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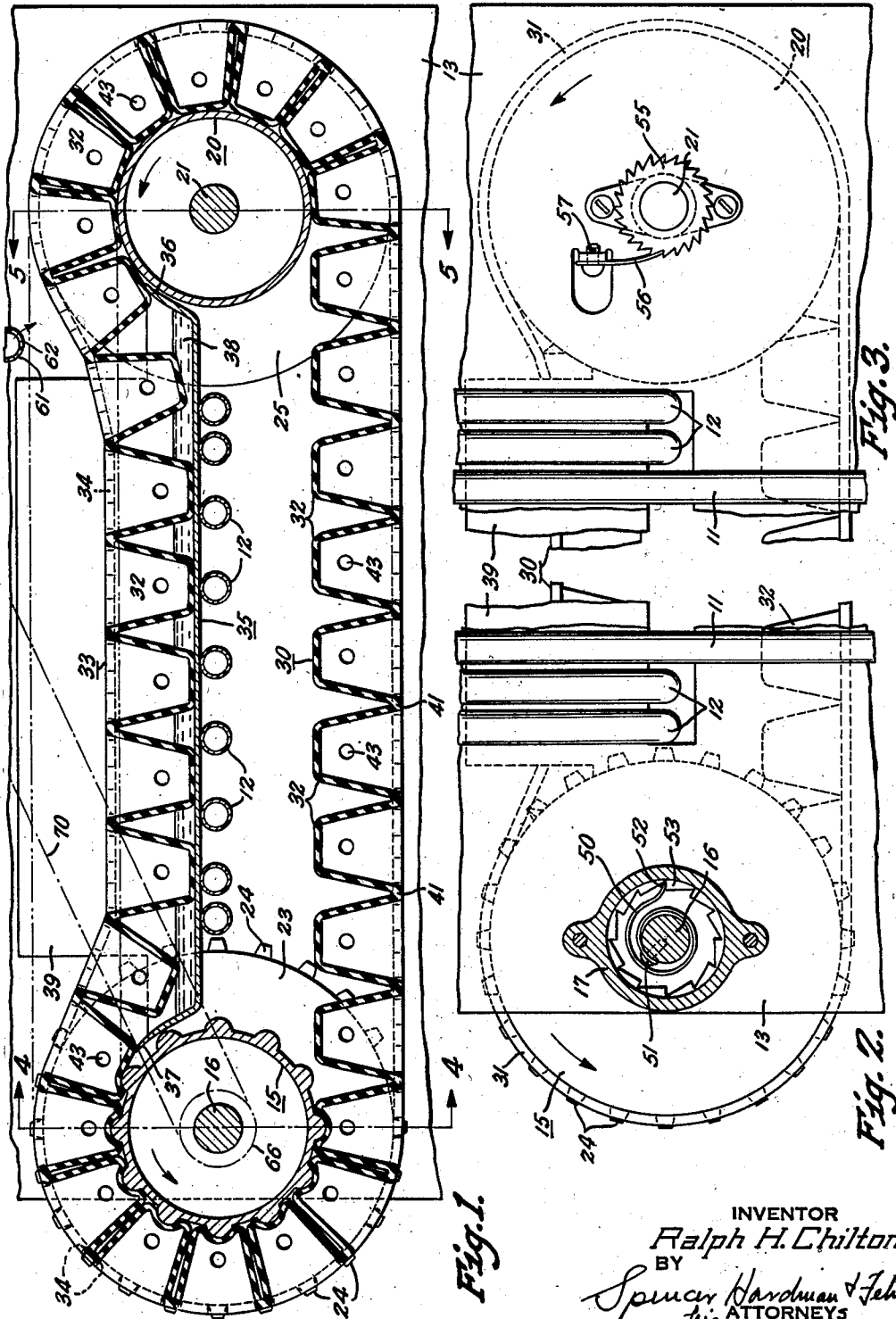
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2,021,047

ENDLESS FREEZING CONTAINER

Filed June 12, 1933

2 Sheets-Sheet 1



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2 Sheets-Sheet 2

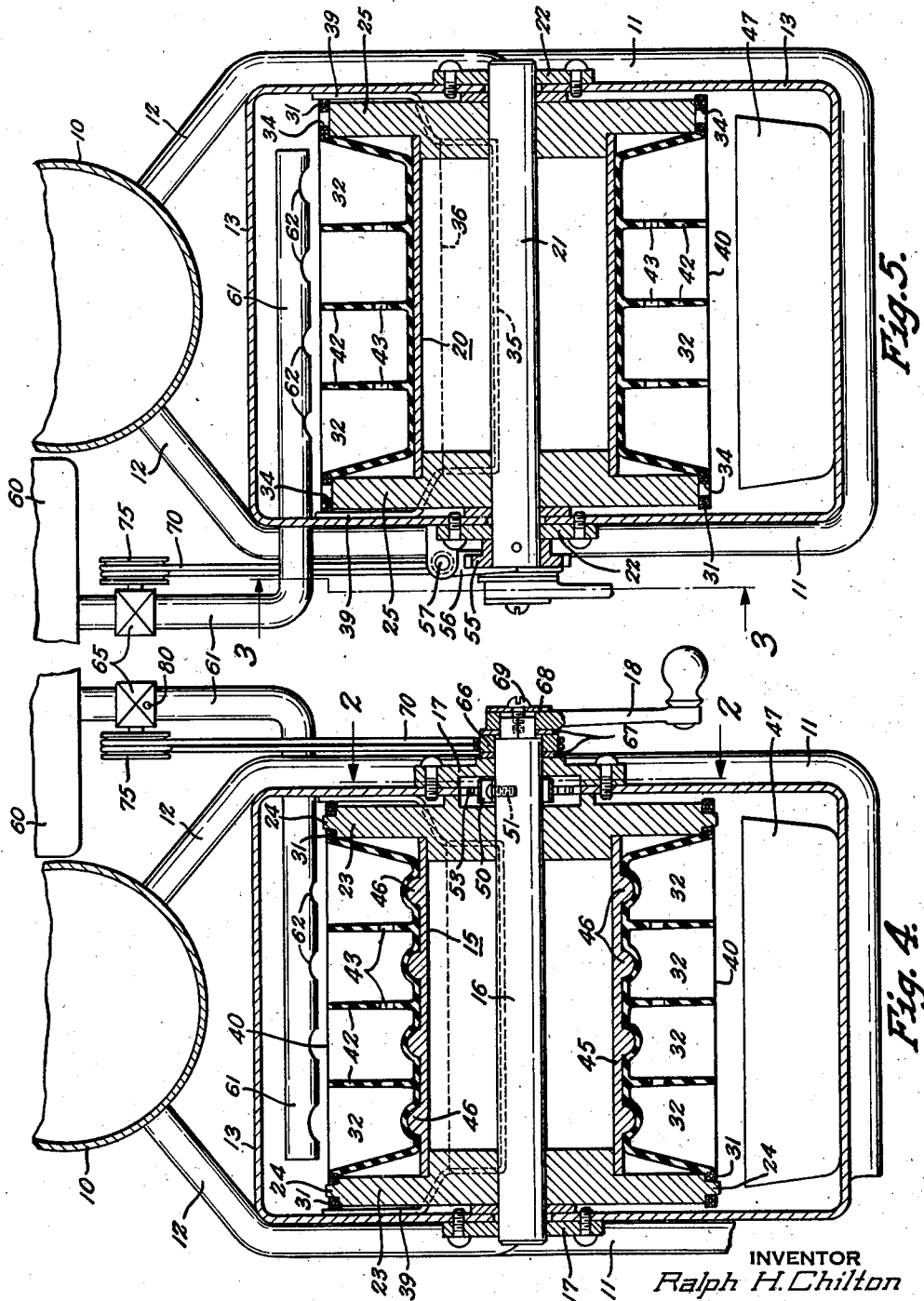


Fig. 5.

Fig. 4.

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ENDLESS FREEZING CONTAINER

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13 Claims. (Cl. 62—108.5)

This invention relates to a freezing container belt and associated means for freezing liquids in a freezing compartment of a refrigerator.

An object of this invention is to provide improvements in a flexible freezing container belt which may be intermittently driven over rotatable rollers, to simplify the filling of the container with the liquid to be frozen, to increase the rapidity of freezing of the liquid contents, and to facilitate the operation of the belt to eject the frozen contents.

This invention comprises various improvements over the disclosure in my copending application Serial Number 577,222, filed November 25, 1931.

A feature of this present invention is the design of the flexible container belt which permits its easy bending around the rollers upon which it is mounted due to the longitudinal spacing of the ice pockets or transverse rows of ice pockets thereon.

Another feature of this invention is the greater rapidity of freezing of the contents of the belt obtained by immersing or at least contacting the lower portions of the filled ice pockets with an anti-freezing liquid such as mercury which covers the refrigerated support for the filled ice pockets.

Another feature of the invention is the avoidance of the great tendency of the filled container to bond to its refrigerated support during freezing of the contents thereof due to an outside collection of frost thereon or from any other cause, and hence the desired intermittent movement of the container belt is greatly facilitated.

Another feature is the improved driving roller for moving the container belt and ejecting the frozen ice cubes without highly distorting or otherwise putting any severe strain upon the flexible rubber or other material of which the flexible belt is made.

Another feature is the automatic mechanism for partially reversing the driving roller upon cessation of the driving operation thereof to restore the desired normal sag to the upper pass of the container belt, whereby the filled pockets are caused to again rest upon the refrigerated support therefor which is covered with the anti-freeze liquid for the purpose mentioned above.

Further objects and advantages of the present invention will be apparent from the following description, reference being had to the accompanying drawings, wherein a preferred embodiment of one form of the present invention is clearly shown.

In the drawings:

Fig. 1 is a somewhat diagrammatic view of the

organization of the invention, showing a longitudinal section of a flexible endless container belt comprising longitudinally separated ice pockets and mounted upon two rollers within a freezing compartment of a refrigerator. The lowered or freezing position of the top pass of the belt is shown in full lines, and the raised or moving position thereof is shown by the dot and dash lines.

Fig. 2 is a view showing the automatic mechanism for reversing the driving roller a partial revolution upon cessation of the driving operation to cause the container belt to sag downwardly into the freezing open-top pan. Fig. 2 is taken on line 2—2 of Fig. 4.

Fig. 3 is a view taken on line 3—3 of Fig. 5 and shows the ratchet mechanism for preventing the reverse turning of the free roller.

Fig. 4 is a section taken on line 4—4 of Fig. 1.

Fig. 5 is a section taken on line 5—5 of Fig. 1.

Similar reference characters refer to similar parts throughout the several views.

10 designates the refrigerant tank having the refrigerant ducts 11 and 12 surrounding the freezing compartment 13 of the cooling unit, which is preferably located in the upper portion of an electric refrigerator in a well-known manner. In the form illustrated, the freezing compartment 13 is an open front metal housing whose metal walls are cooled by the contacting refrigerant ducts 11 and 12 surrounding or partially surrounding same. The flexible freezing container belt 30 of this invention is suitably mounted upon two rollers within the freezing compartment 13.

The front or driving roller 15 is fixedly mounted upon a shaft 16 having bearings 17 suitably supported upon the walls of compartment 13. Roller 15 can be suitably rotated by the small hand crank 18, or by any other desired means.

The rear or free roller 20 is fixed to its shaft 21 which is similarly rotatably mounted upon bearings 22. The roller 15 is provided with two wide end flanges 23 having the sprocket teeth 24 thereon. The rear roller 20 is likewise provided with similar end flanges 25 but preferably without sprocket teeth, as clearly shown in Fig. 5.

The flexible container belt 30 of this invention is suitably mounted upon the two rollers 15 and 20 so that its opposed laterally projecting flanges 31 ride upon the flanges 23 and 25 of the two rollers, while the depending ice pockets 32 thereof fall within the open space between the end flanges. The belt is driven by the sprocket teeth 24 which engage the holes 34 in the flanges 31 of the belt. This container belt 30 is preferably of such length that its upper pass 33 will sag down-

wardly between the two rollers 15 and 20 by gravity when the ice pockets 32 are filled as described herebelow.

An open-top support pan 35 is suitably mounted between the rollers 15 and 20 and at the proper level to provide a suitable refrigerated support for the sagging portion 33 of the container belt. Preferably this pan 35 has at its rear end a curved lip 36 which terminates very closely adjacent the roller 20 (see Fig. 1). Also the front end of pan 35 terminates closely adjacent roller 15 in a curved lip 37, which if desired may be flexible so that it may actually slide upon the rotating roller 15 without serious friction or wear. These lips 36 and 37 of pan 35 are thus made to substantially clear the bottoms of the ice pockets 32 of the flexible belt while it is being moved by roller 15, and so permit the end walls of pan 35 to be higher and thereby retain a greater depth of liquid when this is desired. It obviously also increases the freezing area of pan 35 since the sagging portion 33 of the belt may thereby be given a greater area of contact with the pan or with the anti-freeze liquid 38 contained in the pan 35, as the case may be. Pan 35 preferably has refrigerant ducts soldered or welded in direct contact therewith and, in the form shown in the drawings, pan 35 rests directly upon and is supported by the refrigerant ducts 12 which maintain the pan and the anti-freeze liquid 38 contained therein at the desired cold freezing temperature. This anti-freeze liquid may be any suitable liquid which will not freeze solid at the temperatures used, such as brine of a suitable concentration or various anti-freeze liquids now commonly used in automobile radiators. However it is preferred to use mercury as the liquid 38 since mercury is a liquid metal and an excellent heat conductor and hence will greatly increase the rapidity of freezing of the contents of the ice pockets 32. Also mercury is non-miscible with water and hence any water which condenses and freezes thereupon can be readily removed by removing the ice thus formed on the surface of the mercury. The intermittent operation of the container belt 30 will maintain the mercury 38 substantially clear of such frozen water of condensation as follows: a substantial portion of such ice will stick to the outer sides of the ice pockets 32 and will be removed from the pan 35 as the flexible belt 30 moves over the driving roller 15, whereupon it will break free from the flexible walls of pockets 32 and fall clear of the pan 35. It will be noted that the formation of such condensed ice upon the liquid 38 will be greatly decreased by the substantial prevention of the circulation of air through the air space over this liquid 38. This air space is substantially closed in by the container belt 30 and the upstanding side walls 39 of pan 35 which are formed upwardly and outwardly (as shown in Fig. 5) and lie closely adjacent the outer edges of the flanges 31 of the belt 30 when it is in either its raised or sagged position (as shown in Fig. 1).

The flexible container belt 30 is preferably made of soft flexible rubber and may be integrally molded in a single straight length and then have the two ends thereof joined together to form the endless belt disclosed in Fig. 1. The two ends of the belt may be joined together in any suitable manner at the joint between two transverse rows of pockets 32, such as by providing intermeshing projections on the two ends of the molded belt having aligned holes therein and then inserting a small metal pin through said aligned holes ex-

tending transversely of the belt. Preferably the side flange portions 31 of the belt are reinforced with substantially non-extensible fabric cords (see Figs. 4 and 5) extending longitudinally of the belt, whereby the tension strength of said flange portions 31 is greatly increased without materially reducing the flexibility thereof. The holes 34 in these flanges 31 for the sprocket teeth 24 are preferably molded therein, but if desired they may be cut therein after the belt is molded to the form shown. The ice pockets 32 are molded in transverse rows 40 which are connected together at their top portions by the transverse flexible rubber webs 41. Each row 40 is divided into the separate pockets 32 by the partitions 42. The bottom portions of the pockets 32 taper inwardly sufficiently so that when the belt passes around the rollers 15 and 20 suitable clearance will be provided for these pockets 32 when they close in toward each other, as clearly shown in Fig. 1. The container belt 30 will thus bend very easily around rollers 15 and 20 since the pockets 32 themselves are not distorted by such bending. The tension strength of the belt lies in the substantially non-extensible flanges 31 and the belt is driven by the engagement of these flanges with the sprocket teeth 24 of driving roller 15. The drum portion 45 of roller 15 is preferably provided with small rounded projections 46 so arranged as to flex upwardly the bottom of each pocket 32 as it passes around the roller 15 and thus aid in loosening and ejecting the frozen ice cube therefrom. When the pockets 32 pass around roller 15 and are thereby turned upside down the ice cubes 33 will fall therefrom into the ice storage container 47 or any other suitable receptacle. This action will be aided by a sagging of the lower pass of belt 30 (not shown), which sagging will tend to slightly expand the pockets 32 and so facilitate the dropping of the ice cubes therefrom if they have not dropped out prior to reaching that point.

When roller 15 is rotated by the hand crank 18 the upper pass 33 of belt 30 is put under tension and is partially or entirely lifted from the pan 35 and the liquid 38 contained therein. This permits the liquid 38 to drain off the pockets 32 and reduces the possibility of any anti-freeze liquid being dragged or carried over the roller 15 with the belt. As soon as a few or all of the ice cubes have been removed from the belt, as described above, the roller 15 is preferably reversed a partial revolution to positively cause the upper pass 33 of the belt to resume its sagged position within the freezing pan 35.

An automatic device is shown for providing such reversal of roller 15 (see Figs. 2 and 4). A flat coil spring 50 has one end thereof fixed to shaft 16 by screw 51 and its other end 52 projecting outwardly and constituting a friction pawl which rides over a surrounding internal stationary ratchet 53 whose teeth so engage the pawl 52 as to maintain the coil spring 50 wound up to the desired tension during the time roller 15 is being rotated by crank 18 in the direction shown by the arrow in Fig. 2. Now as soon as the crank 18 is released the coil spring 50 will unwind, the pawl 52 being then held stationary by friction upon the ratchet 53, and hence the shaft 16 will be turned backwards a partial revolution to cause the belt 30 to again drop down upon its support pan 35. During this reverse movement of a portion of the belt 30 the rear roller 20 is kept from reversing by any suitable ratchet mechanism. Such a ratchet mechanism

is shown in Fig. 3. The ratchet wheel 55 is fixed to the projecting end of shaft 21 (see Fig. 5). A stationary spring pawl 56 is fixed to a lug or other support on the metal wall 13 by the screw 57. Thus roller 20 is permitted to rotate only in the direction shown by the arrow in Fig. 3 and hence this will cause all the slack in the belt 30 to be given to the upper pass 33 thereof when the front roller 15 is reversed.

Each transverse row 40 of pockets 32 is filled through the pipe 61 from the cold water tank 60 mounted above the belt and preferably so located with one side thereof adjacent the cooling unit that the cold water will be supplied therefrom to the container belt at a temperature near its freezing point. The water enters each pocket through the graduated holes 62 and will level itself in all the pockets of a transverse row 40 through the holes 43 in the partitions 42 (see Fig. 5). Pipe 61 has a valve 65 suitably located therein for controlling the supply of cold water to the ice pockets 32.

This water supply valve 65 may be hand operated if desired, but preferably it is automatically controlled by the movement of the belt 30 in such manner that the pockets 32 will be properly filled with water as they pass the exit holes 62 in pipe 61. Such an automatic device is illustrated in the drawings (see Fig. 4). The driving shaft 16 has a small drum 66 rotatably mounted thereupon between two friction collars 67 which rotate with shaft 16. The crank handle 18 is pressed against the outer friction collar 67 by the washer 68 and screw 69. By simply adjusting screw 69 there can be obtained the desired amount of friction upon drum 66 to cause it to move with shaft 16 until its motion is arrested by tension of the wire belt 70, which extends around drum 66 one or more turns and is preferably fixed thereto at the central point of its contacting length. A similar wire belt drum 75 is fixed to the valve stem 76 of valve 65 for opening and closing valve 65. Wire belt 70 extends one or more turns around drum 75 and may be fixed thereto at the center of these turns to prevent its possible slipping on the drum 75. It is thus seen that rotation of drum 66 will open or close the water supply valve 65 depending upon its direction of rotation. When roller 15 is rotated in the direction shown by the arrow in Fig. 1 to move the container belt 30 thereover, its first motion will open valve 65 by means of the wire belt 70, and its continued motion will simply cause drum 66 to slip frictionally upon the friction collars 67. However immediately upon the release of crank 18 and the reversal of rotation of roller 15 (as described in detail above) the drum 66 will be rotated in its other direction and immediately close the water supply valve 65. Thus it is seen that by the time the slack in the upper pass of belt 30 is taken up by rotation of roller 15 the valve 65 will have been opened and water will be flowing freely through the exit holes 62 to fill the pockets 32 as they begin to move past this point. This time element for taking up the slack in belt 30 is of importance since some time is required for the water to flow to the exit holes 62 from the valve 65 which must be positioned far enough away from the freezing compartment 13 to prevent freezing of the water in pipe 61. After valve 65 is closed the water in the lower end of pipe 61 will drain out, a suitable vent 80 being provided for this purpose, and hence there will be no water in the lower end of pipe 61 to freeze and clog up

the pipe. Preferably the pipe 61 is made of hard rubber or other poor heat-conducting material so that cold (so to speak) will not be conducted up the pipe and cause the valve 65 to freeze up. Valve 65 should be located at a point in the refrigerator where air well above freezing point circulates freely therearound at all times. Since valve 65 is actuated by a flexible wire cable 70 it will be a simple matter to locate valve 65 at the most desirable location and lead the wire 10 belt 70 thereto by small guide pulleys. It is to be understood that the automatic mechanism shown in the drawings for actuating valve 65 is more or less diagrammatic.

While the form of embodiment of the present invention as herein disclosed, constitutes a preferred form, it is to be understood that other forms might be adapted, all coming within the scope of the claims which follow.

What is claimed is as follows:

1. In a refrigerator having a freezing chamber, a freezing device, comprising: two rotatable rollers, a flexible container belt mounted upon said rollers so as to pass through said freezing chamber, said container belt having a series of ice pockets connected together adjacent their upper portions and having their bottom portions spaced from each other in a direction longitudinally of said container belt, whereby the passing of said belt around said rotatable rollers is facilitated.

2. In a refrigerator having a freezing chamber, a freezing device, comprising: two rotatable rollers, a flexible container belt mounted upon said rollers and arranged to be movable through said freezing chamber, said container belt having a series of transversely extending rows of ice pockets, said rows being connected together adjacent their upper portions and having their lower portions spaced from each other in a longitudinal direction, whereby the lower portions of said transverse rows of pockets may move closer together when said container belt passes around said rollers.

3. In a refrigerator having a freezing chamber, a freezing device, comprising: two rotatable rollers, a flexible container belt mounted upon said rollers and arranged to be movable through said freezing chamber, said container belt comprising a series of longitudinally spaced ice pockets flexibly attached to each other adjacent their upper open-top portions so that said ice pockets may move mutually closer together when said container belt passes around said rollers, whereby the passing of said belt around said rollers is facilitated.

4. In a refrigerator, in combination, a freezing chamber having therein an open pan containing an anti-freezing refrigerated liquid, a rotatable roller mounted at each end of said open pan, a flexible container belt having ice pockets therein and mounted upon said rollers in such manner that the upper pass of said belt normally sags downwardly until the bottoms of the ice pockets thereon are immersed in the refrigerated liquid in said pan, said belt drivingly engaging one of said rollers, means for intermittently rotating the driving roller whereby said container belt is moved around said rollers, and means for reversing said driving roller upon cessation of the driving operation to restore the normal sag of the upper pass of said belt.

5. In a refrigerator, in combination, a freezing chamber having a refrigerated support therein comprising an open pan containing an anti-freezing liquid, a driving roller mounted adjacent

one end of said support, a second roller mounted adjacent the opposite end thereof, a flexible container belt comprising ice pockets and mounted upon said rollers and having its upper pass normally sagging downwardly and resting by gravity upon said pan support during freezing of the contents thereof, means for intermittently rotating said driving roller to move said belt thereover, said driving roller being so positioned relative to said pan support that said container belt is partially lifted from said pan support by tension thereupon upon the operation of said driving roller, and means for reversing said driving roller upon cessation of the driving operation to restore the normal sag to the upper pass of said belt.

6. In a refrigerator having a freezing chamber, a freezing device, comprising: two rotatable rollers, a flexible container belt mounted upon said rollers and arranged to be movable through said freezing chamber, said container belt having a series of transversely extending rows of ice pockets, said rows being connected together adjacent their upper portions and having their lower portions spaced from each other in a longitudinal direction whereby the lower portions of said transverse rows of pockets may move closer together when said container belt passes around said rollers, a single supply duct extending transversely of said belt for filling each transverse row of pockets as it passes thereunder, a control valve in said duct, and means associated with one of said rollers for actuating said control valve.

7. In a refrigerator having a freezing zone, a freezing device, comprising: a rotatable means, a container belt drivingly engaging said means and arranged to be movable through said freezing zone, said container belt comprising an upper flexible tension portion and a series of longitudinally spaced ice pockets depending therefrom when in water-retaining position and secured thereto, and means for rotating said rotatable means to move said container belt through said zone.

8. In a refrigerator having a freezing zone, a freezing device, comprising: a flanged rotatable roller, a container belt mounted upon said roller and arranged to be movable through said freezing zone, said container belt comprising a flexible tension portion and a series of ice pockets depending therefrom when in water-retaining position and secured thereto, said flexible tension portion drivingly engaging a flange on said roller, and means for rotating said roller to cause same to drive said container belt through its engagement with said flexible tension portion thereof.

9. In a refrigerator, in combination, a freezing zone having therein an open pan containing an anti-freezing refrigerated liquid, a rotatable roller mounted adjacent each end of said open pan, a flexible container belt having depending ice pockets and mounted upon said rollers in such manner that the upper pass of said belt normally sags downwardly until the bottoms of the ice pockets depending therefrom contact the refrigerated liquid in said pan, said belt drivingly engaging one of said rollers, and means for intermittently rotating the driving roller whereby said container belt is moved around said rollers.

10. In a refrigerator, in combination, a freezing zone having a refrigerated support therein comprising an open pan containing an anti-freezing liquid, a driving roller mounted adjacent one end of said support, a second roller mounted adjacent the opposite end thereof, a flexible container belt comprising depending ice pockets and mounted upon said rollers and having its upper pass normally sagging downwardly by gravity until said depending ice pockets contact said anti-freezing liquid during freezing of the contents thereof, means for rotating said driving roller to move said belt, said driving roller being so positioned relative to the surface of said anti-freezing liquid that said container belt tends to be lifted therefrom by tension thereupon upon the operation of said driving roller.

11. In a refrigerator having a freezing zone, a freezing device comprising: a stationary refrigerated metal support in said freezing zone, a rotatable roller mounted adjacent said refrigerated support, a movable flexible container having ice pockets therein and drivingly engaging said roller, said movable container being supported so that its upright portion normally sags downwardly until it contacts said refrigerated support during freezing of its contents while said container is stationary, and means for rotating said driving roller to move said container, said driving roller being so positioned relative to said refrigerated support that its driving action upon said container simultaneously moves said container and lifts it from said metal support.

12. In a refrigerator having a freezing chamber, a freezing device comprising two rotatable rollers, a flexible container belt mounted upon said rollers so as to pass through said freezing chamber, said container belt having a series of ice pockets connected together adjacent their upper portions and having their bottom portions spaced from each other in a direction longitudinally of said container belt, whereby the passing of said belt around said rotatable rollers is facilitated, a water supply duct extending to a point adjacent said pockets, a control valve in said duct, means associated with one of said rotatable rollers for opening said valve during movement of said belt, and means associated with one of said rotatable rollers for closing said valve substantially concurrently with the stopping of the movement of said belt.

13. In a refrigerator having a freezing chamber, a freezing device comprising two rotatable rollers, a flexible container belt mounted upon said rollers so as to pass through said freezing chamber, said container belt having a series of ice pockets connected together adjacent their upper portions and having their bottom portions spaced from each other in a direction longitudinally of said container belt, whereby the passing of said belt around said rotatable rollers is facilitated, a water supply duct for filling said ice pockets, a control valve in said duct, means rendered effective by movement of said belt for opening said valve, and means rendered effective by the stopping of the movement of said belt for closing said valve.

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