Sept. 16, 1952 C. FIELD 2,610,474

ART OF CONGELATION AND APPARATUS FOR USE IN CONNECTION THEREWITH

Filed Aug. 15, 1940 5 Sheets-Sheet 1

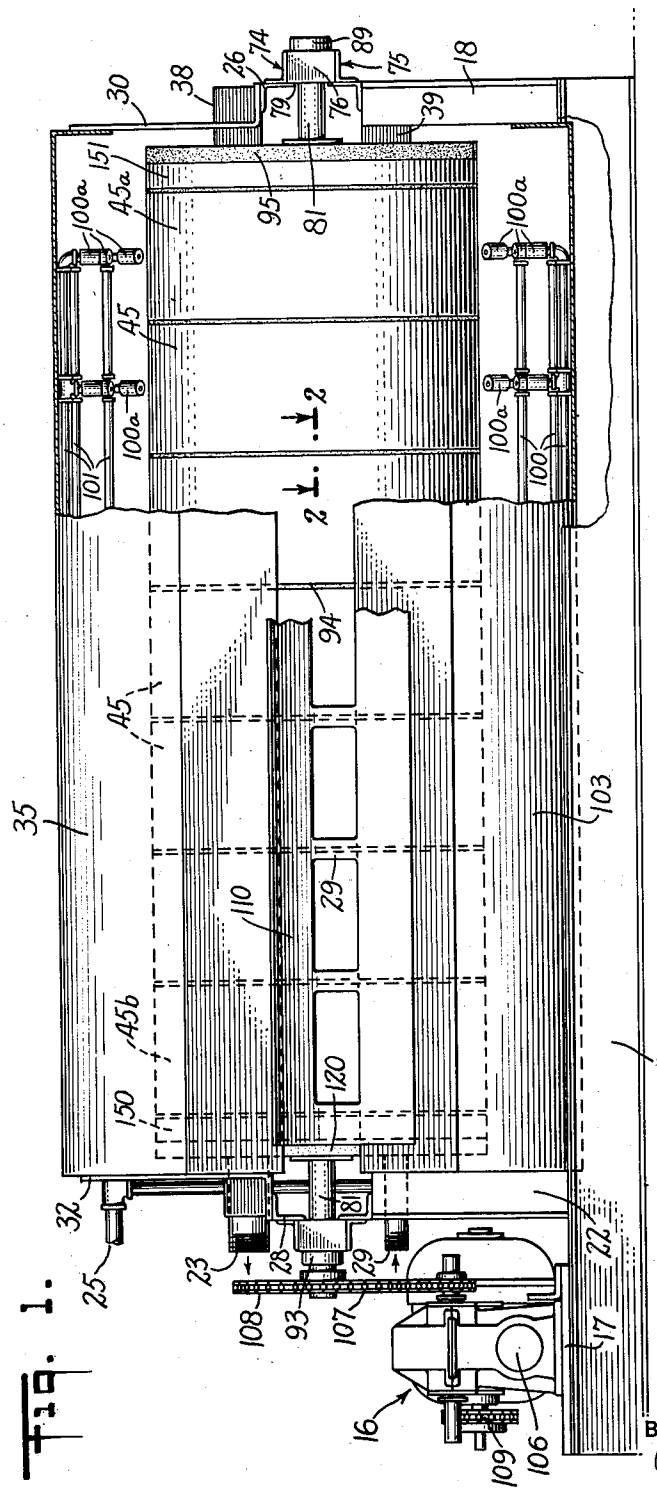


Fig. 1.

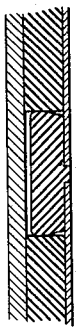


Fig. 2.

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ART OF CONGELATION AND APPARATUS FOR USE IN CONNECTION THEREWITH

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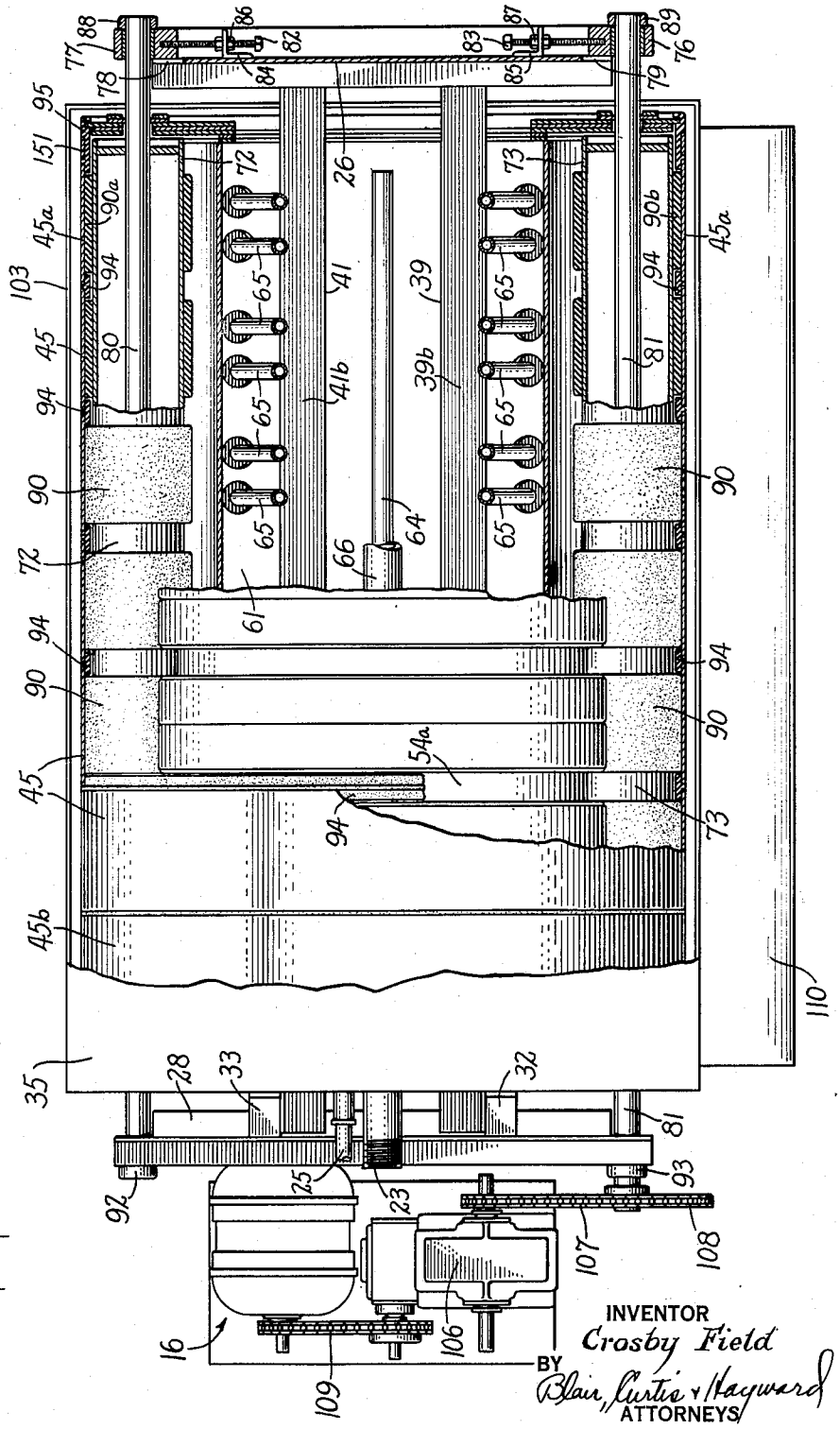


Fig. 3.

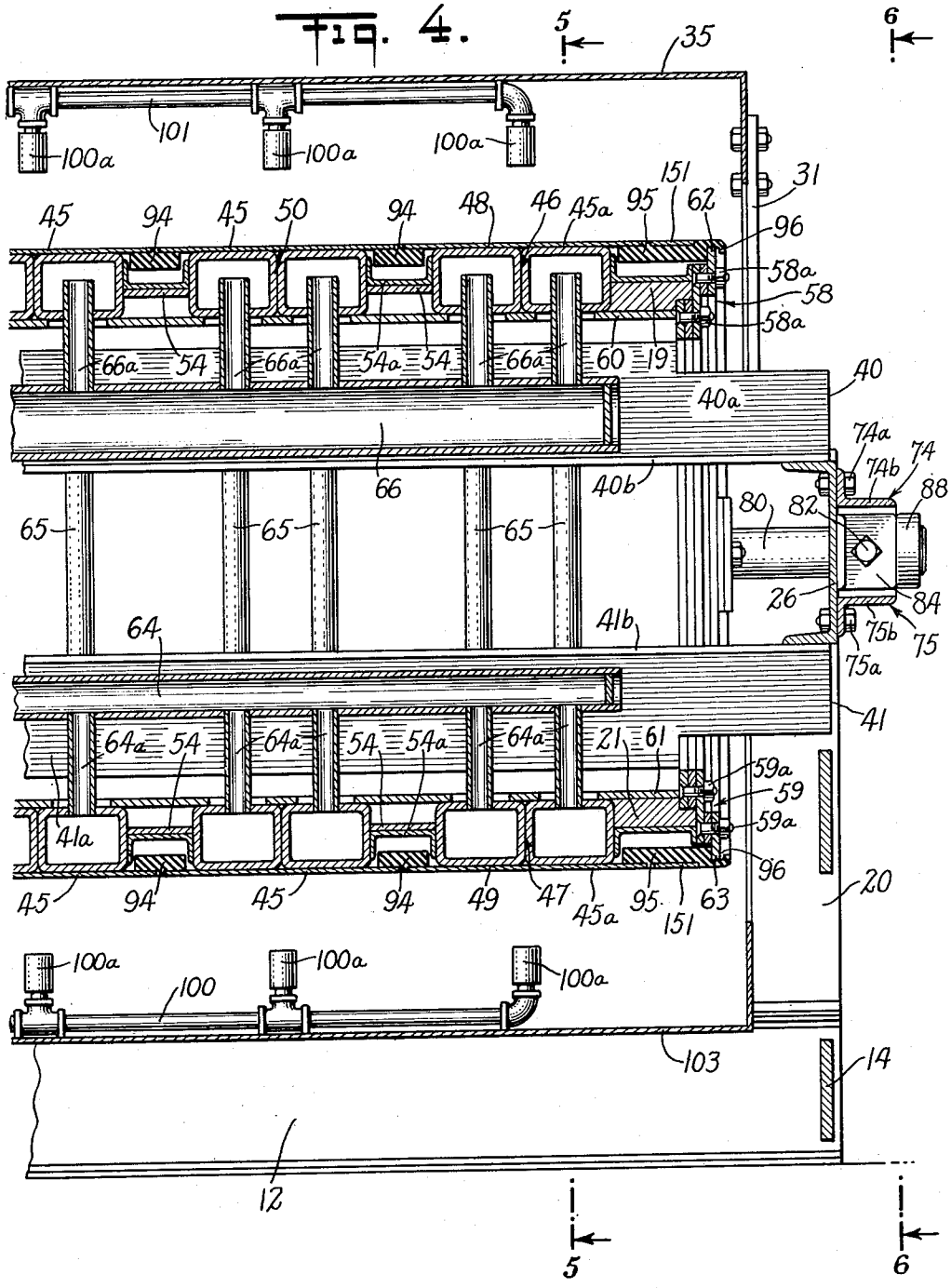
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ART OF CONGELATION AND APPARATUS FOR USE IN CONNECTION THEREWITH

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Fig. 4.



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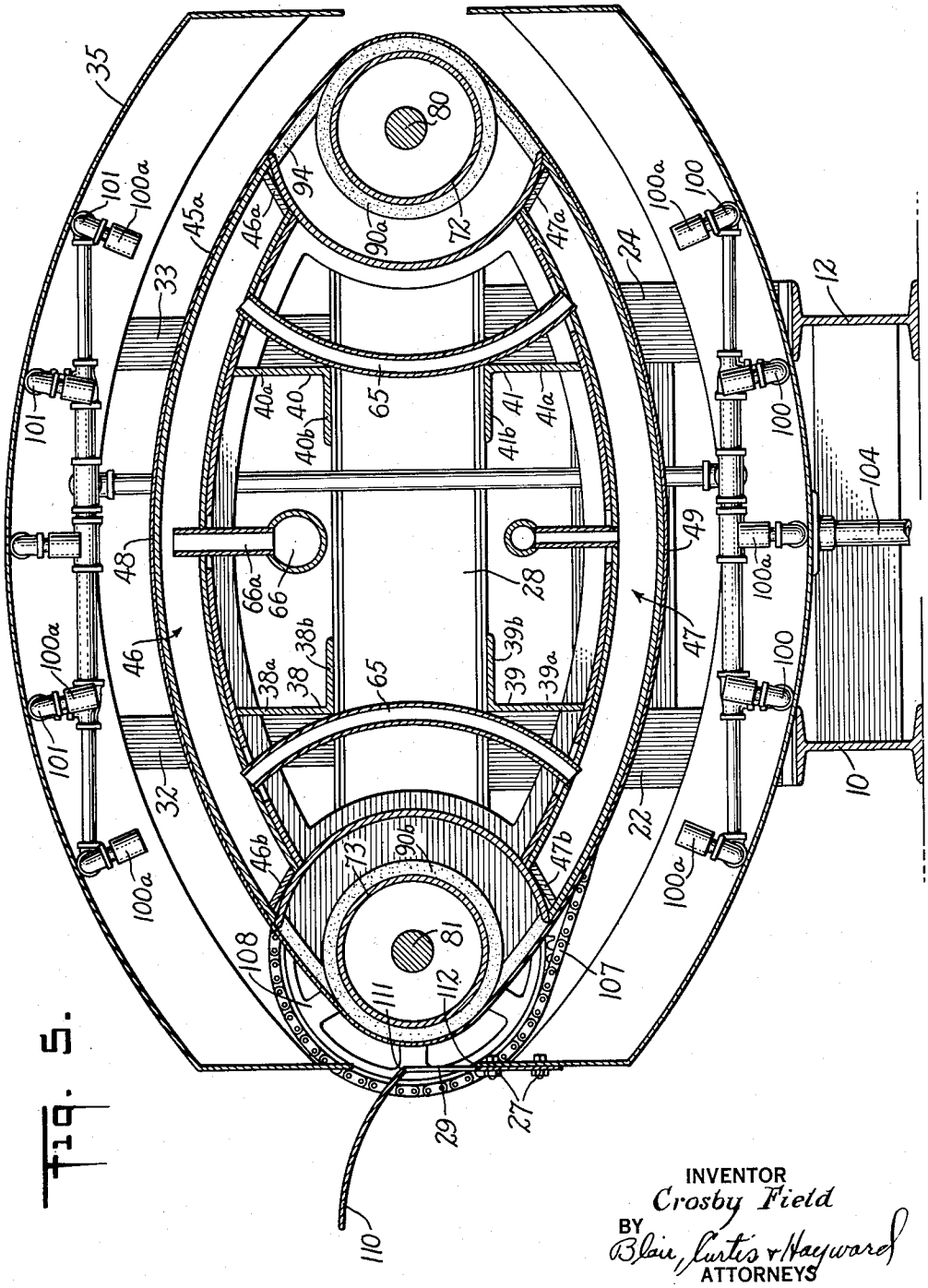


Fig. 5.

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ART OF CONGELATION AND APPARATUS FOR USE IN CONNECTION THEREWITH

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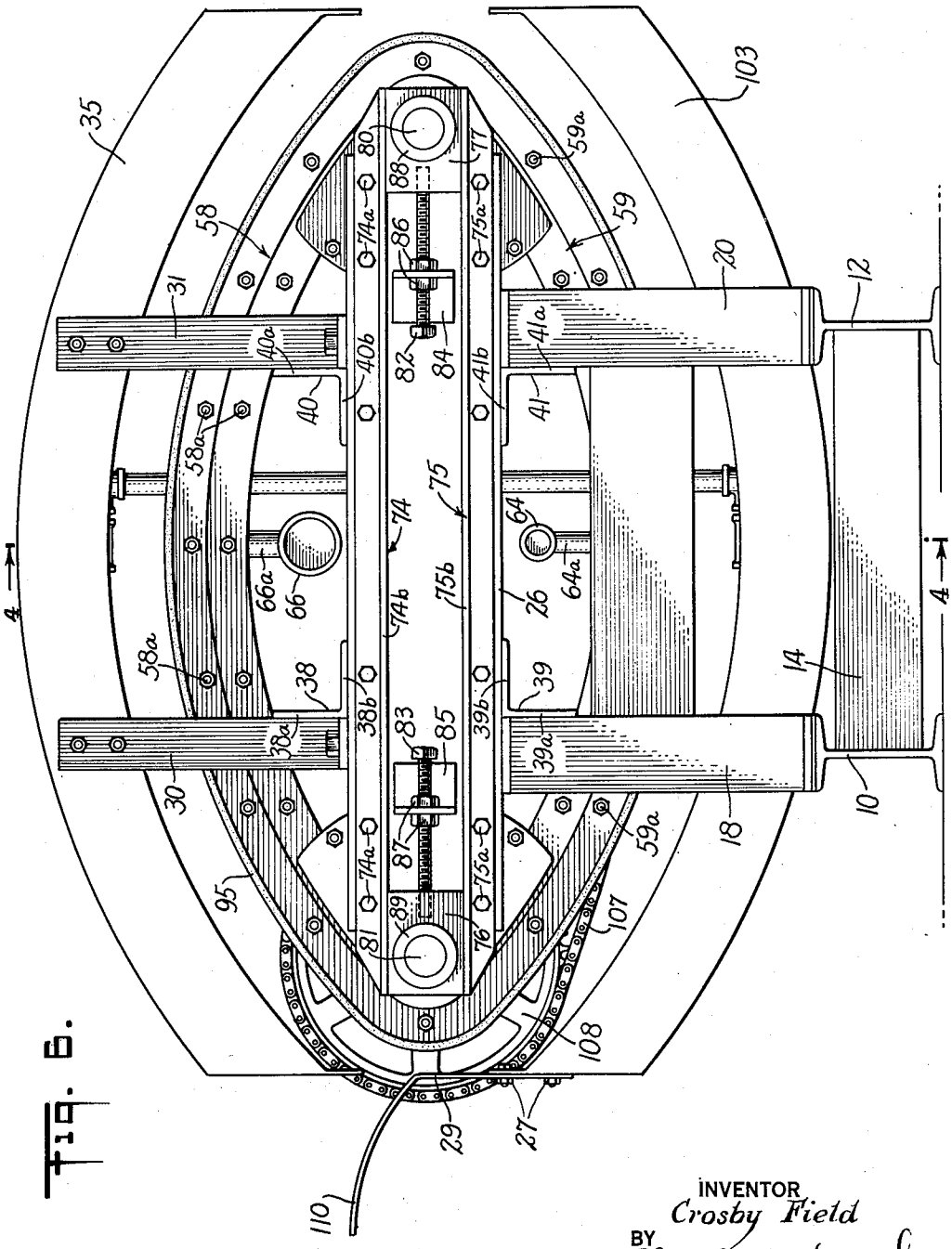


Fig. 6.

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Patented Sept. 16, 1952 2,610,474

UNITED STATES PATENT OFFICE

2,610,474

ART OF CONGELATION AND APPARATUS FOR USE IN CONNECTION THEREWITH

Crosby Field, Brooklyn, N. Y., assignor to Flakice Corporation, Brooklyn, N. Y., a corporation of Delaware

Application August 15, 1940, Serial No. 352,707

18 Claims. (Cl. 62—106)

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This invention relates to the art of congelation and to heat exchange apparatus for use in connection therewith.

One of the objects of this invention is to provide improved heat exchange apparatus to withstand continuous use. Another object is to provide an improved and simplified method of congealing material. Other objects will be in part obvious and in part pointed out hereinafter.

The invention accordingly consists in the features of construction, combinations of elements, and arrangement of parts, and in the several steps and order of each of the same to one or more of the others, all as will be illustratively described herein, and the scope of the application of which will be indicated in the following claims.

In the drawings in which is shown one of the various possible embodiments of my invention,

Figure 1 is an end elevation, partly in section, of an assembled machine embodying my invention;

Figure 2 is an enlarged sectional view taken along the line 2—2 of Figure 1 showing how the flexible panels are formed;

Figure 3 is a top plan view of the machine shown in Figure 1, certain parts thereof being broken away;

Figure 4 is a vertical sectional view on an enlarged scale taken along the line 4—4 of Figure 6;

Figure 5 is a vertical section taken along the line 5—5 of Figure 4; and

Figure 6 is a side elevation taken from the line 6—6 of Figure 4.

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

The present apparatus in general comprises a belt which is moved along a pair of convexly curved refrigerated surfaces while being held in heat transferring relationship therewith. Material to be congealed is supplied to this belt as it travels over these refrigerated surfaces, causing the material to congeal rapidly on the belt. As the belt passes from one refrigerated surface to the other, it passes over pulleys, which alter the curvature of the belt and cause the congealed material thereon to peel off the belt.

Referring now to the drawings and to Figures 1 and 6 in particular, the refrigerating or congealing apparatus is supported by a pair of foundation beams 10 and 12, connected by cross plates, one of which is shown at 14 (Figure 6). A horizontal plate 17 (Figure 1) secured to the

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tops of the foundation beams provides a support for motor driving mechanism, generally indicated at 16. At each side of the apparatus (Figures 1 and 6), angle beams 18, 20, 22, and 24 extend upwardly from the foundation beams to support channel beams 26 and 28.

As best seen in Figures 5 and 6, two sets of supporting members 30, 31 and 32, 33 are secured to and extend upwardly from the top walls of channel beams 26 and 28 respectively, forming supports for the top spray shield 35. Angle beams 38, 39, 40, and 41 extend through the center of the apparatus and are connected by their side walls 38*b*, 39*b*, 40*b*, and 41*b* to the top and bottom walls of channel beams 26 and 28. Through the edges of side walls 38*a*, 39*a*, 40*a*, and 41*a*, they support evaporators, as will be described more fully hereinafter. All of the connections between the above-mentioned beams may be made in any suitable manner, such as by welding.

Referring now to Figure 1, the apparatus for refrigerating the endless flexible belt is an evaporator about which the belt is wrapped. The evaporator comprises upper and lower sections presenting outward smooth curved convex surfaces over which the belt travels. Each evaporator section comprises a series of pairs of separate evaporator tubes connected to common headers, and since the construction of each tube is substantially the same, the detailed description will be limited to the upper and lower pair of evaporator tubes, generally indicated at 46 and 47 respectively, and which are best shown in Figures 4 and 5.

Evaporator 46 consists of two tubes of rectangular cross section (Figure 4) and curved, as shown in Figure 5, and secured together at their sides by spot welding. The ends of these tubes are sealed by end plates 46*a* and 46*b*, and their convexly curved outer surfaces are machined and plated so that they present a smooth surface 48 which is non-rusting. Evaporator 47 is similar to evaporator 46 with its ends sealed by end plates 47*a* and 47*b* and has a machined surface 49 which is non-rusting.

Evaporators 46 and 47, together with the other sets of evaporators, are supported by angle beams 38, 39, 40, and 41, being secured by welding to the edges of side walls 38*a*, 39*a*, 40*a*, and 41*a*.

Each pair of evaporators is secured to its adjoining pair of evaporating units by spacer plates (Figure 4), evaporator 46 being connected to evaporator 50 by plates 54. Covering these plates and a portion of the side walls of each adjoining

pair of evaporators are channel-shaped rubber insulating gaskets, several of which are shown at 54a.

The exposed side of the end evaporators, such as evaporators 46 and 47 (Figure 4), are secured by spacer plates 60 and 61 to a series of longitudinally curved end plates, generally indicated at 58 and 59, which are held together by bolts, such as are indicated at 58a and 59a. The outer diameters of the plates are successively increased, and the arrangement of the plates is such that the outer edges of the outer plates are level with the surfaces 48 of the evaporators. Rubber gaskets 19 and 21 extend between the sides of evaporators 46 and 47 and these staggered edges to form a seal therebetween for insulation purposes. The edges 62 and 63 of the outer plates provide sealing surfaces over which the rubber apron 95 attached to a belt moves, as will be described more fully hereinafter. These plates 58 and 59, their associated gaskets, and the belt aprons prevent moisture from getting between the belts and the surfaces of the evaporators.

The evaporators are supplied with a suitable refrigerating liquid by a header 64 (Figures 4 and 5), which enters at the side of the apparatus, extends across the lower section thereof, and is connected to each tube of the lower section by branch conduits 64a. The liquid enters each tube and flows toward the ends thereof, from which point it flows with any gas to the evaporators of the upper section through curved connecting conduits 65. Gas and any liquid are collected in a gas header 66, connected to the upper section by branch conduits 66a.

Referring to Figure 1, the ends 23 and 29 of the liquid and gas headers extend from the side of the apparatus so that the remainder of the refrigerating system (not shown) may be readily connected to the evaporators. Thus, the refrigerating system of the apparatus comprises upper and lower evaporators securely mounted on the framework of the apparatus with their convexly curved surfaces facing outwardly from the apparatus. Furthermore, they are so interconnected with the refrigeration system that they effectively operate as expansion tubes whereby their outer surfaces are refrigerated.

Extending across the end of the apparatus, as viewed in Figure 3, and positioned between the ends of the evaporators (Figure 5) are cylindrical drums 72 and 73 mounted on shafts 80 and 81 respectively. These shafts are journaled in adjustable bearings slidably mounted in the ends of channel beams 26 and 28, and as the mounting of each of the bearings at each end of each shaft is the same, the description will be limited to the mounting of the bearings on channel beam 26.

As best seen in Figures 4 and 6, a pair of guides, generally indicated at 74 and 75, are secured to the outer surface of channel beam 26 by bolts 74a and 75a so that they present parallel opposed side walls 74b and 75b (Figure 4), which form a channel in which bearings 76 and 77 (Figure 6) are slidably mounted. As best seen in Figures 1 and 3, slots 78 and 79 are cut in the ends of channel beam 26, permitting shafts 80 and 81 to be moved transversely of the apparatus, as viewed in Figure 6, when their respective bearings are moved between guides 74 and 75.

As best seen in Figure 3, collars 88, 89, 92, and 93 are provided on the ends of shafts 80 and 81 to secure them in position on the machine and to hold the bearings between their guides on channel beams 26 and 28. To hold bearings 76 and 77 (Figure 6) in adjusted position, screws 82 and 83, are provided, the ends of which are secured to bearings 76 and 77. These screws extend through braces 84 and 85, which are secured to channel beam 26, and lock nuts 86 and 87 are provided for adjusting the longitudinal relationship of screws 82 and 83 with regard to the braces 84 and 85.

Thus, shafts 80 and 81 are adjustably mounted on the machine so that they may be moved outwardly or inwardly from the side of the apparatus, as viewed in Figure 6. To accomplish an adjustment, nuts 86 and 87 are loosened or tightened as the tightness or slack in the belts may require. When these nuts are loosened or tightened, bearings 76 and 77 are moved in the channel formed by guides 74 and 75 to accomplish the required adjustment. As stated hereinabove, both ends of shafts 80 and 81 are similarly mounted, and thus, both ends are adjusted together. Shaft 81 is driven by a motor, generally indicated at 16, which drives the flexible belt about the evaporators as will be described.

The flexible metal belt on which the material is to be frozen passes over the oppositely disposed polished surface 48 of the evaporators and over the end rollers 72 and 73, as shown in Figure 5. This belt is preferably constructed in the manner described in my Patent No. 2,078,938, and comprises a plurality of endless metal panels in the order of a one-hundredth of an inch thick. The panels are joined to form a single belt unit by means of rubber strips connecting the adjacent edge portions of the panels, the edges of which portions are spaced from each other. As shown in Figure 4, the connecting rubber strips extend inwardly from the inner plate of the metal panels, and the space provided by the plates 54 between the evaporators receives these rubber strips, so that as the belt passes along the evaporators, the rubber strips do not interfere with the metal of the belt contacting the metal surface of the evaporators and thereby establishing a heat transferring relationship.

The end rollers over which the flexible belt passes are also provided with tracks, as shown in Figure 3, in the form of spaced bands 90 wrapped around the rollers and spaced to receive between them the rubber strips from the flexible belt. With this construction of the rollers, the tension placed on the belt by means of the adjustment of the bearings holding the rollers is applied directly to the metal of the flexible belt rather than through its rubber strips. Furthermore, the rubber bands on the rollers provide for friction between the rollers and the flexible belt, so that as the rollers are rotated by a pulley secured to shaft 81, the flexible belt is forced to travel under tension over the heat transferring surface of the evaporators.

The flexible belt in the present embodiment comprises a plurality of endless flexible metal panels joined together. The adjoining edges of the metallic panels are preferably connected by strips of rubber 94, as described in my Patent No. 2,078,938. These strips are of a width slightly smaller than the spaces between the rubber bands on drums 72 and 73 so that when the belts are in position on the drums, each belt-connecting strip lies in between a pair of bands.

As best seen in Figure 3, bands 90a and 90b, and thus the other bands on the drums, are of such a diameter and belt 45a is of such length that when they are in adjusted relationship, the point at which belt 45a meets bands 90a and 90b

is positioned in the continuation of the curve of the surfaces of the evaporators or slightly inwardly therefrom so that the belts are held in contact with the surfaces of the evaporators throughout their entire lengths. Thus, the belts and drums are designed so that there is efficient contact between the belts and the evaporators, and so that the belts are maintained in their proper relationship thereto. Furthermore, as the contact between the belts and the drums is through the rubber bands and rubber strips, the belts are resiliently held in contact with the curved surfaces of the evaporators.

Referring now to Figures 1 and 4, aprons **95** and **120**, which are secured to the outer edges of end belts **45***a* and **45***b* extend outwardly to form a connection with the end plates which enclose the ends of the apparatus. As the connection between the plates and the aprons at each end of the apparatus is substantially the same, the description will be limited to the connection between apron **95** and end plates **58** and **59** (Figure 4).

Preferably apron **95** extends outwardly, contacting plates **58** and **59** in staggered relationship, and has a groove **96** formed therein which is adapted to receive the outer edges **62** and **63** of end plate assemblies **58** and **59**. Preferably secured to and extending around aprons **95** and **120** are a pair of metal bands **150** and **151** (Figures 1 and 4) which serve to hold the aprons in contact with the end plates. As the belts move, apron **95** slides over end plates **58** and **59**, and thus a seal is formed therebetween to prevent moisture from entering this joint and thus getting between the belts and their evaporators.

Referring to Figures 1, 4, and 5, each evaporator has a series of nozzles **100***a* (Figure 5) positioned thereover and directed toward its center portions. Thus, these nozzles are positioned over each belt while it is in contact with its evaporators. The nozzles are interconnected by a series of conduits such as are shown at **100** and **101** (Figures 1, 4, and 5) and are adapted to spray liquid upon the belts. The conduits leading to the spray nozzles are supplied by a main conduit, the end **25** of which extends from one end of the apparatus (Figure 1).

Spray shields **35** and **103** (Figures 1 and 5) are provided, which are positioned above and below the apparatus. The upper spray shield is supported by supporting members **30**, **31**, **32**, and **33** (Figures 1, 5, and 6) which are secured to channel beams **26** and **28** and to the sides of the upper spray shield. The lower spray shield is connected to and supported by foundation beams **10** and **12** (Figure 5). It has a drain **104** positioned in its lowermost portion through which the excess liquid which falls off the belt is drained into a sump (not shown), from which it is preferably recirculated.

In operation, motor **16** (Figures 1 and 3) drives pulley **108** which is connected to shaft **81** through belt **109**, gear reduction **106**, and belt **107**. This turns drum **73** which drives the belts **45** through its connection therewith through the rubber bands **90**. The spray system covers the surface of the belts as they move over the evaporators with an atomized liquid spray which freezes on striking the surface of the belts. As the nozzles are positioned above the centers of the belts, the spray is concentrated on the central portions of each metal belt, forming an individual strip of ice on each belt. Ice is prevented from forming between the belts by the exposed portions of the rubber strip at these places and by the lack of refrigeration thereunder, these portions being insulated by gaskets, such as **54***a* in Figure 4.

The belts rotate clockwise, as shown in Figure 6, and ice which forms on the under surface of the belt is peeled therefrom by the change in the curvature of the belt as it passes over drum **73**. The ice sheet passes outwardly from the side of the machine, striking deflecting plate **110** after passing between the lower edge **111** of this plate and the top edge **112** of the lower spray shield **103**. Deflector **110** is supported by a series of supports, one of which is shown at **29** (Figure 5), which are connected to the end of spray shield **103** by bolts **27**. The ice at the opposite side of the apparatus is also peeled from the belts by the change in curvature of the belts and passes in strips between the edges of the upper and lower spray shields. The ice produced may be collected in any desired manner, such as by providing chutes leading to bins (not shown).

Thus, a practical and efficient apparatus for use in connection therewith has been disclosed in which the several objects hereinabove pointed out, as well as many others, are effectively accomplished.

As many possible embodiments may be made of the mechanical features of the above invention and as the art herein described might be varied in various parts, all without departing from the scope of the invention, it is to be understood that all matter hereinbefore set forth or shown in the accompanying drawings is to be interpreted as illustrative and not in a limiting sense.

I claim:

1. In refrigerating apparatus, in combination, an evaporator having a stationary refrigerated surface, said surface embodying a cylindrical convex curve and corresponding to a surface defined by a straight line moving always parallel to a fixed axis, a flexible belt, means holding said belt in heat transferring relationship with said curved surface and causing said belt to conform to the curvature of said curved surface, means for supplying to said belt while so cooled material to be refrigerated, and means for moving said belt along said curved surface, the path of movement of said belt also following and conforming to said surface defined by a moving straight line, and means for flexing said belt to remove material congealed thereon.

2. In refrigerating apparatus, in combination, an evaporator having a stationary refrigerated surface, said surface embodying a cylindrical convex curve and corresponding to a surface defined by a straight line moving always parallel to a fixed axis, a flexible belt, resilient adjustable means for holding said belt by tension in heat transferring relationship with and in curved conformity to said curved surface while material to be refrigerated is supplied to said belt, means for moving said belt along said surface, the path of movement of said belt also following and conforming to said surface defined by a moving straight line, and means for flexing said belt to remove material congealed thereon.

3. In refrigerating apparatus, in combination, a stationary refrigerated member having a refrigerated surface in the shape of a convexly curved segment, an endless belt made of a thin metallic material, adjustable means for resiliently holding a portion of said belt under tension in contact with said curved surface and for holding another portion of said belt away from said

surface, said means drawing said belt under tension in a direction substantially at a tangent to an edge portion of said curved surface, and means for moving said belt over said curved surface.

4. In refrigerating apparatus, in combination, a pair of refrigerated members having convexly curved refrigerating surfaces, said surfaces facing in opposite directions from each other, an endless belt, means holding said endless belt in contact with said surfaces, and means for moving said belt across said surfaces while held in contact therewith.

5. In refrigerating apparatus, in combination, a pair of curved refrigerated members having convexly curved surfaces, said curved surfaces facing in opposite directions from each other, a pair of rollers positioned at the ends of said curved surfaces, an endless flexible belt moving on said rollers, said rollers being adjustable toward and away from the ends of said curved surfaces to hold said endless belt in tension and in contact with said curved surfaces, and means for causing said belt to travel along said surfaces and about said rollers.

6. In refrigerating apparatus, in combination, a pair of refrigerated members having convexly curved refrigerated surfaces facing in opposite directions from each other, a pair of rollers positioned at the ends of said curved surfaces, an endless belt running on said rollers and across said surfaces, resilient means holding said endless belt in contact with said surfaces, and means for moving said belt over said rollers and across said surfaces.

7. In refrigerating apparatus, in combination, a pair of refrigerated members having convexly curved refrigerated surfaces facing in opposite directions from each other, a pair of rollers positioned at the ends of said surfaces, and an endless belt running over said rollers and across said surfaces, said rollers having a smaller radius than the radius of the curvature of said surfaces whereby said belt is flexed as it passes over said rollers.

8. In refrigerating apparatus, in combination, a pair of refrigerated members having convexly curved refrigerated surfaces, said convexly curved surfaces facing in opposite directions from each other, a pair of rollers positioned at the ends of said surfaces, an endless belt running over said rollers and across said surfaces, said rollers having a smaller radius than the radius of the curvature of said surfaces whereby said belt is flexed as it passes over said rollers, and sprays positioned opposite said surfaces and adjacent said belt to spray on said belt liquid to be frozen thereon, said frozen liquid being removed from said belt by said flexing.

9. In refrigerating apparatus, in combination, a framework, a refrigerated member mounted on said framework having a convexly curved refrigerated surface, a pair of rollers mounted on said framework at the ends of said convexly curved surface, an endless belt running over said rollers and across said surface, means including said rollers for moving said belt across and holding it in contact with said surface, means supported on said framework enclosing the ends of said belt, and apron means formed on said belt and connected to said enclosing means whereby moisture is prevented from entering between the surface of said refrigerated member and said belt.

10. In refrigerating apparatus, in combination, a series of refrigerated members, each of said refrigerated members having a convexly curved surface, all of said convexly curved surfaces lying in a single curved plane, means separating said refrigerated members, a pair of rollers positioned along the ends of said refrigerated members, a series of metallic belts, each contacting one of said curved surfaces and running on said rollers, elastic means connecting the adjacent edges of said belts, and means for driving said belts by means of one of said rollers.

11. In refrigerating apparatus, in combination, a series of refrigerated members, each of said refrigerated members having a convexly curved surface, all of said convexly curved surfaces lying in a single curved plane, means separating said refrigerated members, a pair of rollers positioned along the ends of said refrigerated members, a series of metallic belts, each contacting one of said curved surfaces and running on said rollers, elastic means connecting said belts, means for driving said belts by means of one of said rollers, and sprays positioned opposite said refrigerated members and adjacent said belt for spraying thereon liquid to be congealed on said belts as they are in contact with said curved surfaces, said rollers having a smaller radius than the radius of the curvature of said refrigerated members whereby said belts are flexed as they pass over said rollers, said flexing being adapted to remove the congealed liquid from said belts.

12. The method of congealing material, comprising, continuously causing an endless, impervious, metal belt to travel along a stationary, uniformly curved, refrigerated surface, maintaining said belt by tension against and causing it to conform to said surface, supplying the material to be congealed to the said belt at a point opposite the side in contact with the congealing surface whereby the material congeals on said belt, continuously removing successive portions of the belt from the curved refrigerated surface and simultaneously flexing the belt to a diameter smaller than that of said curved surface to cause the material frozen thereon to peel therefrom.

13. In congealing apparatus of the class described, an evaporator having an external convexly curved refrigerated surface, said evaporator comprising a series of substantially parallel evaporator tubes together defining said refrigerated surface, a flexible metal belt extending over said refrigerated surface, means for continuously holding a portion of said belt under tension in heat transferring relationship against and in conformation with said convexly curved refrigerated surface and deflector means for maintaining another portion of said belt away from said surface and flexed to a diameter smaller than said convexly curved refrigerated surface, means for supplying material to be congealed to the portion of said belt maintained against said refrigerated surface and in heat transferring relationship therewith, and means for progressively relatively shifting said belt and said means for progressively flexing said belt to remove therefrom material congealed thereon.

14. In refrigerating apparatus, in combination, a refrigerated member having a convexly curved surface, said member comprising a plurality of substantially parallel laterally spaced evaporator tubes together defining said convexly curved surface, an endless flexible belt made of metallic material, roller means within said belt for

holding said belt under tension and in contact with the major portion of said refrigerated surface and for holding another portion of said belt away from said surface, said belt comprising tracking means on its inner surface in registration with the lateral spaces extending between parallel evaporator tubes for guiding the belt with respect to said refrigerated surface, means for moving said belt with respect to said surface and over said roller means, said roller means having a radius of curvature less than that of said convexly curved surface, whereby said belt is flexed to a smaller curvature as it passes over said roller means, and means for applying liquid to be congealed on said belt to that portion of said belt in contact with said curved surface, said congealed liquid being removed from said belt by the flexure of said belt as it passes over said roller means.

15. In refrigerating apparatus, in combination, a compressor for supplying under pressure liquid refrigerant to be evaporated, a pair of evaporators having convexly curved surfaces, said surfaces facing away from each other, a conduit for conducting liquid refrigerant from the compressor to one of said evaporators, conduits connecting one of said evaporators to the other of said evaporators, a gas header connected to said last-mentioned evaporator for collecting the evaporated refrigerant and conducting it to the low pressure side of said compressor, a belt having a surface on which material may be congealed, said belt encompassing said evaporators, means for holding said belt in contact with the curved surfaces of said evaporators, and means for moving said belt across said curved surfaces.

16. In apparatus for congealing material, in combination, a refrigerated member having a convexly curved refrigerated surface, said member comprising a plurality of substantially parallel laterally spaced evaporator portions together defining said convexly curved surface, a thin impervious heat transferring endless belt extending around and held under tension in contact with said refrigerated surface, resilient track means secured to said belt, means for driving said belt about said refrigerated surface, said track means registering with the lateral spaces extending between parallel evaporator portions for guiding the belt with respect to said refrigerated surface as it is driven thereabout, means for supplying to said endless belt material that, on congealing, forms a solid adhering to said belt, and means engaging said track means to flex said belt to break the adhesive bond between said solid and said belt to free the solid therefrom.

17. In apparatus for congealing a material, in combination, a stationary refrigerated member having a convexly curved refrigerated surface, said member comprising a plurality of substantially parallel laterally spaced evaporator portions together defining said convexly curved surface, a thin metal endless belt extending around and held under tension in contact with said refrigerated surface, said belt comprising a plurality of substantially parallel laterally spaced elongated panel portions, resilient track means secured to said belt and bridging the spaces between adjacent panel portions, means for driving said belt across said refrigerated surface, said track means registering with the lateral spaces extending between parallel evaporator portions for guiding the belt with respect to said refrigerated surface as it is driven thereacross, means for supplying to said endless belt material that, on congealing, forms a solid adhering to said belt, and means engaging said track means to flex said belt to break the adhesive bond between said solid and said belt to free the solid therefrom.

18. In refrigerating apparatus in combination, a framework, a refrigerated member mounted on said framework and having a rigid convexly curved refrigerated surface, an endless flexible metal belt encompassing said refrigerated member and having a greater periphery than said member, means for tensioning said belt against said convexly curved refrigerated surface, means for imparting relative movement between said belt and said surface, and sealing means including an apron extending from said belt and including means extending from said framework said apron and last-named means coacting to seal the space between said belt and said refrigerated surface from the atmosphere; said apron overlapping marginal portions of the concave side of said tensioned belt and being secured thereto in face-to-face contact therewith whereby the exposed juncture line between belt and apron is along the outermost edge of the belt and spaced from the main freezing surface of the belt by at least the width of the apron secured to the concave face of the belt margin, said means extending from said framework having an endless apron-engaging surface substantially co-extensive with said belt marginal portions, the peripheral length of said endless apron-engaging surface being substantially equal to the peripheral length of said endless belt.

CROSBY FIELD.

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