walls of smaller cross-section to form weaker wall portions.

14. A device as set forth in claim 13, including means adjacent to said transversely extending walls for maintaining the rupture distinct to enable the free flow of the fluid medium from the container in its thawed state to indicate definitely the flow of the fluid medium from said filled container.

15. A defrost evincing device comprising a cylindrical cartridge container of hard synthetic plastic material filled with a fluid indicating medium consisting of an aqueous solution of food coloring material, said container having walls of differential thickness of high load-bearing capabilities and comprising a thick peripheral wall with at least one of the end walls being of small cross-section adapted to be ruptured by the expansive force of the frozen mass of said aqueous solution as it passes through the freezing cycle, said last-mentioned end wall having a recess on the exterior thereof, a sheet of absorbent material within said recess adapted to absorb the colored solution flowing from said ruptured container when the solution passes through a thawing cycle, and a moisture-impermeable transparent envelope of flexible plastic sheet material encasing said filled container.

16. A defrost evincing device comprising a container filled with a fluid indicating medium, said container having walls of differential thickness of high load-bearing capabilities including a wall of thin cross-section adapted to be ruptured by the expansive characteristics of said fluid medium incident to its transformation into a frozen state, said container being formed of a hard

synthetic transparent plastic material, having an internal volumetric capacity for said fluid medium ranging in volume from 0.5 to 0.9 cubic inches and the thickness of the wall of thin cross-section ranging from approximately 10 to 58 thousandths of an inch.

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