

June 1, 1954

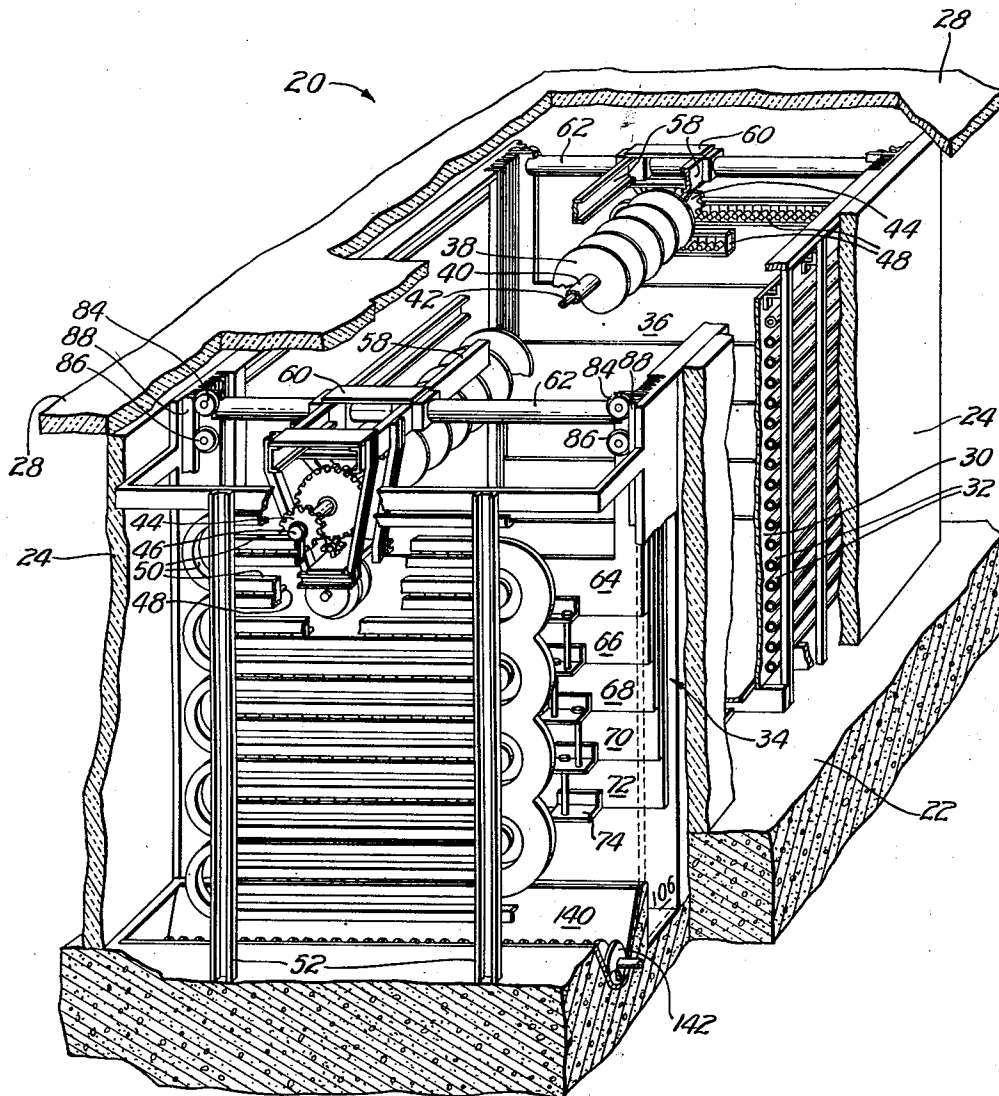
C. FIELD
STORAGE BIN, INCLUDING CONVEYER FOR MOVING
STORED PRODUCTS WITHIN THE BIN

2,679,953

Filed July 8, 1948

4 Sheets-Sheet 1

FIG. 1.



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48 C. FIELD
STORAGE BIN, INCLUDING CONVEYER FOR MOVING
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4 Sheets-Sheet 2

FIG. 2.

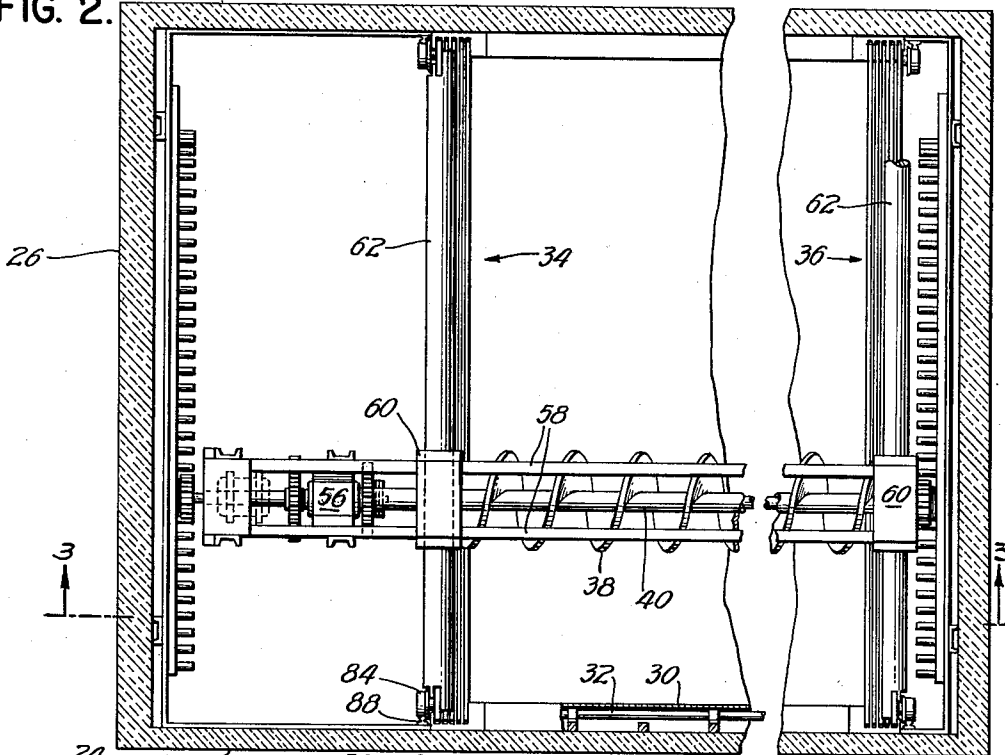
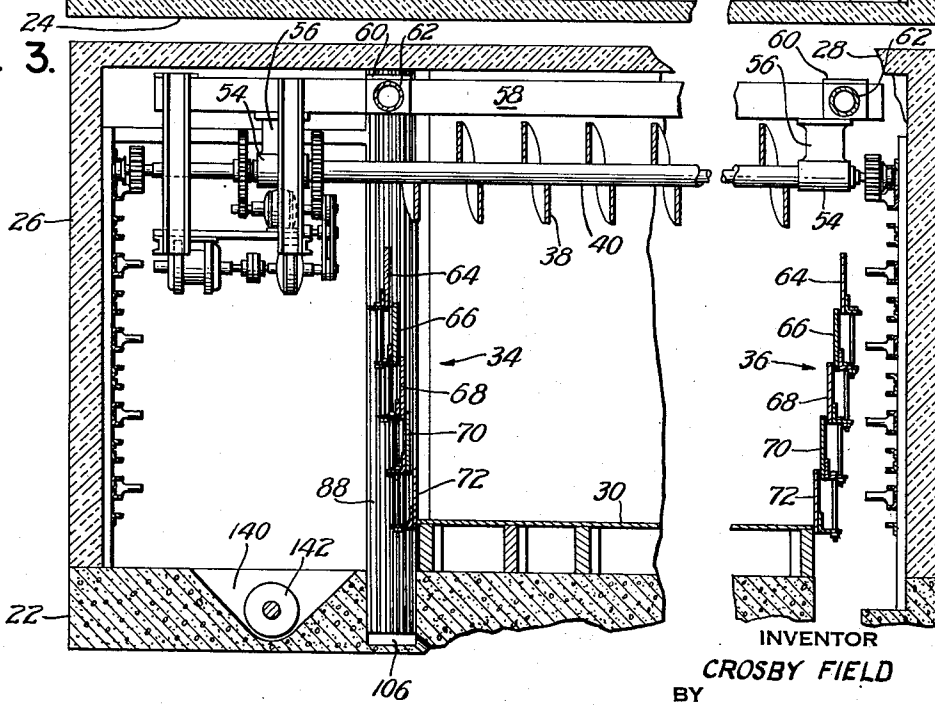


FIG. 3.



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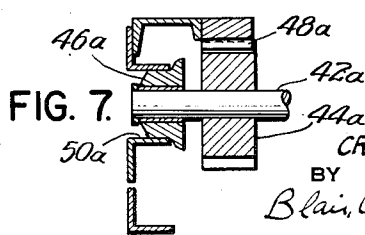
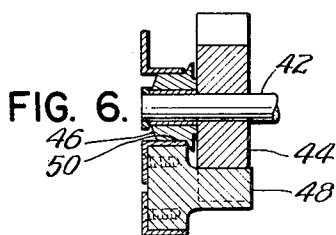
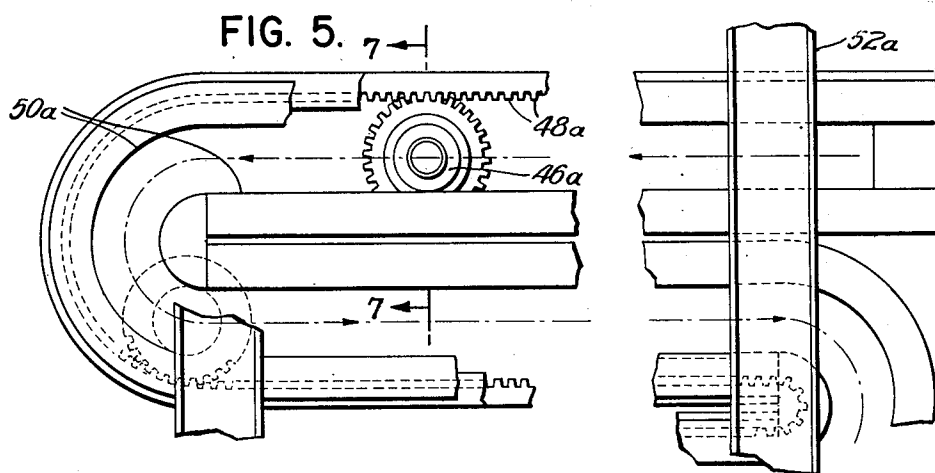
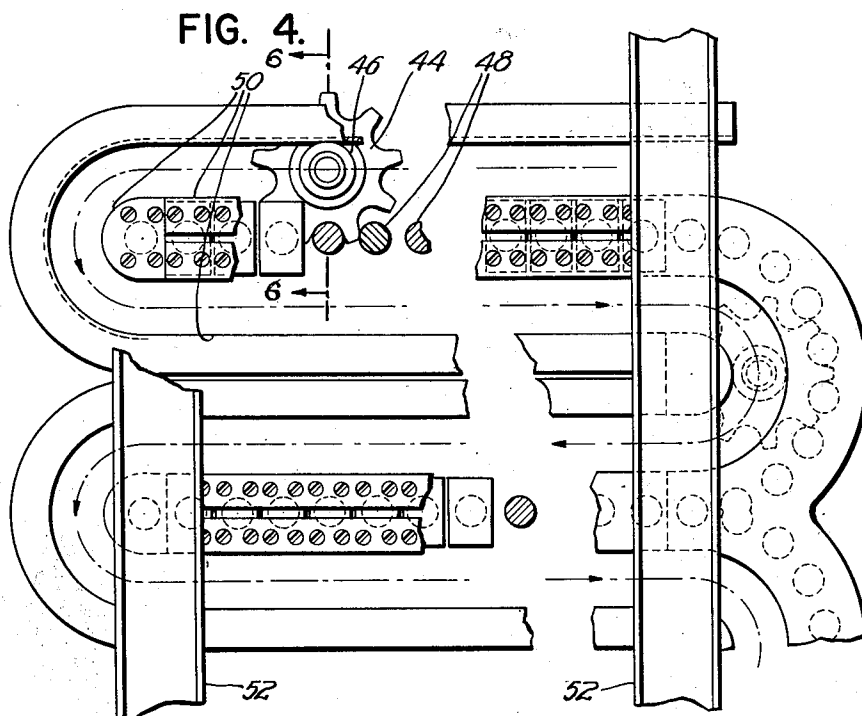
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4 Sheets-Sheet 3



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4 Sheets-Sheet 4

FIG. 8.

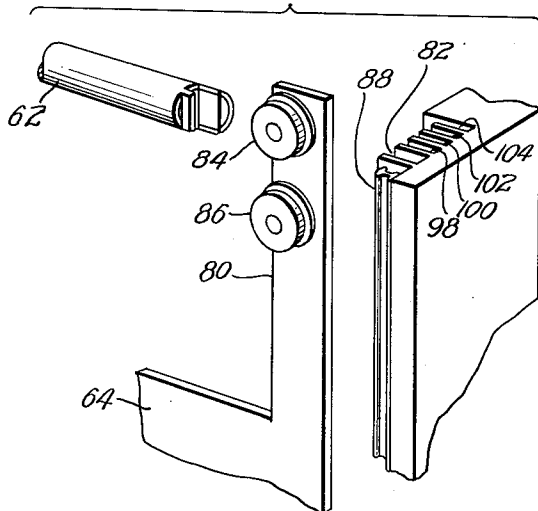


FIG. 9.

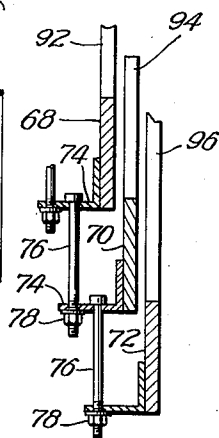


FIG. 10.

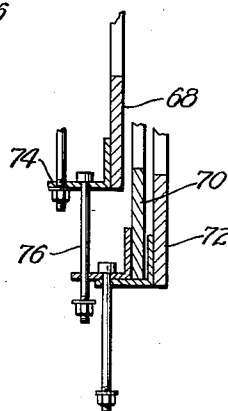
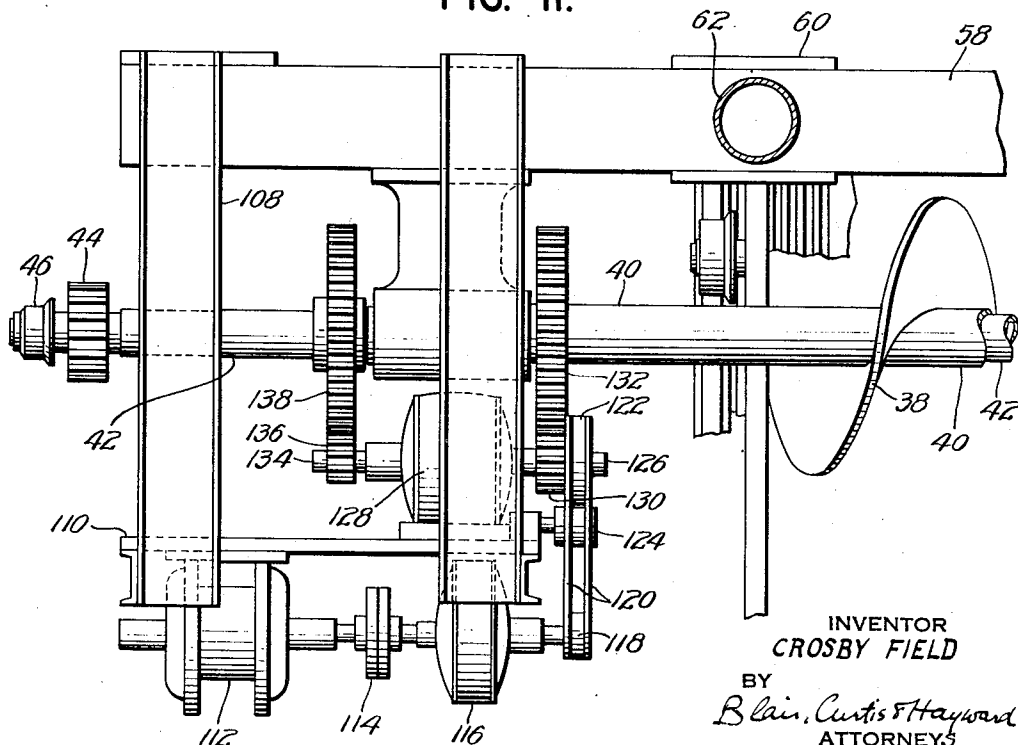


FIG. II.



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UNITED STATES PATENT OFFICE

2,679,953

STORAGE BIN, INCLUDING CONVEYER FOR
MOVING STORED PRODUCTS WITHIN THE
BIN

Crosby Field, Brooklyn, N. Y.

Application July 8, 1948, Serial No. 37,710

14 Claims. (Cl. 222-333)

1

This invention relates to storage bin constructions and more particularly to constructions wherein supplies of a dry, or relatively dry, product can be contained and preserved and from which the product can be withdrawn upon demand in carefully regulated amounts as desired. The present invention is an improvement, in certain respects, upon my previous invention described and claimed in Patent No. 2,222,024. The present improvement will be described in relation to a construction for storing particles of ice but, as will be appreciated by those skilled in the art, it has general application to the storage and ultimate delivery of other products.

The invention of my above-mentioned patent has given excellent satisfaction in commercial practice. There are some instances, however, where a more precise and continuously even control of ice flow at the point of delivery from the bin is desirable. One object of the present invention is to provide a storage bin construction from which ice or other suitable product may be supplied in a continuously even flow. Another object is the provision of equipment for storing ice, or the like, wherein the ice may be accumulated and stored for an indefinite period of time and wherewith it is possible and efficient to demand and receive automatically either a small amount, a large amount, or some intermediate amount, as desired. A further object is to provide ice storing equipment which will overcome certain of the disadvantages inherent in the commercial and prior art constructions heretofore known. Other objects will be in part pointed out as the description proceeds and will in part become apparent therefrom.

The invention accordingly consists in the features of construction, combinations of elements, methods of operation, and arrangements of parts as will be exemplified in the structure and sequences and groups of related steps to be hereinafter described and the scope of the application of which will be set forth in the accompanying claims.

In this specification and the accompanying drawings I have shown and described a preferred embodiment of my invention and suggested various modifications thereof; but it is to be understood that these are not intended to be exhaustive nor limiting of the invention, but on the contrary are given for purposes of illustration in order that others skilled in the art may fully understand the invention and the principles thereof and the manner of applying it in various forms, each as may be best suited to the conditions of a particular use.

2

In the drawings.

Figure 1 is a perspective view of an exemplary storage bin construction embodying my invention with parts broken away and parts in section;

Figure 2 is a sectional plan view of the bin construction shown in Figure 1.

Figure 3 is a side elevation, taken along the section line 3-3 of Figure 2 in the direction of the arrows;

Figure 4 is a fragmentary view, on an enlarged scale, of a supporting frame and related members forming a part of the construction shown in Figure 1;

Figure 5 is a view similar to that of Figure 4 but showing a modified form of supporting frame assembly;

Figure 6 is a sectional view, taken along the line 6-6 of Figure 4 in the direction of the arrows;

Figure 7 is a sectional view, taken along the line 7-7 of Figure 5;

Figure 8 is an exploded perspective view of an assembly including a part of an end gate, as will be described, over which ice particles are delivered when called for;

Figure 9 is a cross-sectional elevation taken through a fragmentary portion of the end gate;

Figure 10 shows the parts illustrated in Figure 9 but in another relationship assumed under certain operating conditions; and

Figure 11 is a fragmentary elevational view, on an enlarged scale, of a power supply unit forming a part of the illustrative form.

In Figure 1, a storage bin construction is generally indicated at 20 based upon a floor 22 and provided with side walls 24 and end walls 26. In the embodiment shown, the floor is of concrete and side walls 24 and end walls 26 preferably are of self-supporting material having insulating properties. The bin is provided with an insulating ceiling 28 wherein supply openings may be included, as disclosed in my above-mentioned patent. The bin interior is fitted with an airtight lining 30 spaced from the side walls and from the floor by appropriate framing to form, together with floor 22 and walls 24 and 26, an enclosed space in which refrigerating coils 32 are disposed. Lining 30 preferably is of heat conductive material such as sheet metal so that the interior of the storage bin can efficiently be maintained at a temperature at which the ice particles will remain dry and hard.

Near each end of the storage bin there is provided a partition (see Figure 2), identified on the left by the numeral 34 and indicated on the right

by numeral 36. Thus, as appears in Figure 2, the insulating compartment in which the ice particles are stored includes bottom 22, a pair of opposing side walls 24, and opposing end partitions 34 and 36. Generally speaking, ice will be supplied for storage through an opening in the ceiling in a manner such, for one example, as disclosed in my aforementioned patent. Depending upon the rate of the supply of ice to the storage compartment and the rate of withdrawal therefrom, the surface of the ice on hand may reach substantially to the top or may be at a somewhat lower level. In order to enable an automatic and even delivery of ice in such quantity as desired I provide a conveying arrangement now to be described.

Across the ice storage compartment, in a position such as to coincide with the surface of the ice, there extends a screw conveyor 38 (see Figures 1 and 3) carried upon a conveyor sleeve 40. Sleeve 40 is itself rotatably carried upon a shaft 42 coaxially disposed therewithin. Conveyor 38 and sleeve 40 are caused to rotate upon shaft 42 by mechanism to be described hereinafter. It will be appreciated, however, that when the conveyor turns clockwise, as viewed in Figure 1, ice in contact with the blades of the conveyor will be moved toward and pushed over the top edge of partition 34.

So that ice will at all times be available in quantity to the conveyor blades, I provide for a sidewise component of movement for the conveyor as a whole, with the result that as it pushes ice over the end partition it slowly moves across the surface and top portion of the bulk of the ice in storage, from one side of the compartment to the other. In the illustrative form the conveyor always is parallel to the side walls 24 and as it moves from one side wall to the other it removes a top layer of ice from the bulk in storage and pushes it in an even, continuous supply into the space at the end of the compartment between partition 34 and adjacent wall 26 (see Figure 2). And, when a pass once across the compartment has been made, then, by means about to be described, the conveyor assumes a position spaced somewhat below the level of the pass just completed and proceeds to make a return pass across the compartment, delivering ice at a constant rate all the while.

Shaft 42 extends beyond each end of conveyor sleeve 40 and at each end extension is fitted with a mangle wheel 44 and a roller 46 (see also Figures 4 and 6). In a plane generally parallel to end partition 34 (see Figures 1 and 2) there is provided a mangle rack 48 with which mangle wheel 44 cooperates and a track 50 on which roller 46 is supported. Rack 48 and track 50 follow a serpentine path (see Figure 4) and are carried upon a pair of vertically disposed frame pieces 52. As shown in Figure 4, mangle rack 48 incorporates a series of parallel pins which are bolted in fixed relationship adjacent to the path formed by track 50. A correspondingly similar rack and track is provided adjacent partition 36 for supporting and guiding the other end of the conveyor assembly.

As rollers 46 roll upon track 50, shaft 42 is maintained in a horizontal position extending across the ice compartment and moves in a series of traverses from one side edge thereof to the other. In so moving, screw conveyor 38 is caused to travel from one side of the ice compartment to the other. The serpentine construction of track 50 is such that when the rollers 46 have

reached one side of the ice compartment they execute a reverse turn through 180° (see Figure 4) and proceed downwardly and then horizontally again back across the lowered surface of the ice. As will be described hereinafter, the translatory movement of shaft 42 is effected by a force of rotation applied to the shaft. This force reacts through mangle wheel 44 and mangle rack 48 to feed the conveyor sidewise and downwardly. The direction of rotation of the mangle wheel remains constant during ice feeding. Accordingly, at the left end (see Figure 4) of a horizontal pass or traverse across the ice the wheel pivots beyond and around and below a single end pin of rack 48. At the right-hand end of the pass the wheel follows inside of the pins as they delineate a 180° arc tangentially joining the path of the pass just completed with the path of the pass next to be executed.

As an alternative to the mangle wheel-mangle rack embodiment above-described I have shown in Figures 5 and 7 a gear and rack construction for performing the same functions. Corresponding parts are identified by corresponding reference characters with the exception that to each reference character on the alternative form an *a* has been added.

From the foregoing it will be observed that as ice feeding proceeds the disposition of the conveyor assembly becomes progressively lower. In order to accommodate the end partitions 34 and 36 to this method of operation I have made the partitions collapsible as will now be described.

As shown in Figure 3, each end of sleeve 40 is carried in a bearing construction 54 forming a part of a pedestal 56 and the pedestals 56 support a pair of rails (see Figure 1) indicated at 58. These rails are incorporated at each end into a translator bearing assembly 60 resting upon the upper portion of a pedestal 56. Bearing assemblies 60 are disposed around and slidable upon a pair of translator beams 62, one of which is disposed at each end of the ice storage compartment above end partitions 34 and 36 respectively (see Figure 2). Each translator beam 62 serves as a top support from which depends a series of imbricate partition plates 64, 66, 68, 70 and 72, which series of plates together form at each end of the ice storage compartment the partitions 34 and 36.

Figures 1, 9 and 10 show how each partition plate is provided across its bottom portion with a flange 74. Plate 66 is suspended from plate 64 by means of headed bolts, one of which appears at 76 in Figure 9, which pass downwardly through holes in the flange 74 fixed to plate 64, and thence through aligned holes in the flange 74 forming a part of plate 66. The lower end of each bolt 76 is provided with a nut 78. Similarly, plate 68 is suspended from plate 66 by headed bolts 76 and nuts 78 extending from the flange 74 on the bottom of plate 66 to the flange 74 on the bottom of plate 68. This construction is such that partitions 34, 36 formed by the imbricate plates are progressively collapsible, and one plate can move with respect to the next, as shown in Figure 10.

The uppermost plate is provided at each of its sides with an upwardly extending elongated guide shoe 80 which is slidably positioned in a vertically disposed guide slot 82 formed in the adjacent side wall of the storage compartment (see Figure 8). Thus the guide shoe 80 at each end of plate 64 enables the plate to slide upwardly and downwardly within slots 82 without any

tendency toward jamming. Each guide shoe 80 is provided with a pair of rollers 84 and 86 (see Figure 8). These rollers cooperate with a vertically extending rail 88 aligned adjacent to the guide slots 82. Thus, in addition to the guiding effect of shoes 80 in slots 82, the rollers 84 and 86 with the vertical rails 88 further facilitate free up and down movement of carrying plate 64. Each of the depending partition plates 66, 68, 70 and 72 is provided, respectively, at each of its sides with a pair of upwardly projecting, elongated guide shoes 90, 92, 94 and 96. These shoes cooperate, respectively, with pairs of guide slots 98, 100, 102, 104 vertically disposed in the adjacent compartment side walls.

Plates 64 are thus enabled freely to move up and down in their vertical planes at each end of the ice compartment following the movements of translator beams 62. And as plates 64 so move the imbricate partition plates depending therefrom also freely move in their respective guide slots. As shown in Figure 3, a plate sump 106 is provided beneath partitions 34 and 36 so as to form spaces into which the plates may descend in making clearance for the conveyor as the conveyor proceeds to deliver ice from surface portions of the stored pile. It will be appreciated, of course, that the vertical position of plate 64 at any time depends upon the vertical position of translator beam 62 and, as illustrated in Figure 1, the position of translator beam 62 depends upon the vertical location of bearing assembly 60 carried above the screw conveyor.

It is necessary to supply power to the conveyor assembly in order to perform the ice feeding previously described. One way of accomplishing this is as follows: As shown herein in Figure 11, rails 58 extend beyond translator beam 62 to form a support for a power unit frame indicated at 108. Frame 108 carries a plate 110 below which is suspended a reversible electric motor 112. Motor 112 drives through a flexible coupling 114 to a speed reducer 116. The output of speed reducer 116 is to a pulley 118 and then through a double sprocket chain 120 to an intermediate pulley 122 along with an idler 124 maintaining the endless sprocket chain in driving tension. Pulley 122 is carried upon and drives an input jackshaft 126 which feeds into a second speed reducer 128. A pinion 130 is carried upon input jackshaft 126 and meshes with a conveyor gear 132 in driving relationship with the end of screw conveyor sleeve 40. Thus, power is transferred from motor 112 to the screw conveyor 38. The output of the second speed reducer 128 is to output jackshaft 134, upon which is carried a pinion 136 meshed with a conveyor shaft gear 138 carried upon shaft 42. Thus power is transferred from motor 112 to shaft 42 and then to mangle wheel 44 as described above.

In one form which the invention has taken motor 112 is a three H. P. 1200 R. P. M. motor. The useful output of this motor is approximately 1160 R. P. M. The reduction effected by speed reducer 116 is at a ratio of 4.14 to 1, so that the resulting output at pulley 118 is approximately 281 R. P. M. The relationships among the sprocket chain and pulleys are such that the input to shaft 126 is approximately 154 R. P. M. and the speed of conveyor sleeve 40, and accordingly of conveyor 38, is approximately 31 R. P. M. The reduction ratio of speed reducer 128 is approximately 40 to 1, so that with the added effect

of gears 136 and 138, shaft 42 is caused to make somewhat less than one R. P. M.

The ice delivered over the edge of the plate 64 by the screw conveyor falls into a sump (see Figure 1) indicated at 140 in which is disposed a second screw conveyor 142. By using conventional electrical controls for the motors driving the two screw conveyors, the two conveyors are coordinated. In the majority of installations one of my storage bin constructions will be installed beneath one or more of the ice making machines of the type referred to in my above-mentioned patent so that the ice product is continuously supplied to the top of the quantity of ice in the storage bin. Where my ice storage bin is associated with a continuously operating ice making machine, it is preferable that controls be incorporated in the motor circuits so that the screw conveyor, after a period of inactivity, will return to its uppermost position, and so that the end partitions 34 and 36 will be in their extended conditions. The inactive conveyor then will not be buried underneath a pile of freshly frozen ice particles and the capacity of the bin will be at a maximum. I have found in practice that a good balancing of results is attained if the controls for the motors are such that the screw conveyor remains in its position of last delivery for about 20 minutes of inactivity. If 20 minutes have passed and no demand has been made by the operator of the bin for delivery of ice particles, then the motor should be actuated in reverse so as to cause the conveyor to make its way upward. Thus ice coming into the machine from above will be retained by the raised end partitions and the conveyor itself will not be buried.

From the foregoing it will be seen that an ice storage bin construction made in accordance with the present invention is well adapted to attain the ends and objects hereinbefore set forth and to be economically manufactured since the several parts and assemblies are well suited to common production methods and are susceptible to a wide latitude of variations as may be desirable in adapting the invention to different applications.

As various embodiments may be made of the above invention and as changes might be made in the embodiment above set forth 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. A storage bin construction for storing a quantity of a product and for delivering upon demand a continuous supply of the product taken from upper portions of the stored quantity, said construction including: a vertically disposed collapsible partition forming a wall of the bin, a horizontally disposed conveyor assembly extending from said partition and across the bin, a pair of conveyor supporting frames disposed one at each end of the conveyor assembly and each lying in a plane substantially normal to the axis of said conveyor assembly, and a power unit coupled to said conveyor assembly; each frame comprising a conveyor track which defines a continuous path extending from a point near the top of the bin and proceeding downwardly thereof back and forth across said frame, and said conveyor assembly being supported at each of its ends by said tracks.

2. The invention of claim 1 wherein said col-

7

lapsible partition is suspended from said conveyor assembly.

3. A storage bin construction for storing a quantity of a product and for delivering upon demand a continuous supply of the product taken from upper portions of the stored quantity, said construction including: a pair of vertically disposed collapsible partitions forming opposite walls of the bin, a horizontally disposed conveyor assembly extending between said partitions and across the bin, a pair of conveyor supporting frames disposed one at each end of the conveyor assembly and each lying in a plane substantially normal to the axis of said conveyor, and a power unit coupled to said conveyor assembly; each frame comprising a conveyor track which defines a continuous path extending from a point near the top of the bin and proceeding downwardly thereof back and forth across said frame, and said conveyor assembly being supported at each of its ends by said tracks.

4. The invention of claim 3 wherein said collapsible partition is suspended from said conveyor assembly.

5. A storage bin construction for storing a quantity of a product and for delivering upon demand a continuous supply of the product taken from upper portions of the stored quantity, said construction including: a horizontally disposed conveyor assembly extending across the bin, a rotatable drive member and a rotatable load-carrying member at each end of the conveyor assembly, and a pair of conveyor supporting frames disposed one at each end of the conveyor assembly and each lying in a plane substantially normal to the axis of said conveyor assembly; each frame comprising a conveyor rack and track arrangement which defines a continuous path extending from a point near the top of said frame and proceeding downwardly thereof back and forth across said frame, said drive members being engaged with the rack and said load-carrying members being supported by the track of said rack and track arrangement.

6. A storage bin construction for storing a quantity of a product and for delivering upon demand a continuous supply of the product taken from upper portions of the stored quantity, said construction including: a horizontally disposed conveyor shaft extending across the bin, a screw conveyor rotatably carried upon said shaft intermediate of the ends of said shaft, a rotatable drive member and a rotatable load-carrying member on each end of said conveyor shaft, a pair of conveyor shaft supporting frames disposed one at each end of the conveyor shaft and each lying in a plane substantially normal to the axis of said shaft, and a power unit carried upon said shaft; each frame comprising a conveyor rack and track arrangement which defines a continuous path extending from a point near the top of said frame and proceeding downwardly thereof back and forth across said frame, said drive members being engaged with the rack and said load-carrying members being supported by the track of said rack and track arrangement, and said power unit incorporating a low speed drive to said shaft and a higher speed drive to said conveyor.

7. In a construction of the character described, a frame, a load-supporting track for a rolling member mounted on the frame and defining a continuous path comprising a series of substantially horizontal, parallelly-disposed traverses across the frame and arcuate half-loops smoothly

8

joining pairs of adjacent traverses, said half-loops being positioned alternately one at one side of the traverses and the next at the other side of the traverses, and a drive arrangement extending in spaced relationship beside said track.

8. In a construction of the character described, a frame, a load-supporting track for a rolling member mounted on the frame and defining a continuous path comprising a series of substantially horizontal, parallelly-disposed traverses across the frame and arcuate half-loops smoothly joining pairs of adjacent traverses, and a drive arrangement extending in spaced relationship beside said track; said half-loops being positioned alternately one at one side of the traverses and the next at the other side of the traverses, and said drive arrangement being juxtaposed beside said track through its traverses and around the half loops on one side of said frame.

9. In a storage bin construction for storing a quantity of a product and for delivering upon demand a continuous supply of the product taken from upper portions of the stored quantity, the combination including: a horizontally disposed conveyor shaft movably supported at each of its ends, a bearing and pedestal assembly positioned upon the shaft, said shaft being rotatable within the bearing and said bearing supporting the pedestal, a frame carried upon the pedestal and overlying the shaft, a translator bearing carried in the frame with its axis lying in a plane normal to the axis of the shaft, a translator beam disposed within the translator bearing, said translator bearing being bodily movable along said translator beam, and a partition assembly suspended from end portions of said translator beam and extending crosswise below said shaft.

10. The invention of claim 9 wherein said partition comprises a series of imbricate plates.

11. In a storage bin construction for storing a quantity of a product and for delivering upon demand a continuous supply of the product taken from upper portions of the stored quantity, the combination including: a pair of tracks disposed opposite each other one at each side of said bin, a horizontally disposed conveyor shaft movably supported at each of its ends upon said tracks, a bearing and pedestal assembly positioned upon the shaft, said shaft being rotatable within the bearing and said bearing supporting the pedestal, a frame carried upon the pedestal and overlying the shaft, a power unit mounted on said frame, and a power drive coupling said unit to said shaft and supplying power thereto.

12. In a storage bin construction for storing a quantity of a product and for delivering upon demand a continuous supply of the product taken from upper portions of the stored quantity, the combination including: a horizontally disposed conveyor shaft movably supported at each of its ends, a bearing and pedestal assembly positioned upon the shaft, said shaft being rotatable within the bearing and said bearing supporting the pedestal, a frame carried upon the pedestal and overlying the shaft, a translator bearing carried in the frame with its axis lying in a plane normal to the axis of the shaft, a translator beam disposed within the translator bearing, said translator bearing being bodily movable along said translator beam, a partition assembly suspended from end portions of said translator beam and extending crosswise below said shaft, a power unit mounted on said frame, and a power drive coupling said unit to said shaft and supplying power thereto.

9

13. In a storage bin construction for storing a quantity of a product and for delivering upon demand a continuous supply of the product taken from upper portions of the stored quantity, the combination including: a pair of tracks disposed opposite each other one at each side of said bin, a horizontally disposed conveyor shaft movably supported at each of its ends upon said tracks, a screw conveyor rotatably disposed upon said shaft, a bearing and pedestal assembly positioned upon the shaft, said shaft being rotatable within the bearing and said bearing supporting the pedestal, a frame carried upon the pedestal and overlying the shaft, a power unit mounted on said frame, a first power drive coupling said unit to said shaft for supplying power thereto, and a second power drive coupling said unit to said screw conveyor for supplying power thereto.

14. In a storage bin construction for storing a quantity of a product and for delivering upon demand a continuous supply of the product taken from upper portions of the stored quantity, the combination including: a horizontally disposed conveyor shaft movably supported at each of its ends, a pair of bearing and pedestal assemblies positioned one at each end of the shaft, said shaft being rotatable within the bearings of said

10

assemblies and said bearings supporting the pedestal, a frame carried upon the pedestals and overlying the shaft, a pair of translator bearings carried in the frame one at each end thereof with their axes lying in planes normal to the axis of the shaft, a pair of translator beams disposed one within each translator bearing, each translator bearing being bodily movable along its translator beam, and a pair of partition assemblies suspended from end portions of each translator beam and extending crosswise below said shaft and parallel to each other.

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