

Aug. 7, 1945.

H. LUTES ET AL

2,381,069

REFRIGERATING APPARATUS

Filed June 1, 1943

3 Sheets-Sheet 1

FIG. 1.

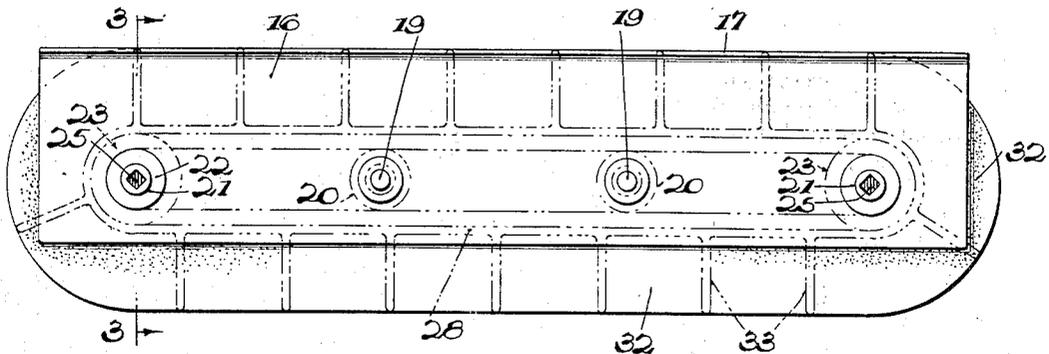


FIG. 2.

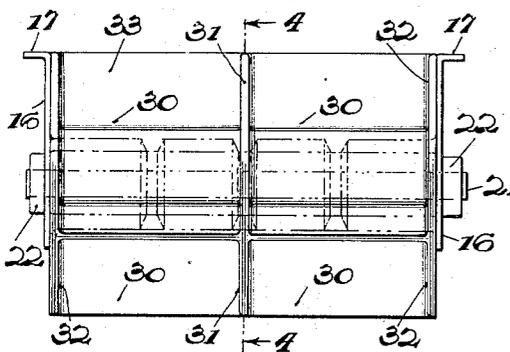


FIG. 3.

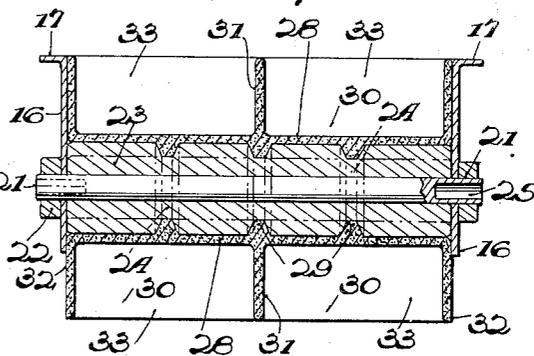
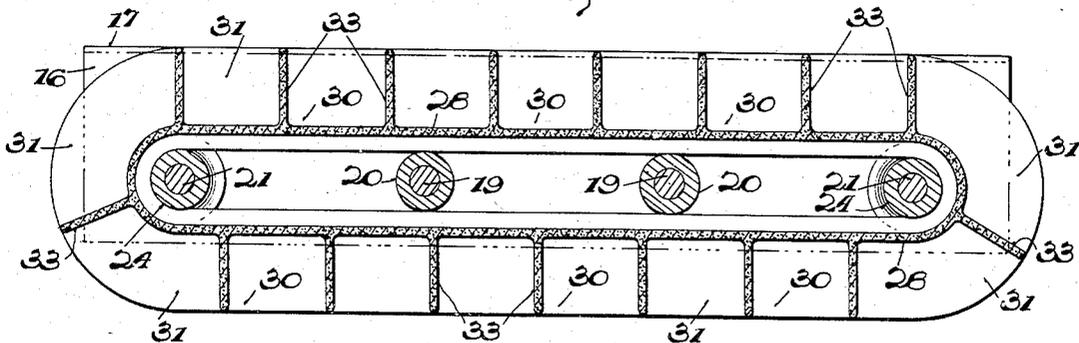


FIG. 4.



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FIG. 9.

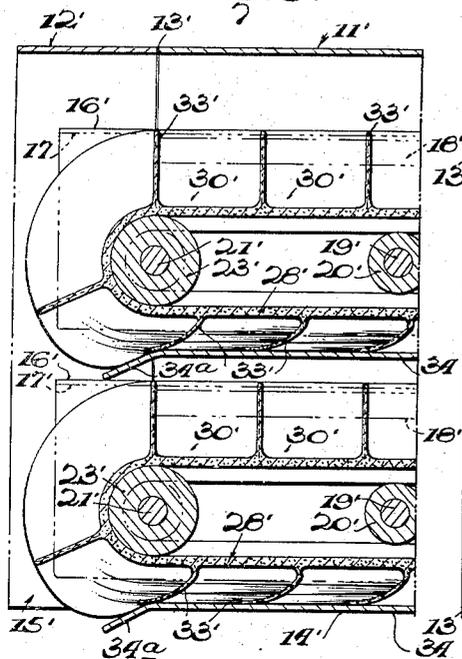


FIG. 5.

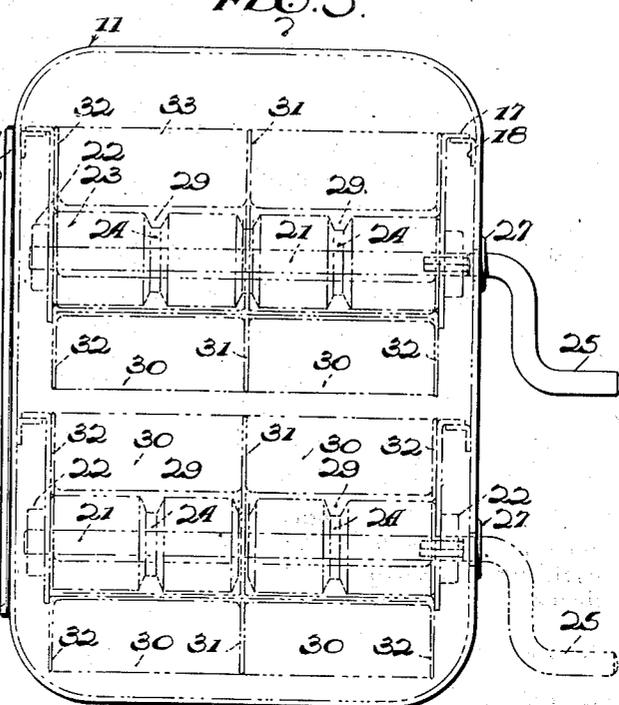


FIG. 6.

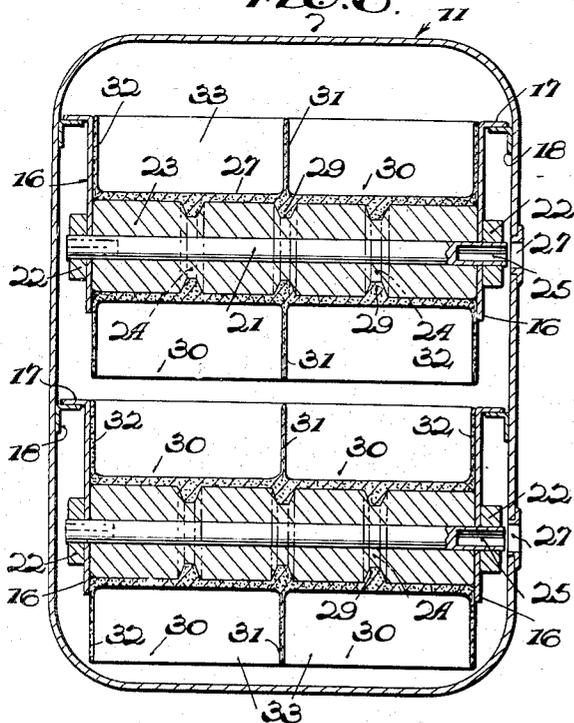
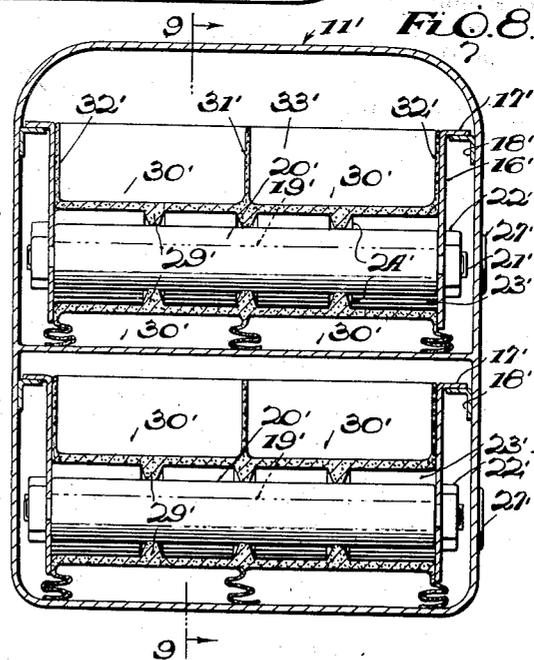


FIG. 8.



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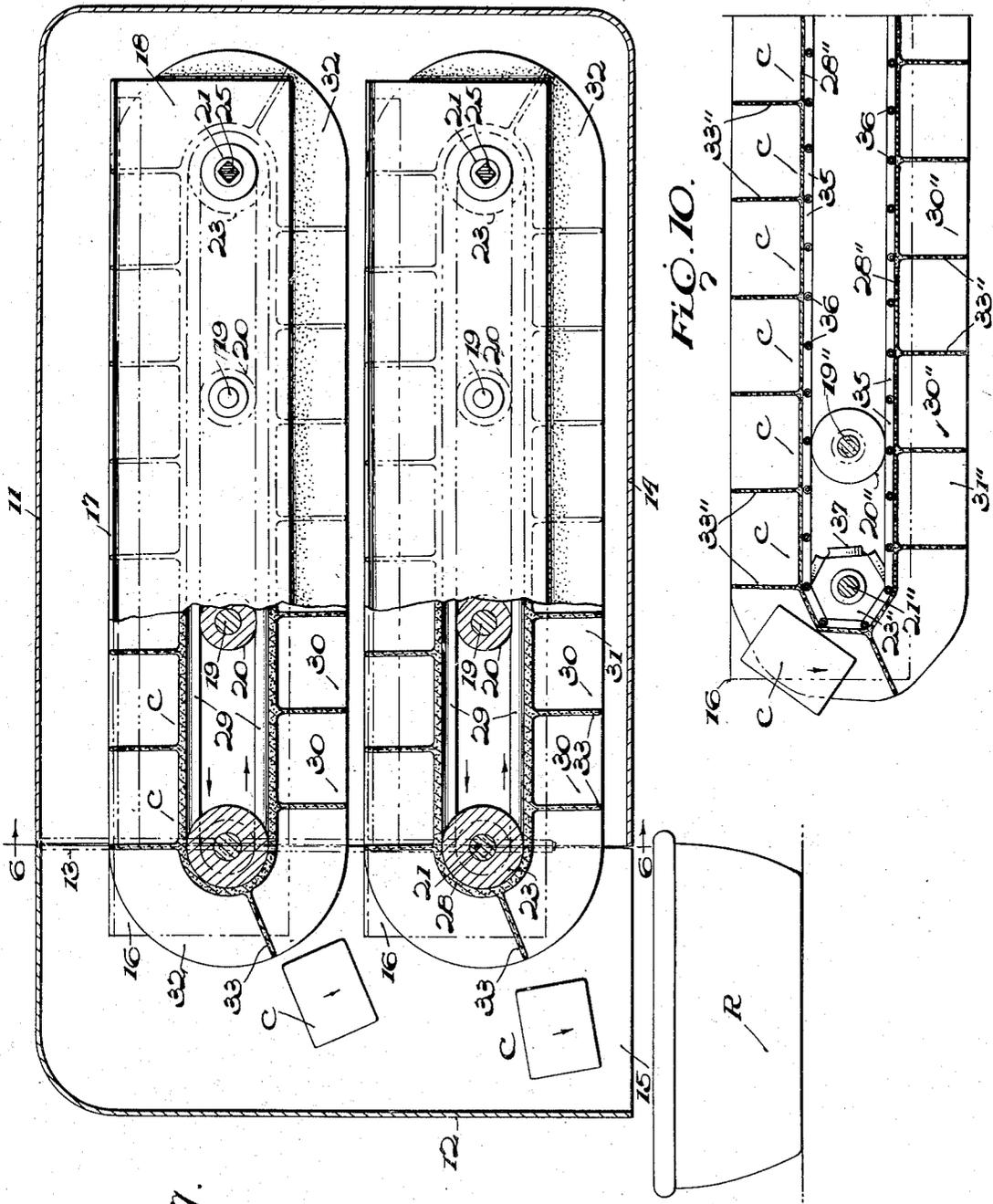


FIG. 7.

FIG. 10.

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# UNITED STATES PATENT OFFICE

2,381,069

## REFRIGERATING APPARATUS

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Application June 1, 1943, Serial No. 489,282

6 Claims. (Cl. 62—108.5)

The invention relates to refrigerating apparatus generally and more particularly to certain improvements in means and mechanisms for freezing ice to multi-cube form in the freezing compartments or chambers of mechanical refrigerators and the like.

Due to shortages in aluminum, steel, and rubber stocks, occasioned by the demands of war, it has become necessary that manufacturers find substitutes therefor, in order to maintain commodity production to meet civilian consumer needs. This is especially true of the refrigerator industry, in its endeavors to supply replacement of parts necessary to the maintenance and operation of mechanical refrigerators for household use. To such end, resort has been had to the synthetic materials, particularly certain of the plastics whose characteristics permit of their use as substitutes in the making, for instance, of ice cube forming compartments, such as the so-called freezing trays. Also, the aforesaid shortage in the metal stocks of the country will adversely affect the provision of certain types of the ejector devices and mechanisms that have heretofore been employed to facilitate the removal of frozen cubes from the freezing trays or other ice cube forming compartments or pockets, so that the need to seek other methods and means for accomplishing this much to be desired result has likewise arisen.

An object of the invention is to provide an ice cube freezing unit that is of a comparatively simple and inexpensive design to meet the aforesaid conditions and one that is readily adapted for removal and replacement relative to the freezing chamber of a mechanical or like refrigerator in substitution for standard forms of ice cube freezing trays and with the advantage that the frozen cubes, either in their entirety or in part, may be discharged directly from the cube forming elements for use, without necessitating the removal of the unit from the freezing chamber to that end.

Another object of the invention resides in the provision of an ice cube forming element of the freezing unit that is in the form of an endless compartmented belt made from a highly flexible, non-metallic, material, and wherein successive transverse rows of its compartments will be moved from freezing positions within the freezing chamber of a refrigerator to discharge positions of the frozen cubes therefrom and from within the freezing chamber itself.

A further object of the invention lies in the provision of a supporting frame for the afore-

5 said endless compartmented belt which is carried on rollers journaled in opposite ends of the frame so that successive transverse rows of the compartments on the belt will be automatically expanded at the bend of the belt about a roller for the freeing of the frozen cubes from the walls of the compartments and their subsequent forcible ejection from within the compartments and discharge from within the freezing chamber.

10 Yet another object of the invention has to do with the making of the endless compartmented belt and the supporting rollers therefor, the latter either wholly so or in part, from a plastic or like frost resistant material, for instance, from the synthetic thermoplastic substance or material 15 known as "Koroseal" that is characterized by its durability and toughness and its freedom from odor and taste, in order that adhesive effects, due to the frosting that is of common occurrence during the freezing operation within a refrigerator, will be minimized if not wholly eliminated.

20 With these and other objects and advantages of equal importance in view, the invention resides in the certain new and useful combinations, constructions, and arrangements of parts, as will be hereinafter more fully described, set forth in the appended claims, and illustrated in the accompanying drawings, in which:

25 Figure 1 is a side elevation of a preferred form of the ice cube forming unit, in accordance with the invention;

Figure 2 is an end elevation;

30 Figure 3 is a transverse vertical section taken on the line 3—3 of Figure 1;

35 Figure 4 is a longitudinal vertical section taken on the line 4—4 of Figure 2;

40 Figure 5 is a front elevation of a freezing chamber of a refrigerator, showing two of the improved ice cube freezing units arranged in freezing positions therein;

Figure 6 is a transverse vertical section taken on the line 6—6 of Figure 7;

45 Figure 7 is a side elevation, partly in longitudinal section, of the two-unit freezing chamber as in Figure 5, showing the manner of discharge of frozen cubes from the front ends of the compartmented belts;

50 Figure 8 is a transverse vertical section through a modified form of refrigerator freezing chamber, showing the superposed compartmented belts, each accommodated within a separate freezing compartment of the chamber;

55 Figure 9 is a fragmentary, vertical section taken on the line 9—9 of Figure 8; and,

Figure 10 is a fragmentary, longitudinal, vertical section through a modified form of freezing unit, showing the endless compartmented belt support upon a supplemental endless belt of hinged link construction, and wherein alternate hinge connections between the several links function to forcibly eject frozen cubes from successive transverse rows of cube forming pockets on the compartmented belt in the travel of the superimposed belts about a supporting roller.

Referring to the drawings, wherein like characters of reference denote corresponding parts through the several views, and more particularly to Figures 1 to 7, inclusive, the preferred embodiment of the invention, as is exemplified therein, is comprised in a metal freezing chamber 11 having its front end open and normally closed by a door 12 that is hinged, as at 13, to one of its vertical side walls, and its bottom wall 14 formed with an opening 15 at its front end for the discharge downwardly therethrough of frozen cubes (Figure 7) from an ice cube forming unit, or units, housed within the chamber; the discharge of the frozen cubes to be effected without removing a freezing unit from within the freezing chamber and, if desired, without opening the door 12.

A freezing unit, in accordance with the invention, is comprised in a metal frame formed of parallel vertical side walls 16, which are spaced apart to a width substantially equal to that of a standard ice cube freezing tray, and have out-turned flanges 17 coextensive with their top edges for sliding support upon angled brackets or the like 18 secured at the inner sides of the side walls of the freezing chamber 11. The side walls 16 of the frame are held in required spaced relation by means of transverse rods or shafts 19 which are fixedly secured at their ends in said walls in any suitable manner and, additionally, they serve as bearings for rotatable cylindrical elements or rollers 20. Arranged in horizontal alinement with the fixed rods or shafts 19 are rotatable shafts 21 that have their opposite ends projecting outwardly of bearing apertures formed in the side walls 16; the ends of the shafts, extending beyond the side walls, having retaining collars or the like 22 fixed thereon. These rotatable shafts 21 are spaced apart from the outer sides of the rollers 20, one toward each of the opposite ends of the frame, and carry fixed cylindrical elements which, together with the shafts 21, constitute driving rollers 23; one or both of the shafts having one or both of their ends socketed, as at 25, to receive the squared shank of an operating element, such as the hand-crank 26. Thus, if but one of the shafts 21 is so provided, a freezing unit will not be reversible for replacement within the freezing chamber 11, and the end thereof that is equipped with such shaft will constitute its front end, in order that a socket 25 will be disposed in line with a suitably reinforced aperture in a side wall of the freezing chamber 11, through which the squared shank of the hand-crank 26 is to be inserted for operative engagement therewith.

Trained about the drive rollers 23 is an endless belt that has its under side provided with longitudinally extending ribs 29 that engage in circumferential grooves 24 formed in the peripheries of the rollers 23 for the purpose of guiding the belt and to prevent any lateral displacement of the same in its travel, when one or the other of the rollers 23 are rotated from the hand-crank 26. These ribs 29 also act to strengthen

the belt structure by reinforcing it along its length, as will be obvious. Formed on the outer side of the belt 28 are parallel longitudinal and transverse rows of ice cube forming compartments or pockets 30; two longitudinal rows thereof only being shown by way of example. These pockets 30 are formed between a centrally disposed longitudinal partition wall 31 and outer side walls 32 extending parallel thereto and transverse partition walls 33 in connection with these walls 31 and 32; the transverse partitions being equidistantly spaced along the length of the belt. As before stated, the cylindrical elements forming the rollers 20 and 23, together with the compartmented belt structure 28, are formed from a flexible, i. e., substantially elastic, material that is frost resistant. Certain of the synthetic plastics, such as "Koroseal," are here preferred, for instance, to natural rubber which has heretofore been extensively employed in the manufacture of ice cube freezing trays, since these plastics, as a rule, have advantages of being more nearly odorless and tasteless and take smoother surface finishes, without undue loss in elasticity or flexibility.

In the use of this form of freezing unit, it will be inserted into the freezing chamber 11, through the opening for the door 12, and be supported in place from the flanges 17 resting on the brackets 18, after the pockets 30 on the upper run of the belt 28 have previously been filled with water, or other material to be frozen. In this position, the socket 25, in the end of the shaft 21 at the front end of the unit, will be in line with the reinforced aperture 27 in a side wall of the chamber 11 for the ready engagement therewith of the squared end of the hand-crank 26. Also, the front end of the unit will be spaced inwardly from the door 12 to a distance that will permit the frozen cubes C (Figure 7) to drop downwardly through the opening 15 in the bottom wall 14 of the chamber 11, and into a suitable receptacle R held or otherwise supported below the opening 15. Thus, to discharge the frozen cubes C, it will not be necessary that the freezing unit be displaced from its position within the freezing chamber 11, nor that the door 12 be opened to that end.

After a freezing operation and it is desired to remove the frozen cubes C for use, the hand-crank 26, if not already in position, will have its squared shank inserted inwardly through the reinforced aperture 27 and into engagement with the socket 25 in the alined shaft 21 of a roller 23. If the hand-crank 26 is positioned for use at the right hand side of the freezing chamber 11, anticlockwise turning movements thereof will result in a similar directional travel of the upper run of the belt 28 on the rollers 20 and 23, e. g., toward the front end of the chamber 11. As is shown in Figure 7, as the first transverse row of pockets 30 move over and downward about the front roller 23, they are enlarged through expansion or stretching of the longitudinal partition walls 31 and 32 thereof and free themselves from the opposed surfaces of the frozen cubes C which, with the continued downward movement of the belt 28, finally drop downwardly through the opening 15 and into the receptacle R; the freeing of the cubes from all of the walls of the pockets 30 being enforced by an outward ejection pressure exerted on the underlying portions of the belt, forming the bottom walls of the pockets, by the bending curvature of the belt about the roller 23. Thus, by successive intermittent or continuous

movements being imparted to the belt 28, the frozen cubes C will be discharged from the pockets 30 only as required, and a freezing unit need only be removed from within the freezing chamber 11 for purposes of replenishing an exhausted supply of the liquid or other material to be frozen.

With reference to Figures 8 and 9, the freezing chamber 11' as shown therein, although readily accommodating cube freezing units of the same size and capacity as those employed in the freezing chamber 11 (Figures 6 and 7), is preferably made appreciably smaller, at least as to height, than that of the latter and is further modified by being divided into upper and lower compartments by a horizontal division wall 34 located in spaced relation to and above the supporting brackets 18' of the lower of the freezing units. The side walls of the freezing chamber 11' are made shorter to an extent that the bottom wall 14' will bear the same relation to the lower side of the lower freezing unit as does the horizontal division wall 34 to the lower side of the upper freezing unit, and the spacing of these horizontal division and bottom walls with respect to the lower surfaces of the rollers 20' and 23', of the respective freezing units, is substantially less in height than is that of the walls 31', 32', and 33', forming the pockets 30' on a belt 28', so that in the rearward travel of the lower runs of the belts, the pockets on these runs will be collapsed in their passage through the reduced spaces so provided. To facilitate the entry of the lower runs of the belts 28' into the spaces immediately above the walls 14' and 34, the front end edges of the walls are formed with downwardly angled portions 14a and 34a, respectively, which act to initiate the bending (rearward with respect to direction of lower belt run travel) of the transverse partition walls 33' necessary to effect the collapse of the pockets. In collapsing, the bend of the transverse partition walls 33' is such as to trail in the direction of travel of the lower runs of the belts 28', while the longitudinal walls 31' and 32' fold upon themselves, somewhat as shown. Also, to render the collapsing of the several walls of the pockets 30' more effective, these walls are all made from a comparatively thinner material than that employed in the fabrication of the belts proper. Of course, the pockets 30' resume their normal state as they emerge from the ends of the spaces and pass upwardly of and about the rollers 23' at the rear ends of the freezing units.

In the form of freezing unit as in Figure 10, which may be employed in either one or the other of the freezing chambers 11 or 11', the driving rollers 23'' are preferably made polygonal, six-sided in the present instance, and the compartmented belt 28'' is supported on a supplemental belt trained over and about these rollers. This supplemental belt is preferably made up of a series of links 35 that are hinged together, as at 36, and are each rectangular in plan and of an area equal to that of each of the plane surfaces of the rollers 23''. Also, the links are so proportioned that each two adjacent of the same have a combined area that equals the area of each of the bottoms of a transverse row of the pockets 30'' on the main belt 28'', so that, when the two belts are brought into assembly on the rollers 23'', alternate of the hinge connections 36 will be disposed directly beneath and in line with the transverse partition walls 33' of the pockets and the intermediate hinge connections beneath and in line with the transverse centers of the bottoms

thereof. Likewise, in the emplacement of the superimposed belts on the rollers 23'' and their movement therewith for the discharge of frozen cubes C from the pockets 30'' on the belt 28'', the hinge connections 36 of the link belt 35, in consecutive order, will engage the rollers at the angles of connection between adjacent plane surfaces, so that, the two links beneath the bottoms of each row of the pockets will be subjected to relative angular movements, due to the continuously changing angular movements of the plane surfaces effected by the rotation of the driving roller, and in a manner that the expansion of the pockets and the ejection of the frozen cubes C therefrom will be positive in accomplishment. As shown, the transverse centers of the cubes, within the pockets of each transverse row thereof, have an ejecting pressure exerted thereon by the hinge connection overlying the high point of the angle formed between adjacent plane surfaces of the driving roller, which surfaces are in contact with the pair of links underlying the bottoms of the pockets. The driving rollers 23'' preferably have the plane surfaces thereof provided with raised portions 37 that are of a shape to conform to and engage with the open centers of the links 35, when the rollers and superimposed belts are placed in motion, the portions 37 being centered on the plane surfaces and function with the links after the manner of a chain and sprocket mechanism.

In the enlarging of the pockets by expansion of the walls thereof, in all instances recited herein, the initial movement of a transverse row of the pockets 30'' downward over and about a driving roller 23 immediately results in a stretching of the longitudinal partition and side walls 31 and 32 relatively to the opposed surfaces of the frozen cubes within the pockets and this is accompanied by a separation of the leading transverse partition wall 33 from the forward surfaces of the cubes. Following this, and due to the points of support of the cubes C at their transverse centers on the surfaces (cylindrical or angular) of a driving roller, continued motion of the latter results in a forceful separation of the trailing transverse partition walls and the bottom walls of the pockets from the surfaces of the cubes that are opposed thereto and the cubes are then entirely free for subsequent discharge from the pockets, downwardly of the space at the front of the freezing units and out of the opening in the wall 14 forming the bottom of the freezing chamber.

Having thus fully described the invention and certain of the advantages, objects, and purposes, of the same, it is to be emphasized that, while the disclosed forms of ice cube freezing units are extremely simple in design, construction, and arrangement, they are also highly efficient in use; allowing, as they do, a quick freezing of the content of the cube forming pockets on the endless compartmented belts; ease in removal of the units from and replacement within a freezing chamber or zone, with removal only required for replenishment of the content of the pockets upon the discharge of frozen cubes therefrom, or for cleaning purposes; and the ejection of but one transverse row of frozen cubes at a time and delivery of the same direct from the belted pockets and the freezing chamber, without the usual messy inconvenience and discomforting handling of either freezing unit or frozen cubes. Also, by enabling the user to remove only a required few of the whole number of the frozen cubes at a time, waste of the remainder is avoided and an economy

in power necessary to the freezing operation of the refrigerator is had.

While preferred embodiments of the invention have been specifically described herein, it is to be understood that various changes in materials employed, or in details of construction and arrangement of parts, may be resorted to, without departing from the spirit of the invention, or its scope as claimed.

What we claim is:

1. The combination of the freezing chamber of a mechanical refrigerator and a removable ice cube forming unit therefor, said unit comprising parallel members, rollers journaled in and extending between the members, cooperative means carried by the members and opposed walls of the freezing chamber for supporting the unit, an endless belt trained over and about the rollers, pockets formed along the outer surface of the belt, the belt and the pockets being formed from a flexible material to which ice does not readily adhere, and means insertible through one of the opposed walls of the freezing chamber for driving engagement with one of the rollers to impart motion to the belt, certain of the walls of the pockets being distortable by the bending action of the belt in its travel about the said one of the rollers to free the frozen cubes therefrom for subsequent discharge from the freezing chamber.

2. The combination as in claim 1, wherein the freezing chamber of the refrigerator has an opening in the front end of its bottom wall downwardly through which the frozen cubes are discharged upon being freed from the pockets at the front bending end of the belt.

3. The combination as in claim 1, wherein the freezing chamber of the refrigerator has its front end open and normally closed by a hinged door for the removal and replacement of an ice cube forming unit and its bottom wall provided with an opening downwardly through which the frozen

cubes discharge upon being freed from the pockets at the front bending end of the belt.

4. The combination as in claim 1, wherein the freezing chamber of the refrigerator is divided into compartments and the supporting means for the ice cube forming unit in each compartment is arranged so that the pockets on the lower run of the belt are collapsed upon themselves to conserve space without necessitating a reduction in the capacity of the freezing chamber.

5. The combination as in claim 1, wherein the freezing chamber of the refrigerator is divided by horizontally disposed partition walls to provide a tier of compartments and the supporting means for the ice cube forming unit in each compartment is arranged so that the pockets on the lower run of the belt are collapsed upon themselves in their passage over the underlying wall, thus conserving space without necessitating a reduction in the capacity of the freezing chamber.

6. A removable freezing unit for refrigerators, comprising a frame adapted to be supported within the freezing chamber of a refrigerator, rollers of polygonal form journaled transversely of said frame, a link belt trained about said rollers, a pocketed belt of a flexible material trained about said link belt, and means for imparting motion to said rollers and said belts, the individual links of said link belt having an area substantially equal to that of a plane surface of said rollers so that the pivot connections between the links coincide with the vertex of each of the angles of adjacent plane surfaces and alternate pivot connections engage the inner side of the flexible belt in the plane of the transverse center of each of said pockets, during the travel of the belts about said rollers, whereby to exert a positive pressure on the bottom walls to eject the frozen cubes therefrom.

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