July 18, 1950 W. W. COWGILL 2,515,294

FREEZING UNIT DEFROSTER

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Fig. 1

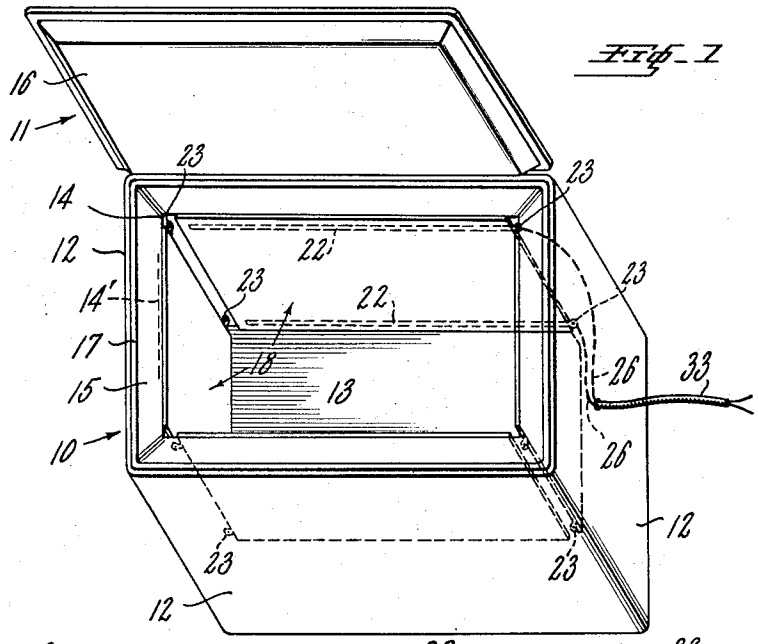


Fig. 2

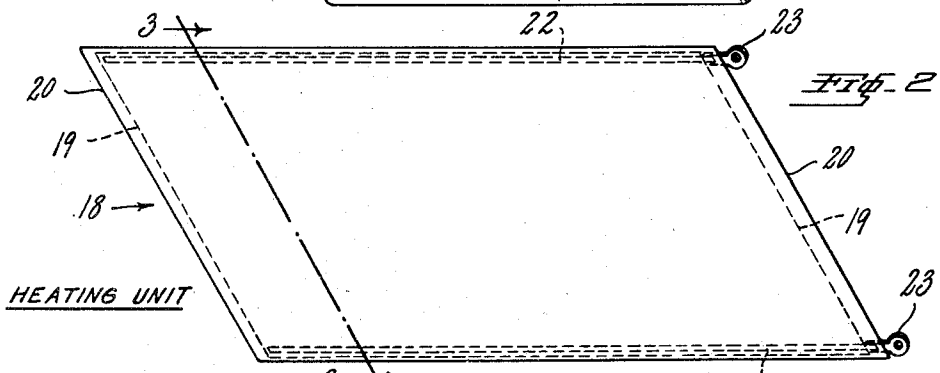


Fig. 3

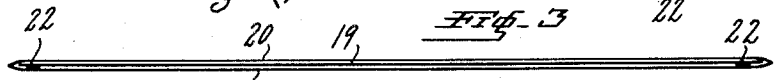


Fig. 4

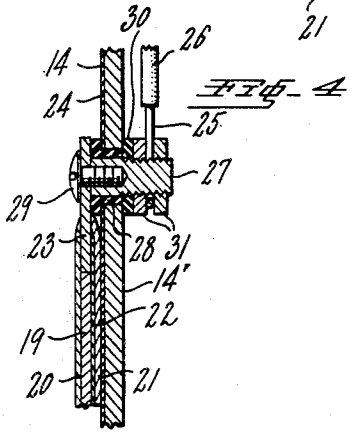
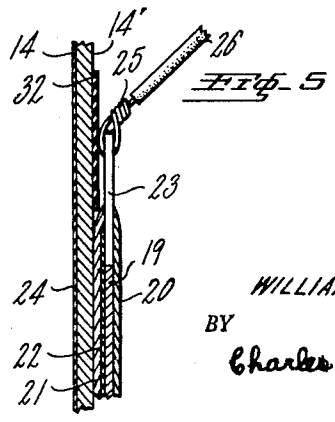


Fig. 5



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FREEZING UNIT DEFROSTER

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4 Claims. (Cl. 219—19)

1

This invention relates to means for defrosting the freezing compartment of refrigerators and so-called "deep freeze boxes," and is particularly well adapted for use to release the layer of ice-forming frost from the inner walls of a deep freeze box, so that such sheet of ice may be lifted out of the box without the necessity of raising appreciably the temperature of the food stored in the box.

When a freezing compartment is kept below the temperature at which water freezes the moisture in such compartment will deposit on the top, bottom and sides of the compartment and form frost. As this frost accumulates it forms a layer of ice that, due to its insulating effect, reduces the efficiency of the apparatus for reducing the temperature of the freezing compartment. It is therefore necessary to defrost such compartment from time to time.

The general practice heretofore in defrosting the freezing compartment of a deep freeze box has been to stop the supply of cooling fluid to such box and open up the lid of the box so as to expose the interior of the box to room temperature and thereby cause the layer of ice upon the walls to melt, but this practice is open to the objection that the temperature of the food stored in the box rises unduly while the box is being defrosted. It has also been the practice heretofore to scrape the frost free from the walls of the freezing compartment and then remove the scraping from the box, but this is a comparatively difficult job, and allows the contents of the box to become warm while this is being done.

The present invention contemplates a simple and practical freezing unit defroster whereby the layer of ice-forming frost that has built up upon the walls of the freezing compartment may be quickly and easily released from such walls and then lifted out of the box. This is accomplished by heating the wall itself or other surface upon which the ice-forming frost has become deposited so that this layer of ice will be released or "decemented" from the wall upon which it formed and can then be lifted out of the compartment. In this manner the layer of ice-forming frost may be removed from the interior of the freezing compartment in a short time and without causing any appreciable rise in the temperature of the food stored in the freezing compartment.

In order to carry out the present invention the walls, and also if desired the top and bottom, of the freezing compartment to be defrosted are each provided with a defrosting unit having the form of a heating sheet of substantial area which

2

is secured to each wall that is to be freed from ice. This sheet-like heating unit may be adhesively secured to the exposed porcelain lined face of the walls of the freezing compartment, or if desired it may be attached to the inner or concealed face of such walls against which the fibre glass or other insulating material normally rests.

The heating sheet, in accordance with the present invention, is so constructed that it will generate heat approximately uniformly throughout the entire area of the heating unit and is designed to produce only a moderate amount of heat say about 100° F. to 200° F. throughout its area, since all that is required of such heating unit is to decement or release the bond between the sheet of ice and the wall of the freezing unit to which it is adhered. As soon as this is done the released sheets of ice may be lifted out of the freezing unit in large sections.

The heating sheet used in carrying out the present invention comprises a plastic sheet having electrical conductivity, the desired amount of conductivity is imparted thereto by employing a plastic that contains conductive particles such as acetylene black. This permits an accurate control of the heating properties built into the plastic sheet, since the conductivity of such sheet may be increased as desired by applying thereto successive layers of a solvent plastic film carrying the conductive particles. After a plastic sheet having the desired conductivity is produced, electrical conductors preferably in the form of metal ribbons are secured thereto in spaced parallel relation to each other, so that the conductor sheet will generate heat substantially uniformly throughout its area when a different electric potential is maintained between the spaced conductors. The heating sheet thus produced is preferably confined or sandwiched between two sheets of insulating material.

The above and other features of the present invention and novel arrangement of parts will be further understood from the following description when read in connection with the accompanying drawing illustrating good practical embodiments of the invention, and wherein:

Fig. 1 is a perspective view of a deep freeze box having the four side walls thereof equipped with defrosting units in accordance with the present invention;

Fig. 2 is a perspective view of a defrosting unit of the type used in Fig. 1, and comprising an electrically heated plastic sheet;

Fig. 3 is a sectional view taken on the line 3—3 of Fig. 2;

Fig. 4 is a section view on an enlarged scale taken through one of the inner walls of the deep freeze box of Fig. 1 and showing the heating unit as applied to the exposed face of such wall upon which ice tends to accumulate; and

Fig. 5 is a view similar to Fig. 4 but shows a modified arrangement in which the heating unit of Fig. 2 is applied to the concealed face of the inner wall against which fibre glass or other insulating material normally rests.

Fig. 1 of the drawing shows in perspective view a low temperature box of the type commonly referred to as a "deep freeze unit" or "deep freeze box" and is designated generally by the numeral 10. This box has the usual lid 11 shown in the raised position so that the interior of the box which constitutes the freezing compartment may be seen. The lid 11 is secured to the box 10 by hinges not shown.

The walls of the box are made thick as shown for heat insulating purposes and comprise an outer metal shell having the outer walls 12 and a considerably smaller inner metal shell having the bottom 13 and side walls 14. The arrangement is such that a hollow space is left between the inner and outer shells which is filled with fibre glass or other heat insulating material, not shown. The inner and outer shells just mentioned are connected at the upper end of the box by the inclined metal walls 15 which slope to correspond with the bevel of the thick insulating portion 16 of the lid 11. The bevelled portion 15 of the box 10 has secured thereto the rubber sealing bead 17.

The deep freeze box so far described is of well known construction and constitutes one form of freezing unit which may be readily equipped with the defrosting units contemplated by the present invention. One such defrosting unit designated by 18 is shown in perspective in Fig. 2 of the drawing. This unit may be applied to all four vertical walls 14 of the inner shell of the deep freeze unit, and if desired it may also be applied to the bottom 13 and to the surface 16 of the lid 11, however it is shown in Fig. 1 as having been applied only to the four walls 14.

The heating unit 18 preferably comprises a sheet 19, see Fig. 4, having electrical conductivity, and this sheet is sandwiched between two non-conducting sheets 20 and 21. The sheet 19 preferably is formed of a sheet of thin woven fabric such as ordinary woven cotton fabric or a sheet of tough durable paper, and has applied to one face thereof a plastic film carrying electrical conductive properties. This film is preferably formed of rubber, and is applied to the fabric or paper as a thin solvent coating having mixed therein conductive particles such as acetylene black. The desired electrical conductivity is imparted to the sheet 19 by applying successive coats of the conductive rubber to the textile fabric or paper, so that each coat will increase slightly the conductivity of the sheet 19.

The insulating sheets 20 and 21 may be formed of the same textile fabric or paper as is employed in the sheet 19 and are coated with a solvent resin such for example as a phenolic resin or polystyrene. The insulating sheets 20 and 21 are slightly larger in area than the conductive sheet 19 so that the insulating sheets will extend beyond the four edges of the conductive sheet to completely insulate it as shown in Fig. 2.

In order to supply the conductive sheet 19 with an operating electrical current it has placed lengthwise thereof adjacent its opposite edges, as shown in Figs. 2 and 3, the tape conductors 22

formed of thin strips of metal such as aluminum or copper. After the parts are assembled in the position in which they are shown in Figs. 2 and 3 the composite sheet thus produced with the conductive tapes 22 in place is preferably placed in a heated platen press, whereupon the press is closed for a sufficient length of time to soften the plastic coating on the sheets 20 and 21 and bond the several parts firmly together, to thereby provide the finished heating unit having a thickness of only several hundredths of an inch. This completes the formation of the heating unit 18 except that contact tabs 23, shown as of the eyelet type, are preferably secured to one end of each of the conductor strip 22 as shown in the drawing. These tabs 23 provide a convenient means for connecting the conductor strips 22 to a source of electrical energy, so that when a difference of electrical potential is maintained between the two widely spaced conductor strips 22 of the heating unit 18 electric current will travel across the conductor sheet 19 from one tape to the other to heat this sheet substantially uniformly throughout its entire area, to thereby defrost the wall to which the freezing unit 18 is secured.

The inner shell which forms the freezing compartment and has the side walls 14 and bottom wall 13 has upon its exposed surfaces a protecting layer of white enamel or porcelain. This enamel layer is designated by 24 in Figs. 4 and 5 of the drawing, whereas the opposite face of the wall 14 which is normally concealed and against which the insulating material commonly rests is designated by 14' in these two figures.

The enamel covered faces 24 of the vertical walls 14, when the freezing unit is in operation to keep the food therein frozen, are the walls upon which ice-forming frost accumulates. As this frost increases in thickness it forms a heat insulating layer that seriously interferes with the efficiency of the box to maintain the freezing compartment at the desired low temperature, which in most cases should be around zero Fahrenheit. It is therefore important to defrost the deep freeze unit from time to time, say at least once in three months, but if the freezing fluid to the box is cut off and the lid is left open so that the freezing compartment becomes warm enough to melt the ice deposited upon such walls, the frozen food stored in the box is likely to spoil due to its rise in temperature.

Having in mind the difficulty experienced heretofore in defrosting the freezing compartment of freezing units, the present invention contemplates the use of a defrosting unit comprising the heating sheet 18 best shown in Fig. 2 of the drawing, and which sheet is used upon each wall of the box or other freezing unit to be defrosted. It will be noted that each of the four vertical walls 14 of the box 10 has secured thereto a heating unit 18 that is large enough to cover substantially the entire area of the wall 14 to which it is secured. The heating unit 18 may be applied to the enamel face 24 of each wall 14 as shown in Fig. 4 of the drawing, or it may be applied to the inner concealed face 14' of said walls as shown in Fig. 5 of the drawing. In either case it will serve to generate sufficient heat throughout its entire area to release or "decement" the bond which secures the layer of ice to such wall. As soon as this is done the integral layer of ice, or a large portion of such layer which is now released from a wall 14 may be lifted bodily out of the box. As a result the

defrosting of the box may be carried out quickly without the temperature of the frozen food stored in the box rising appreciably, since the ice in the box does not have to be melted beyond the point where its bond to the wall 14 is released. Due to the high heat insulating properties of the frost ice the heat applied to the box walls will be confined to the vicinity of such walls by the layer of ice deposited thereupon and will not raise the temperature of the storage space appreciably.

The heating unit 18 may be secured to the enamel face 24 or to the inner face 14' of a wall 14 by simply adhesively bonding it to such wall to cover a large area thereof.

In the construction shown in Figs. 1 and 4 the ice-forming frost will be deposited on the exposed face of the heating unit 18 rather than upon the wall it covers, so that when the heating unit is supplied with a heating current the ice will quickly release its grip upon the outer face 20 of the heating unit. On the other hand if the heating unit is secured to the inner face 14' of the wall 14 as shown in Fig. 5 of the drawing and current is supplied to this heating unit, its heat will be quickly transmitted through the wall 14 to cause the ice deposited on the enamel face 24 to release its hold.

In some cases it may be desirable to avoid the expense of applying the enamel 24 to the walls 14, and in place thereof apply the heating units 18 directly to the metal face of the walls 14, and then cover the entire interior of the box with a protecting film of polystyrene so that it will cover the pads 18 and exposed portions of the walls 14.

If the heating unit is applied to the face 14' of the wall 14 as shown in Fig. 5, the problem of supplying operating current to the conductive strips 22 is a simple one, since all that is necessary is to connect one conductor wire 25 of an insulated conductor 26 as shown in Fig. 5 to the upper tab 23 of each heating unit 18, and a similar conductor 25 to the corresponding lower tab 23 of such heating unit.

When the heating unit 18 is applied to the enamel face 24 of the wall 14 as shown in Figs. 1 and 4 it is then preferable to form a hole through the wall 14 at each point where a tab 23 is positioned so that each tab may be connected with a conductor wire 25 of an insulated conductor 26 disposed adjacent the inner wall 14'. One construction for connecting such tab with a conductor wire is shown in Fig. 4 and comprises a stud 27 which is tightly secured in an insulating sleeve 28, which sleeve extends through a hole formed in the wall 14. This stud 27 is internally threaded at one end to receive the screw 29 which is employed to clamp a tab 23 to the outer end of the stud 27. The inner end portion of the stud 27 has mounted thereupon the insulating disk 30 and the clamping nuts 31 to clamp between such nuts the conductor wire 25. In the construction of Figs. 1 and 4 the head of the screw 29 may be painted over with shellac or other insulating material, and the clamping nuts 31 and other exposed portion at the inner end of a bolt 27 may be covered with suitable insulating material. Likewise in Fig. 5 an insulating sheet 32 is preferably provided between the tab 23 and the wall 14, and the parts 23, 25 may be further protected by insulating material not shown. The insulated conductors 26 are the positive and negative wires secured to the tabs 23 to operate each heating unit 18 and are led

inwardly from the cable 33 that enters a hole in a wall of the box. This cable 33 may be connected to the ordinary 110 volt outlet box.

It will be understood that the heating units 18 may be applied also to the bottom 13 and top 16 of the box 10, but the application of the heating unit 18 to the four upright walls 14 will enable the box to be quickly freed from the most objectionable deposits of ice within the freezing compartment. It is desired to point out that while the freezing unit defroster of the present invention has been shown and described in connection with a deep freeze unit, it is also well adapted for use in defrosting the low temperature compartment of the ordinary household refrigerator, and for use to defrost various other types of low temperature boxes having a freezing compartment provided with walls upon which a layer of ice-forming frost tends to accumulate.

Having thus described my invention, what I claim and desire to protect by Letters Patent is:

1. In a low temperature box having a freezing compartment, top, bottom and side walls enclosing said compartment and upon which a layer of ice-forming frost tends to accumulate, a defrosting unit comprising a flexible heating sheet adhesively secured to one face of at least one of said walls so as to cover a large area of such face and heat this area approximately uniformly to free it from the layer of ice, including a plastic sheet having electrical conductivity and spaced current supply conductors attached thereto so that this sheet will generate heat substantially uniformly over its surface when a difference in electric potential is maintained between said conductors and heat the wall to which it is secured.

2. In a low temperature box having a freezing compartment, four upright walls enclosing said compartment and upon which a layer of ice-forming frost tends to accumulate, a defrosting unit for each wall comprising a flexible heating sheet adhesively secured to one face of each of said walls so as to cover a large area of such face and heat the area approximately uniformly to free it from the layer of ice, including a plastic sheet having electrical conductivity and spaced current supply conductors attached thereto so that this sheet will generate heat substantially uniformly over its surface when a difference in electric potential is maintained between such conductors and heat the wall to which it is secured.

3. In a low temperature box having a freezing compartment, walls enclosing said compartment and upon which a layer of ice-forming frost tends to accumulate, a defrosting unit comprising a laminated heating sheet adhesively bonded to at least one of said walls so as to cover a large area of this wall and heat this area approximately uniformly to release the layer of ice formed upon such sheet, including a plastic sheet having electrical conductivity and spaced current supply conductors attached thereto so that this sheet will generate heat substantially uniformly over its surface and heat the wall to which it is secured when a difference in electric potential is maintained between said conductors, and an insulating layer covering the heating sheet.

4. In a low temperature box having a freezing compartment, walls enclosing said compartment and upon which a layer of ice-forming frost tends to accumulate, a defrosting unit comprising a heating sheet adhesively secured to one face of a wall of such compartment so as to cover a large area of such wall and heat this area approxi-

mately uniformly to decement the layer of ice from such wall so that a large integral sheet of the decemented ice may be removed from the compartment, including a plastic sheet having electrical conductivity and spaced conductors attached thereto so that this sheet will be heated substantially uniformly over its area when a difference in electric potential is maintained between said conductors and heat the wall to which it is secured.

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