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REFRIGERATION SYSTEM

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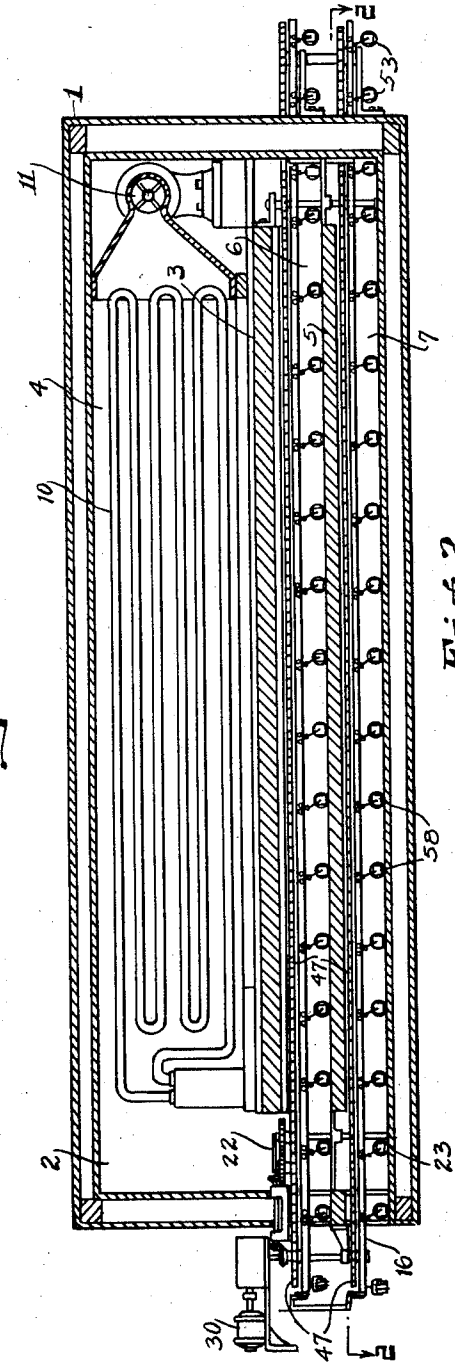


Fig. 1.

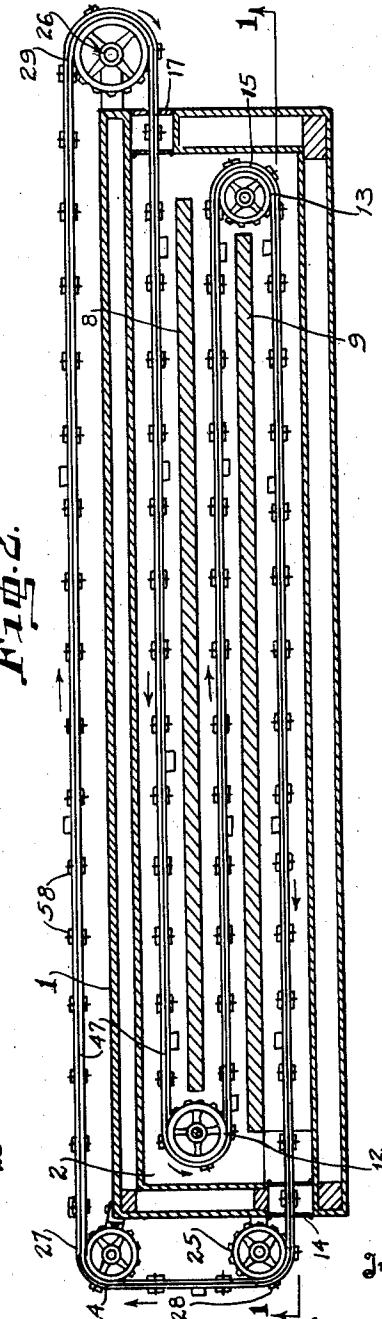


Fig. 2.

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Fig. 3.

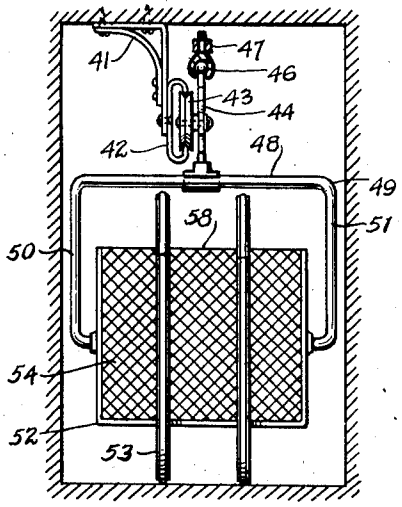


Fig. 4.

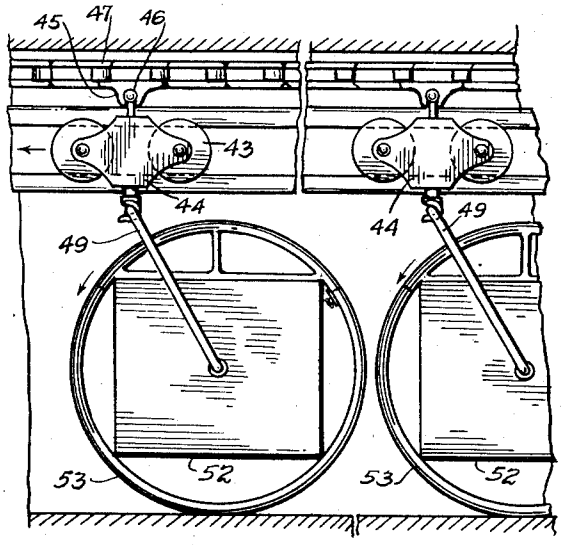


Fig. 5.

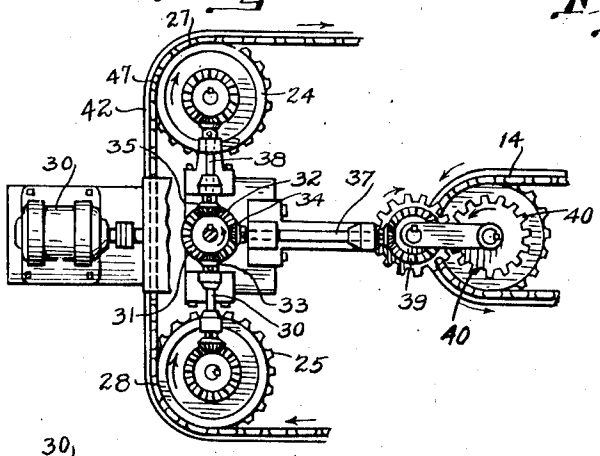


Fig. 7.

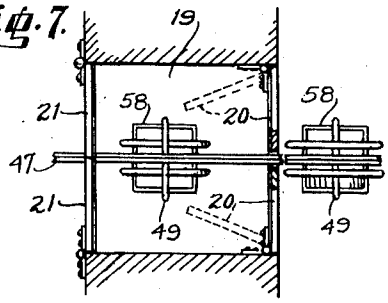
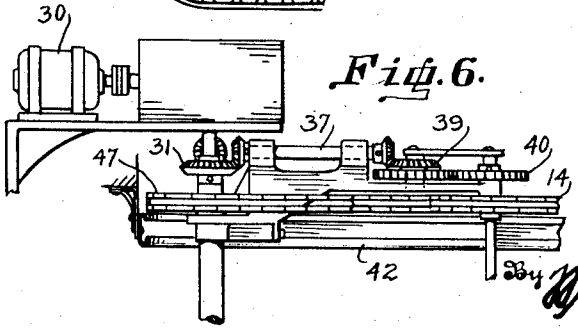


Fig. 6.



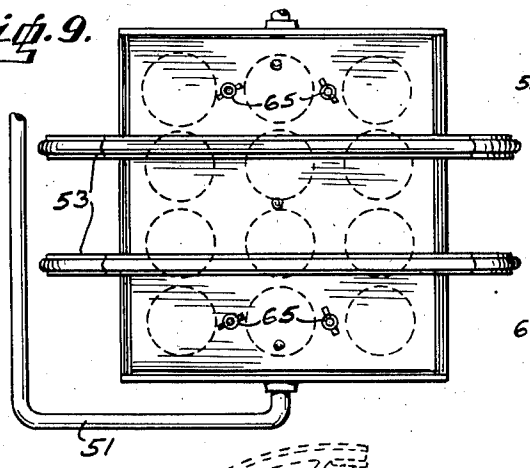
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REFRIGERATION SYSTEM

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Fig. 9.



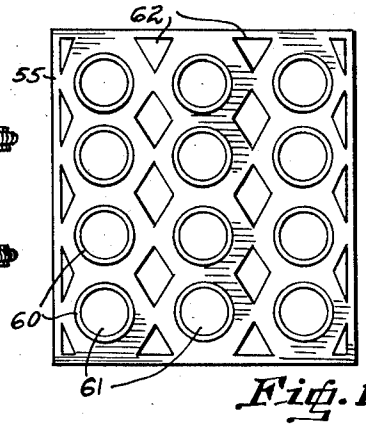


Fig. 13

Fig. 8.

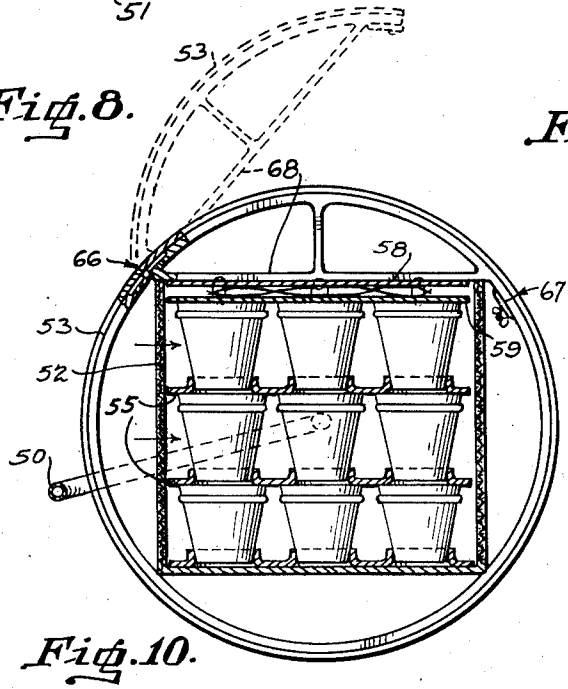


Fig. 10.

Fig. 12

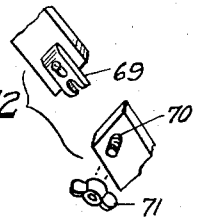
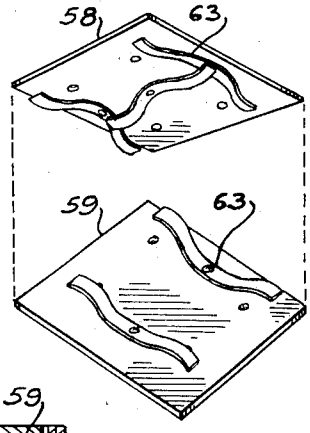
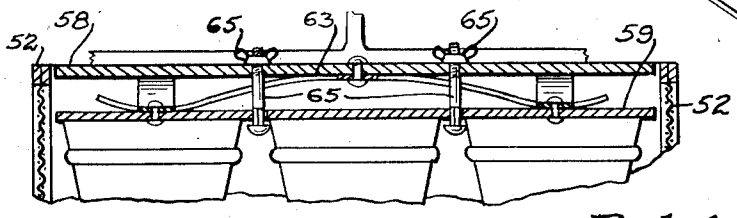


Fig. 11.





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Patented Feb. 27, 1934 1,948,790

UNITED STATES PATENT OFFICE

1,948,790

REFRIGERATION SYSTEM

Ralph V. Grayson, Atlanta, Ga., assignor of fifty per cent to E. G. Ballenger, C. M. Foster, and F. M. Bird, all of Atlanta, Ga., as organizers and incorporators of Refrigeration Patents and Processes, Inc., a corporation to be organized under the laws of Georgia

Application September 10, 1930
Serial No. 480,997

9 Claims. (Cl. 62—104)

This invention relates to refrigeration, and particularly to the fast freezing of food stuffs by passing them for the required freezing period through refrigerated chambers or tunnels.

Although the invention may be successfully practised in relation to any refrigeration system of the type indicated, it is particularly designed to be employed in connection with the refrigeration system disclosed and claimed in my application for patent Number 442,834, in which a closed circulation of air or gas is maintained through a battery of tunnels arranged in multiple and adapted to be brought collectively, singly, or in any number into series communication, forming a path or paths of suitable length to carry out the refrigerating operation, the air or gas being itself refrigerated through contact with the evaporation element of Carnot cycle refrigerating unit.

One of the objects of the invention is the construction of apparatus embodying the principles of the invention.

Another object of the invention is the provision of a novel refrigeration process.

Other objects of the invention will appear as the following description of the illustrative embodiment thereafter proceeds.

In the drawings in which the same characters of references are used throughout the several figures to denote identical parts, Figure 1 is a longitudinal vertical section, largely diagrammatic, through the refrigeration system, embracing the principles of the present invention.

Fig. 2 is a longitudinal, horizontal section.

Fig. 3 is a cross-section of one of the tunnels on an enlarged scale, showing one of the conveyor baskets.

Fig. 4 is a horizontal section taken along the line 4—4 of Fig. 3.

Fig. 5 is a view in elevation of an exemplary form of variable speed drive.

Fig. 6 is a side elevation of the same drive.

Fig. 7 is a horizontal section through the receiving end of one of the tunnels, showing the flapper doors.

Fig. 8 is a side view of a basket for holding the filled receptacles while in the process of freezing;

Fig. 9 is a plan view of the same;

Fig. 10 is a vertical section on an enlarged scale showing the resilient filler associated with the lid of the basket;

Fig. 11 is an exploded view of the two plates with associated springs which constitute the filler and lid;

Fig. 12 is a detail in perspective showing the means for securing the hinged segment of the rim in place; and

Fig. 13 is a plan view of the perforate bottom of one of the trays.

Referring in detail to the several figures, the numeral 1 represents walls enclosing a chamber 2. This chamber is provided with a longitudinal partition 3, forming an upper air refrigerating tunnel 4, while a lower horizontal partition 5 divides the spaces beneath the air refrigerating chamber into upper and lower levels of tunnels 6 and 7. It will be noted from Fig. 2 that there are also vertical longitudinal partitions 8 and 9 arranged beneath the air refrigerating chamber, defining with the horizontal partition 5, a plurality of tunnels in each tier or level. The vertical and horizontal partitions all fall short of meeting the end walls of the chamber 2 so that a space for the circulation of refrigerated air or gas is provided. The frigid fluid descending from the air refrigerating chamber at one end by convection, circulates longitudinally through the tunnels and then when somewhat less frigid passes upwardly again into the air refrigerating chamber at the opposite ends of the tunnels. A Carnot cycle refrigeration system is arranged in the air refrigerating chamber, the heat exchanging element of which is contituted by the coils 10, while a blower 11 accelerates the convection flow of refrigerated air or gas through the system.

Fig. 2 shows that the vertical partitions 8 and 9 are slightly staggered in order to make room at one end of each of the said partitions for the conveyor shafts 12 and 13 and their respective sprockets, 14 and 15.

In the exemplary embodiment of the invention, as shown, the end walls of the chamber 2 are provided in line with one end of each of the tunnels with a receiving opening 16, and a delivery opening 17. These openings are guarded by air traps which are shown somewhat diagrammatically in Figure 7, each trap consisting of a chamber 19, defined at its opposite ends by pairs of swinging flapper doors 20 and 21, hinged at opposite sides of said openings and having their edges meet when the doors are in transverse position, closing the chamber 19. The doors are maintained in closed position by spring means and when they are engaged by the object upon the conveyor, they are opened by said object to a position somewhat as indicated in the dotted lines in Figure 7, one pair of the doors closing before the other pair begins to be opened. In this way,

little or none of the refrigerated air or gas escapes at the points of entrance and emergence of the conveyor.

In Figure 1, the conveyor is shown as having upper and lower flights 22 and 23 corresponding to the upper and lower levels of the tunnels and the conveyor follows a sinuous circuit from one tunnel laterally into the next tunnel and then laterally into the third tunnel, and, finally, to the delivery point which is outside of the chamber 2. The conveyor is of the endless type and while it is travelling outside of the tunnels opportunity is given for taking off the frozen product for storage and placing on the conveyor fresh products to be frozen.

At those points outside of the refrigerated chamber, at which the conveyor changes its direction of travel, it is supported on suitable shafts 24, 25 and 26, furnished with corresponding sprockets 27, 28 and 29. The conveyor is driven by any desired type of prime mover, such as electric motor 30, which motor is connected with variable speed drive 31 of any suitable construction and from which the power is transmitted to the conveyor. On account of the length of the conveyor, it is desirable, in order to avoid undue strain, to transmit the drive separately to the conveyor at a number of points. Figure 5 shows an arrangement for accomplishing this purpose, consisting of a bevel gear 32 driven from a variable speed drive in and carried by means of pinions 33, 34 and 35, with stub shafts 36, 37 and 38, respectively, which in turn mesh with bevels by which the sprockets 14, 27 and 28 are rotated. An idler 39 is superposed in the driving connection between the stub shaft 37 and the gear 40, which drive the sprocket 14, the purpose of this idler being to reverse the direction of rotation of the sprocket 14 which otherwise would oppose the direction of travel of the conveyor imparted to it by the sprockets 27 and 28.

It is to be understood that the type of drive as shown, and its driving connections to the conveyor are merely suggestive and by no means to be considered limitative of the scope of the invention.

The details of the conveyor may be gathered from reference to Fig. 3 and Fig. 4, in which it will be noted that the tunnels are provided with brackets 41 fixedly supported and carrying a suitable track 42 in which rollers 43 are supported and retained. The rollers are connected in pairs by a carriage 44, to which they are pivotally mounted and which carriage has a ball connection 45 is fitted in a suitable socket 46 in a link 47. The links 47 are especially constructed, as shown, with reference to the carriage, but the intervening links 47', between successive carriages are of ordinary construction, being adapted merely to embrace the teeth of the several sprockets about which the conveyor passes. The carriage 44 through an intermediary of the ball connection 45 supports the conveyor chain against catenary deflection.

A frame 48 is pivotally mounted at the lower end of each of the carriages by means of the link 49, each frame comprising bifurcated arms 50 and 51, pivotally connected to opposite sides of the basket or carrier 52 along an axis which preferably passes through the center of gravity of the basket when filled with the packaged products to be frozen. The baskets 52 are provided with rims or tires 53 mounted in vertical planes and suitably secured to said baskets. Said rims or tires tractively engage the floors of the tunnels so that while the conveyor travels horizontally, the baskets rotate about the horizontal axis, the packages of frozen foods being repeatedly overturned during the traverse of the conveyor through the tunnels. Over-turning of the freezing products prevents settling of solid bodies in the syrup or juice by which they may be surrounded, and therefore produces homogeneous freezing and distribution of the constituents of the frozen products, and, especially in the case of fruit juice such as orange or grape-fruit, sedimentation during the freezing process is thus avoided.

The baskets 52 are loaded with trays filled with packages 54 of the food stuff while the conveyor is outside of the freezing chamber, and at the point of filling, the track 42 may be discontinuous so that the frame 48, together with the basket, may be swung around at right angles to its normal position by virtue of the ball connection 45 for ease in filling.

Trays 55 are preferably provided, which can be filled with the packages at a convenient distant point and then placed in the baskets which may be constructed to receive the trays at one side, the limbs 50 and 51 being detachably connected for this purpose. It is obvious that the packages in the baskets must be kept immovable in view of the over-turning process, and consequently it is preferred to construct the trays so that the packages will be positively held in place. To this end, the trays are preferably made of sheet metal having punched up annular flanges 60 surrounding apertures 61 of such size as to snugly receive the bottom portions of the receptacle. It is obvious that the bottoms of the receptacles are thus freely exposed to the refrigerated air circulating through the baskets. The trays are formed with additional perforations 62 ensuring free circulation of refrigerated air through the inter-tray spaces.

The lid 58 of the receptacle is preferably provided on its under-side with a filler plate 59, connected to said lid by means of springs 63 which normally tend to bias said lid and plate apart. The extent to which the lid and filler plate may extend are controlled by means of bolts 64 provided with thumb nuts 65. When the lid together with the filler plate, is in place, the filler plate presses upon the top layer of the receptacles firmly holding the whole body of the receptacles immovably in the basket. To permit filling of the basket, a part of each of the rims 53 is hinged as indicated at 66 and severed at 67, so that the hinged portion 53 may be lifted out of the way giving free access to the basket through the top. When the hinged portions 53 are restored to their normal circumferential position the chordate portions 68 thereof press upon the lid, holding it firmly in place and serving as an abutment for the reaction of the filler plate 59. The hinged portion is held in place by means such as the slotted lug 69 and the stud 70 which enters into said lug, the parts being maintained in position by means of the thumb nut 71.

It is to be understood that the details of construction of the basket and its appurtenant parts may be varied to suit the exigencies of use. The packages may be of metal although the invention contemplates the use of paper packages having lids of the same material.

Since the operation of the apparatus has been described in connection with the construction of its several features, it is obvious without further description, that when the filled baskets are returned to the conveyor and properly oriented

relative to the track, the conveyor is set into operation and the baskets travel through the air traps at the ends of the chamber 2 and serially through the several tunnels, there being a separate conveyor for each level, and the conveyor being driven simultaneously, and from a common driving source. The speed of the conveyor is determined with relation both to the aggregate length of the tunnels at even the level and with respect to the temperature of the refrigerated air, so that when the baskets emerge from the delivery end of the apparatus, the packages therein contained are fully frozen.

It is to be understood that none of the structural detail in the foregoing description should be considered limitative upon the invention, as claimed, except where such limitation is compelled by the state of the prior art.

What I claim as my invention is:

1. Refrigeration system comprising, means defining a conduit for the re-current circulation of refrigerated air, said means including a tunnel, and an endless conveyor for the product to be frozen, having a portion thereof travelling longitudinally within said tunnel, of such length and travelling at such speed as to effect the requisite freezing during the sojourn of said product within said tunnel, said conveyor including means cooperating with a wall of said tunnel for repeatedly overturning the product to be frozen during its progress within said tunnel.

2. Refrigeration system comprising, a tunnel for refrigerated air, a conveyor travelling longitudinally through said tunnel, a receptacle for the product to be frozen, carried by said conveyor, and means responsive to the longitudinal movement of said conveyor cooperating with a wall of said tunnel for revolving said receptacle about a horizontal axis while it is being conveyed through said tunnel.

3. Refrigeration system comprising, a tunnel for refrigerated air, a conveyor travelling longitudinally through said tunnel, a receptacle for the product to be frozen, carried by said conveyor, and means associated with said receptacle and rolling along the floor of the said tunnel responsive to the longitudinal movement of said conveyor for revolving said receptacle about a horizontal axis as it is being conveyed through said tunnel.

4. In a refrigeration system means forming a tunnel for refrigerated air, a chain conveyor travelling longitudinally within said tunnel, a track within said tunnel extending substantially parallel to said conveyor, carriages mounted on said track connected to said conveyor, baskets suspended from said carriages and rolling means fixed with respect to said baskets, engaging the floor of said tunnel for overturning said baskets when the latter are drawn by said conveyor.

5. In a refrigeration system, means forming a tunnel for refrigerated air and a chain conveyor travelling longitudinally within said tunnel, a track within said tunnel extending substantially parallel to said conveyor, carriages mounted on said track connected to said conveyor, baskets, means forming a ball and socket joint by which the baskets are suspended from said carriages, and rolling means fixed with respect to said baskets engaging the floor of said tunnel for overturning said baskets when the latter are drawn by said conveyor.

6. In a refrigeration system, means forming a tunnel for refrigerated air and a chain conveyor travelling longitudinally within said tunnel, a track within said tunnel extending substantially parallel to said conveyor, carriages mounted on said track, rigid means connecting said carriages to said conveyor to maintain the latter in a plane, baskets suspended from said conveyor and rolling means fixed with respect to said baskets, revoluble about the axis, passing substantially through the center of gravity of said baskets and engaging the floor of said tunnels for overturning said baskets when the latter are drawn by said conveyor.

7. In a refrigeration system in combination with a substantially horizontally travelling conveyor, a basket drawn by said conveyor by means connected to said basket substantially at a horizontal axis passing through its center of gravity, and circular means encompassing said basket in a vertical plane and cooperating with a wall of said tunnel for causing it to revolve about said horizontal axis when drawn by said conveyor.

8. A basket for over-turning packaged products during a freezing process comprising a receptacle, rolling means encompassing said receptacle in a vertical plane, a lid for said receptacle, said rolling means having a hinged section above said lid permitting removal of said lid when said section is open and holding said lid closed when said section is shut.

9. A basket for over-turning packaged products during a freezing process as claimed in claim 8, including a plurality of superposed trays and a resilient filler reacting between said lid and the packaged products upon said trays for maintaining the whole in unitary relation.

RALPH V. GRAYSON.