Sept. 8, 1931. C. BIRDSEYE 1,822,124

REFRIGERATING APPARATUS

Original Filed Feb. 6, 1929

Fig. 1.

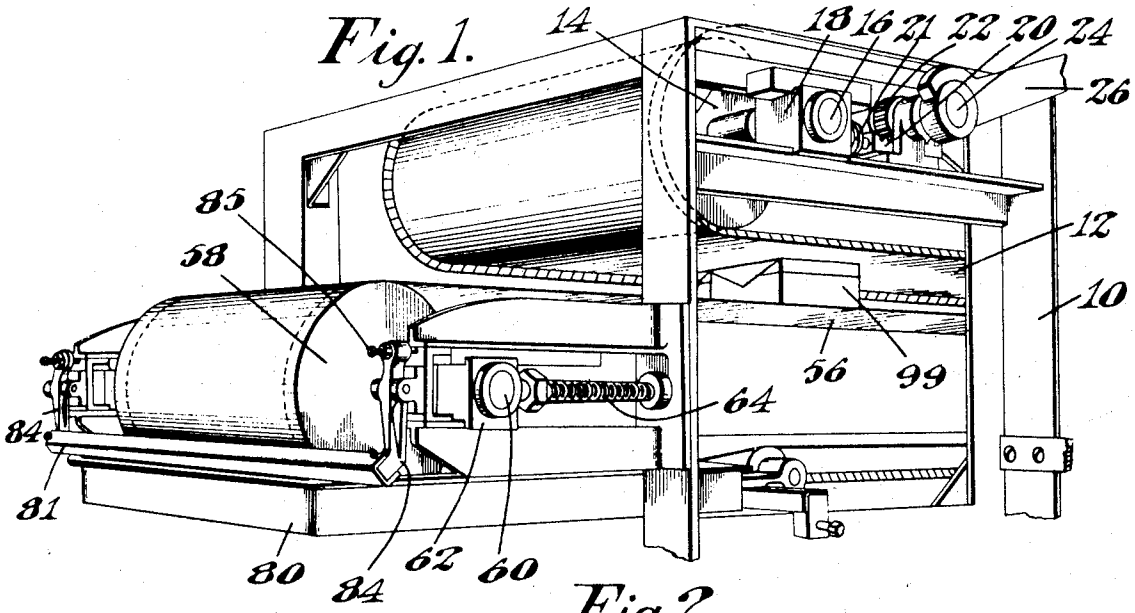


Fig. 2.

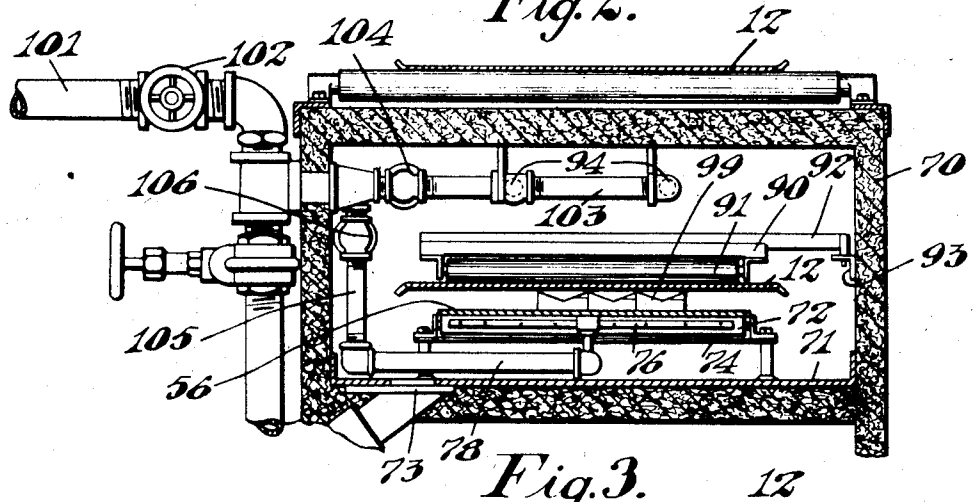


Fig. 3.

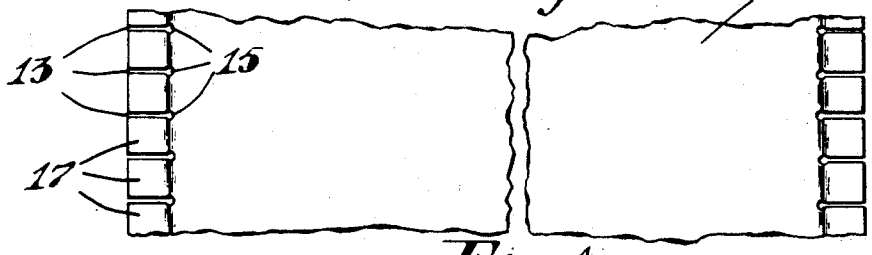


Fig. 4.



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UNITED STATES PATENT OFFICE

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REFRIGERATING APPARATUS

Original application filed February 6, 1929, Serial No. 337,858. Divided and this application filed December 31, 1929. Serial No. 417,694.

This invention relates to refrigerating apparatus of the type used for freezing, quick-freezing or chilling food products of various kinds, and more particularly to that type of apparatus adapted to operate continuously and in which a conveyor band is employed both to carry the product to be refrigerated and as a heat-conducting medium.

In one aspect this invention consists in improvements in the construction and general organization of conveyors employed in refrigerating apparatus and in an improved manner of combining a conveyor with a system for circulating a fluid refrigerating medium. In another aspect it consists in improvements in the construction of sheet metal conveyor bands. Where one conveyor band is arranged above another and the heat interchange effected by a direct application to the bands of a temperature-controlling medium, such as cold brine, it is important to prevent the brine from in any way reaching the product carried by or between the bands, or from coming into contact either with the lower side of the upper band or the upper side of the lower band where the product is located. Further, the bands must be so constructed as to withstand continuous bending without cracking or breaking when used in the form of an endless conveyor and flexed repeatedly over supporting rollers.

I have found that brine may be kept within the necessary bounds by deflecting the marginal edge of the upper band in such a manner as to direct the brine away from the product beneath it. An important feature of my invention, therefore, consists in a metallic band guided to travel substantially in the plane of its surface and having its marginal edge deflected out of said plane. This may be effected in any desired manner, either temporarily throughout a portion of the path of the band or by shaping the band permanently in such manner as to provide an integral deflected portion, or a series of deflected portions.

The continuous flexing of the band over its supporting rollers, particularly where the band is maintained at a relatively low temperature, has a tendency to cause cracks to start at the edge of the band which eventually cause it to break down. This tendency is intensified in a band having a deflected edge or edges and the band is rendered objectionably stiff against longitudinal bending. In accordance with another feature of the invention, the life of the band is prolonged and its flexibility improved by the provision of transverse slits in its edge forming between them a series of separated tabs. Preferably, and as herein shown, the slits are of appreciable width and terminate in rounded perforations which act to prevent concentration of stress at the base of the slits and so still further relieve the material of the band.

These and other features of the invention will be best understood and appreciated from the following description of a preferred embodiment thereof, selected for purposes of illustration and shown in the accompanying drawings, in which

Fig. 1 is a view in perspective of a portion of the apparatus seen from the receiving end;

Fig. 2 is a view in vertical section of an intermediate part of the apparatus, showing the arrangement of temperature-controlling fluid jets;

Fig. 3 is a plan view, on a larger scale, of a portion of one of the upper conveyor bands; and

Fig. 4 is a view in cross section of the same band.

The invention is herein illustrated as embodied in the refrigerating apparatus of my copending application Serial No. 337,858, filed February 6, 1929, of which the present application is a division.

The frame 10 of the apparatus is built up in sections of convenient length of standard structural shapes and comprises two structural steel end sections in which the drums for the conveyor bands are journaled, connected to an insulated intermediate section containing the refrigerating chamber and a part of the brine circulating system.

The conveyor bands are of thin heat-con-

ductive material, preferably of nichrome steel about 0.0312" thick. An upper band 12 is arranged to run over a driven drum at one end (not shown) and an idle drum 14 at the receiving end of the machine, shown in Fig. 1. The drum 14 is fast on a shaft 16, journaled in sliding blocks arranged for movement longitudinally in ways formed in the frame. Adjustably secured to each journal block 18 by a screw 21 is a horizontally disposed rack 20. Meshing with the rack 20 is a pinion 22 fast on a transverse shaft 24 which is mounted in stationary bearings in the frame. At its outer end the shaft 24 is connected to an arm 26, to the free end of which is connected a tension spring or other suitable force-applying mechanism. This arrangement tends to swing the arm 26 in a clockwise direction, as seen in Fig. 1, and to move the blocks 18 and the drum 14 yieldingly toward the left or in a direction to take up any slack occurring in the band 12 and maintain it under uniform tension.

A lower band 56 passes about a driving drum at one end and about an idle drum 58 at the receiving end. The drum 58 is carried by a shaft 60 journaled in sliding blocks 62 positioned by screws 64, each threaded into a stationary boss on the frame. It will be noted that the drum 58 is not free for yielding movement as in the case of the drum 14 but that it is adjustable and positively maintained in adjusted position by the construction of its bearings and adjusting screws 64. The drum 58 is located considerably beyond the drum 14 so that the upper surface of the band 56 may conveniently serve to receive articles to be refrigerated. These, as will be understood, are placed upon the band 56 and carried inwardly thereby until engaged by the lower pass of the upper band 12.

The intermediate portion of the frame 10 is occupied by an elongated refrigerating chamber, a section of which is shown more clearly in Fig. 2, through which the adjacent passes of the conveyor bands 12 and 56 travel and in which the refrigeration of the articles is effected. Each refrigerating chamber is surrounded by longitudinal walls of insulating material 70 and suitable openings are provided at opposite ends for the adjacent passes of the conveyor bands. The upper pass of the lower band 56 is supported practically throughout its length within the refrigerating chamber by rollers 72 journaled at either end in a stationary frame 74 and constituting an antifriction support for the band. In the same plane with these rollers there is located a series of perforated, transversely-extending brine pipes 76. Each of the pipes 76 has a central, downwardly-extending connection to a longitudinally disposed feed pipe. Brine is supplied under pressure by a connecting pipe 78 to the feed pipe and is sprayed upwardly and divergently from perforations in the transverse pipes 76 against the under side of the band 56. Thus, the band traveling longitudinally passes through a series of parallel, closely-spaced transverse zones of refrigerated spray, so that complete and uniform refrigeration of the heat-conductive band is insured.

Adjacent to the idle drum 58 of the lower band 56 is disposed a shallow tank or pan 80 which may contain relatively warm brine and alcohol or other cleansing and sterilizing fluid. A length of flexible material suitable for a wiper is carried by a cross bar 81 extending between the lower ends of a pair of arms 84 mounted between ears on a bracket or angle plate associated with the block 62 on the drum shaft 60. Each arm 84 carries an adjusting screw 85 at its upper end by which the cross bar 81 may be adjusted with respect to the drum and pressure of the wiper upon the band 56 regulated. This treatment of the band serves to remove accumulated frost as well as waste or dirt which may have reached the band and to insure that a clean surface is presented to receive the articles to be refrigerated.

While the lower band 56 is arranged to travel in a predetermined horizontal path and maintained in such path by supporting rollers 72, the upper band 56 may be arranged to accommodate itself automatically to the thickness of the article or articles presented to the conveyor. For this purpose the lower pass of the band 12 may be weighted to cause it to sag into contact with articles on the lower band 56. To this end one or more independent frames 90, carrying a series of transverse rollers 91 therein, are disposed upon this portion of the band 12. Each frame 90 is provided with a connecting member 92 suitably braced for stiffness and each having a downwardly-extending pin loosely mounted in a stationary bracket 93 secured to the inner wall of the refrigerating chamber. Each member 92 is pivotally fastened to a frame 90 at its forward end by means of bolts which permit the frames to swivel freely. Each frame 90 is, therefore, anchored against transverse movement but is free to rise and fall with the band 12. The rollers 90 are spaced from each other and constitute an anti-friction bearing for the frame upon the band. Each frame is suitably weighted so that together they overbalance the tension in the band caused by the tensioning means applied to the arm 26 and bring the band into contact with any articles supported upon the lower band 56.

Brine is supplied to the band 12 by two longitudinally-extending feed pipes 94 dis-

posed in the upper part of the refrigerating chamber above the frames 90 and with their perforations so disposed as to deliver the brine in jets playing above and between the rollers 91.

The upper band is wider than the lower band 56 with which it is associated and is symmetrically disposed with respect to it. Thus, the edges of the lower band 56 are set back from or within the edges of the upper band 12 an appreciable amount, as will be apparent from Fig. 2. As already intimated, it is important to prevent the brine delivered upon the upper surface of the band 12 from running inwardly from the edge thereof and also from dripping upon the upper surface of the lower band 56, thereby reaching and rendering useless the articles being refrigerated. To prevent this, both edges of the upper band are deflected so as to shed the brine beyond the edges of the lower narrower band 56. In the lower pass of the band 12, therefore, its edges may be deflected downwardly and outwardly at a suitable angle, as for instance, an angle of approximately 45°. As herein shown both edges of the band are permanently deflected throughout their entire length.

It will be apparent that a severe strain would be imposed upon a metallic band with permanently deflected integral edges, on account of the continual flexing to which it is subjected in passing about its supporting drums. This is relieved and the life of the band correspondingly increased, as herein shown, by forming in the deflected edges of the band 12 a series of short transverse slits, preferably in the form of slots 13 of appreciable width. This results in the formation of a series of fluid-directing tabs 17 along the edges of the band. The slots permit the edge to be elongated when the band is curved in a convex sense and to contract when the band is curved in a concave sense. The space between the sides of the slots permits contraction to take place without any wedging action of the material between the slots. In order to distribute the residual strain and prevent any tendency to crack at the base of the slots, the band is first perforated and each slot 13 cut into a perforation 15 of greater diameter than the width of the slot. The line of deflection extends substantially through the perforations 15, the extreme inner edge of the perforation being without substantial deflection from the plane of the middle portion of the band. The surface tension of the brine flowing upon the upper surface of the band is sufficient to prevent any of it from passing through the perforations 15 or the slots 13, so that it reaches the marginal edges of the band 12 and falls beyond the edges of the lower band 56 without entering into the space between the bands.

It has been explained how the brine is directly supplied upon the upper surface of the band 12 by the two longitudinal pipes 94 and to the lower surface of the band 56 by the transverse pipes 76 and the feed pipe 78. These pipes comprise part of a circulating system in which is included a supply pipe 101 located substantially at the level of the top of the apparatus and provided with a valve 102. A horizontal branch 103 extends inwardly through the wall of the refrigerating chamber and communicates with the two longitudinal pipes 94, being provided with a valve 104 for controlling the flow of these pipes. A downwardly-extending connection 105, similarly provided with a valve 106, communicates with the feed pipe 78.

In the bottom of the refrigerating chamber is a tank or pan 71 in which all the brine is collected after flowing from the bands 12 and 56. A trap 73 drains each chamber and communicates with a suitably disposed outlet pipe to which connection may be made to a pump or other apparatus used for circulating the brine.

The apparatus herein shown is adapted for freezing a packaged food product, such as dressed fish, whereby the fish is quick-frozen in the package in which it is to be marketed. The package preferably comprises a cardboard carton 99, waxed or otherwise rendered resistant to the absorption of moisture and completely filled with material to be refrigerated, so as to reduce to a minimum air pockets which might impede rapid heat transference. The cartons 99 may be delivered to the lower conveyor band 56 at the receiving end of the machine and advanced by the band into refrigerated zone between it and the upper band 12 arranged closely, side by side and end to end, and carried into the refrigerating chamber in this condition. The speed of the conveyor may be adjusted to move the cartons through the refrigerating chamber in the length of time necessary for freezing or the cartons may be advanced into the chamber by the bands and the conveyor then stopped, retaining the cartons in the chamber for the desired length of time and then put in motion to deliver the cartons from the apparatus. However, the construction of the machine is such as readily to adapt its use for a continuous operation.

While I have referred particularly to the application of the apparatus to the refrigeration of packaged food products, this is by way of example only, for the apparatus may be employed with advantage to effect any desired heat interchanging process in which a fluid-refrigerating or other temperature-regulating medium may be utilized. Again,

I have referred to fresh fish as an example of one specific food product which may be treated with good results, whereas an even more important field of use of the apparatus disclosed is in the treatment of fresh meat in various stages between slaughtering and dispensing in package form.

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

1. In a refrigerating apparatus, a conveyor band, means for distributing a temperature-regulating fluid on said band and tabs connected to said band for directing said fluid away from the central portion thereof.

2. In a refrigerating apparatus, a sheet conveyor band, means for distributing a temperature-regulating fluid on the upper surface of said band and a plurality of downwardly-extending fluid shedding tabs attached to said band at the edges thereof.

3. In a refrigerating apparatus, a conveyor band of flat sheet metal, means for distributing a temperature-regulating fluid on the upper surface of said band and downwardly-bent tabs connected to the edges of said band for directing fluid away from the under surface of said band.

4. In a refrigerating apparatus, a pair of conveyor bands arranged one above the other, composed of continuous strips of flat sheet metal, the lower band being of less width than the upper band and having its edges set back from the edges of the upper band, a source of temperature-regulating fluid above said upper band having openings for projecting the fluid against the band, and a series of fluid-directing tabs adjacent the edges of said upper band for preventing contact of said fluid with said lower band.

5. In a refrigerating apparatus, a pair of conveyor bands arranged one above the other, composed of continuous strips of flat sheet metal, means for projecting temperature-regulating fluid against the upper surface of said upper band and a series of fluid-directing tabs along the edge of said upper band projecting beyond the edge of the lower band for preventing the fluid from reaching the under surface of said upper band and the upper surface of said lower band.

6. In a refrigerating apparatus, an article-engaging band having its edges deflected so as to direct moisture outwardly away from the conveyed article, and means for delivering a liquid refrigerant to the outer face of the band.

7. In a refrigerating apparatus, an article-enveloping conveyor including a sheet metal band having its longitudinal edges deflected obliquely from the plane of its surface, and means for delivering a moisture-containing refrigerant to the surface of the band.

8. In a refrigerating apparatus, a sheet metal conveyor band arranged to cover the conveyed article and having its edges permanently bent downwardly and outwardly to shed moisture away from the conveyed article, and means for delivering a moisture-containing refrigerant to the upper surface of the band.

9. In a refrigerating apparatus, a sheet metal conveyor band, and drums for determining the path of the band, the band being provided with slits at intervals and obliquely bent marginal edges, and means for delivering a liquid refrigerant to the band in a location from which it may flow over said bent marginal edges.

10. In a refrigerating apparatus, a sheet metal conveyor band guided in an endless path and having in its edge a series of short slots of appreciable width, in combination with ducts for delivering a liquid refrigerant to the upper surface of the band.

11. In a refrigerating apparatus, a sheet metal conveyor band guided in an endless path, having its edges provided with short slots of uniform length and bent obliquely on a line corresponding substantially with the root of said slots, in combination with means for flowing a liquid refrigerant over said band and the edges thereof.

12. In a refrigerating apparatus, a sheet metal conveyor band guided in an endless path, having in its edge a series of slots each opening into a circular perforation in the band and being bent obliquely on a line passing substantially through said perforations, in combination with means for supplying a liquid refrigerant to said band.

13. In a refrigerating apparatus, an endless conveyor band composed of flat sheet metal and positioned by one or more rollers with a portion extending in a horizontal position, a second conveyor band of sheet metal positioned by other rollers above the flat portion of said first band, having its marginal edges deflected obliquely from the plane of its surface and extending beyond the corresponding edge of said first band, in combination with means for spraying a liquid refrigerant upon the upper face of the band.

14. In a refrigerating apparatus, a heat-conductive conveyor band of thin sheet metal having a series of integral tongues bent out of the plane of the band along an edge thereof and perforations adjacent to the tongues so disposed as to permit easy flexing of the band without breakage, and means for delivering a liquid refrigerant to the face of the band away from which said tongues are bent.

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