

[54] ICE RAKE FOR ICE MAKING APPARATUS
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Primary Examiner—Robert G. Sheridan

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 [58] Field of Search..... 214/17 D, 17 DB; 198/172,
 198/174; 62/344; 241/200

[57] ABSTRACT

An ice rake mechanism for use with ice raking apparatus including an elongate frame having drive means mounted thereon and adapted to travel longitudinally about frame, a plurality of rake flites mounted on the drive means, with the flites including a channel member for a flange element thereon and teeth fastened to the flange elements, with the teeth on adjacent flites being staggered relative to each other to prevent excessive stress on the ice raking mechanism.

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3 Claims, 4 Drawing Figures

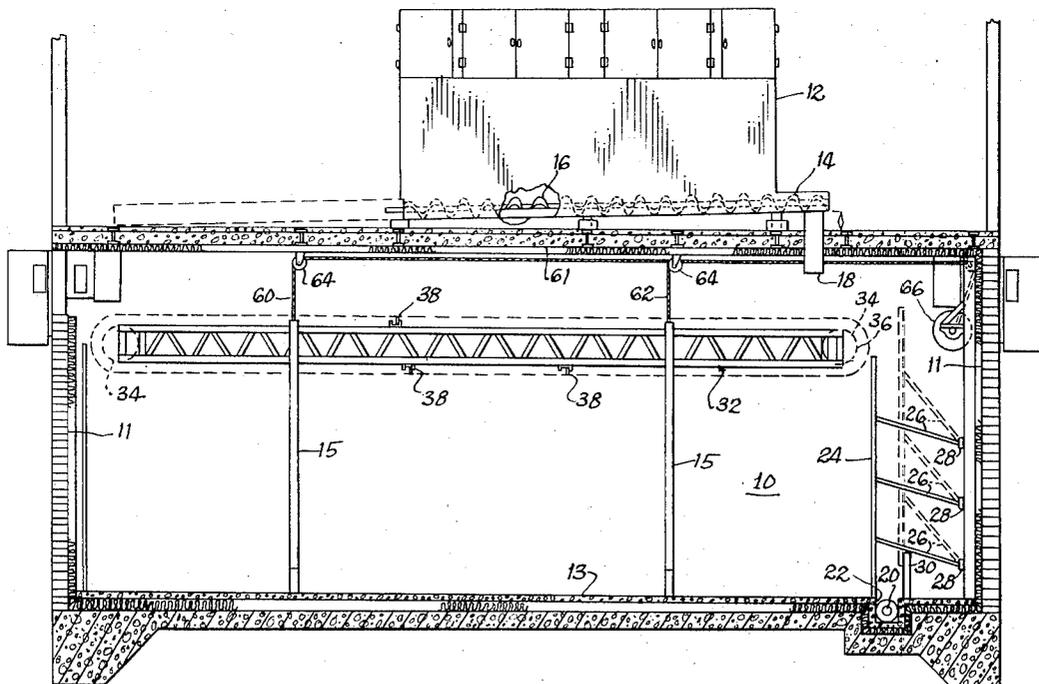


FIG. 1

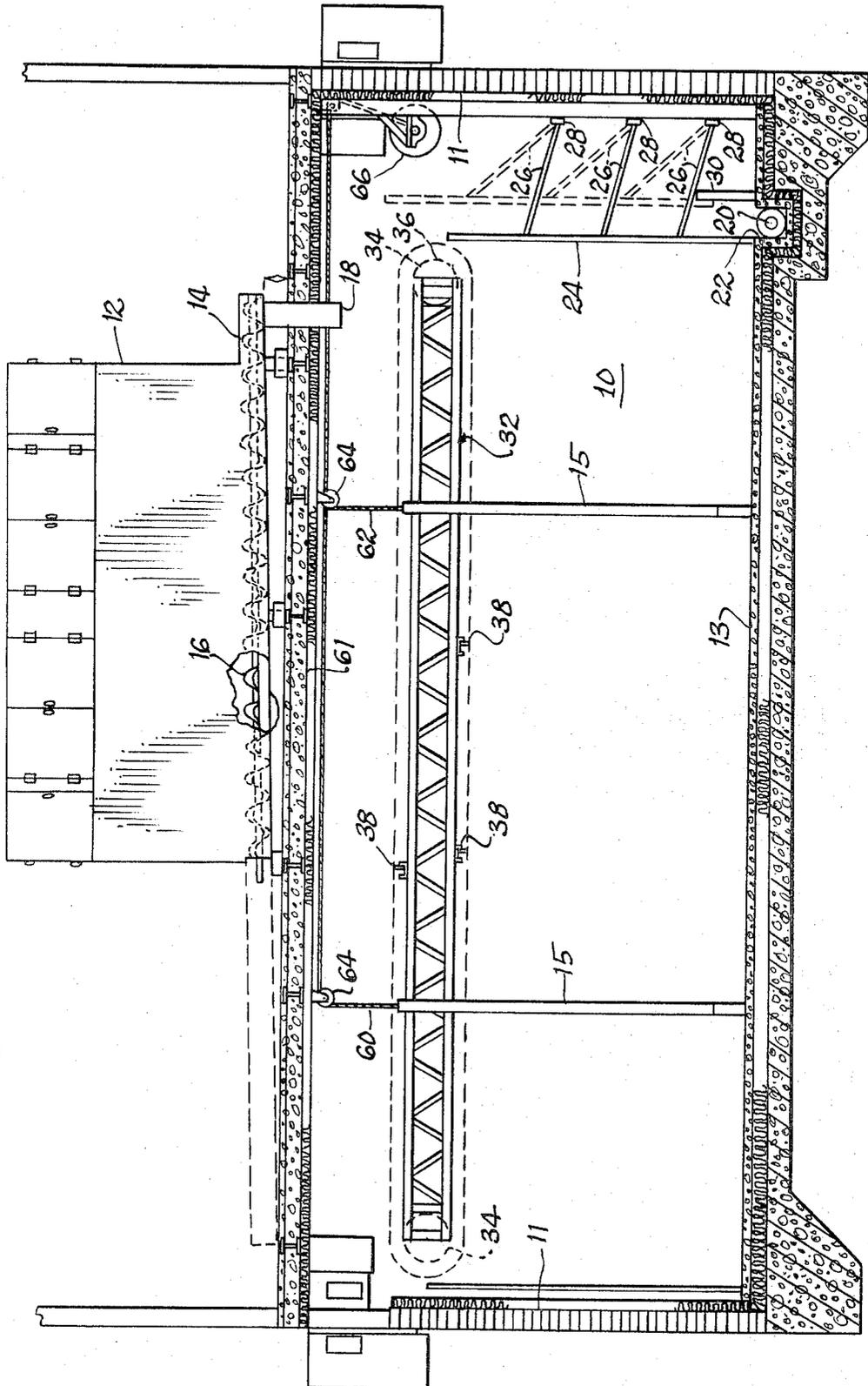


FIG. 2

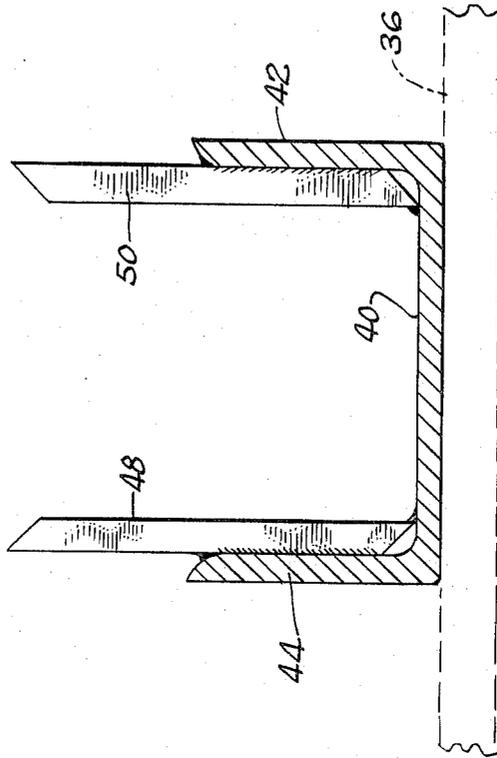
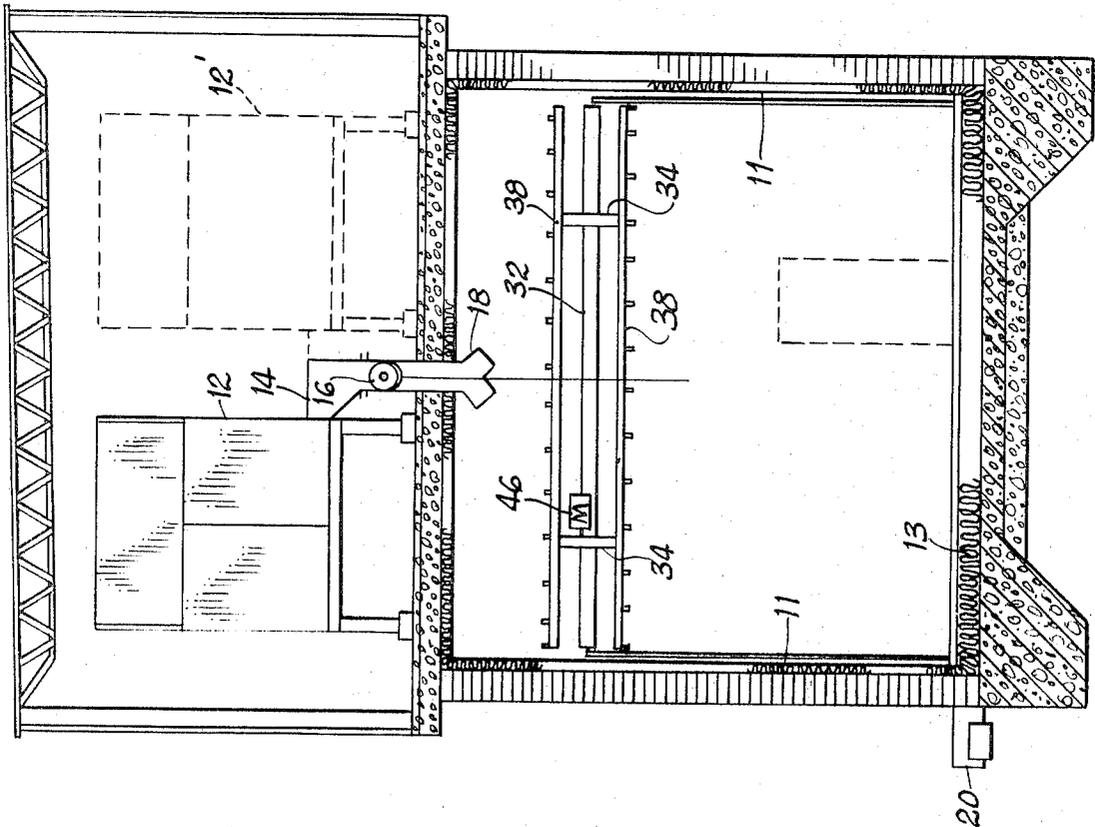
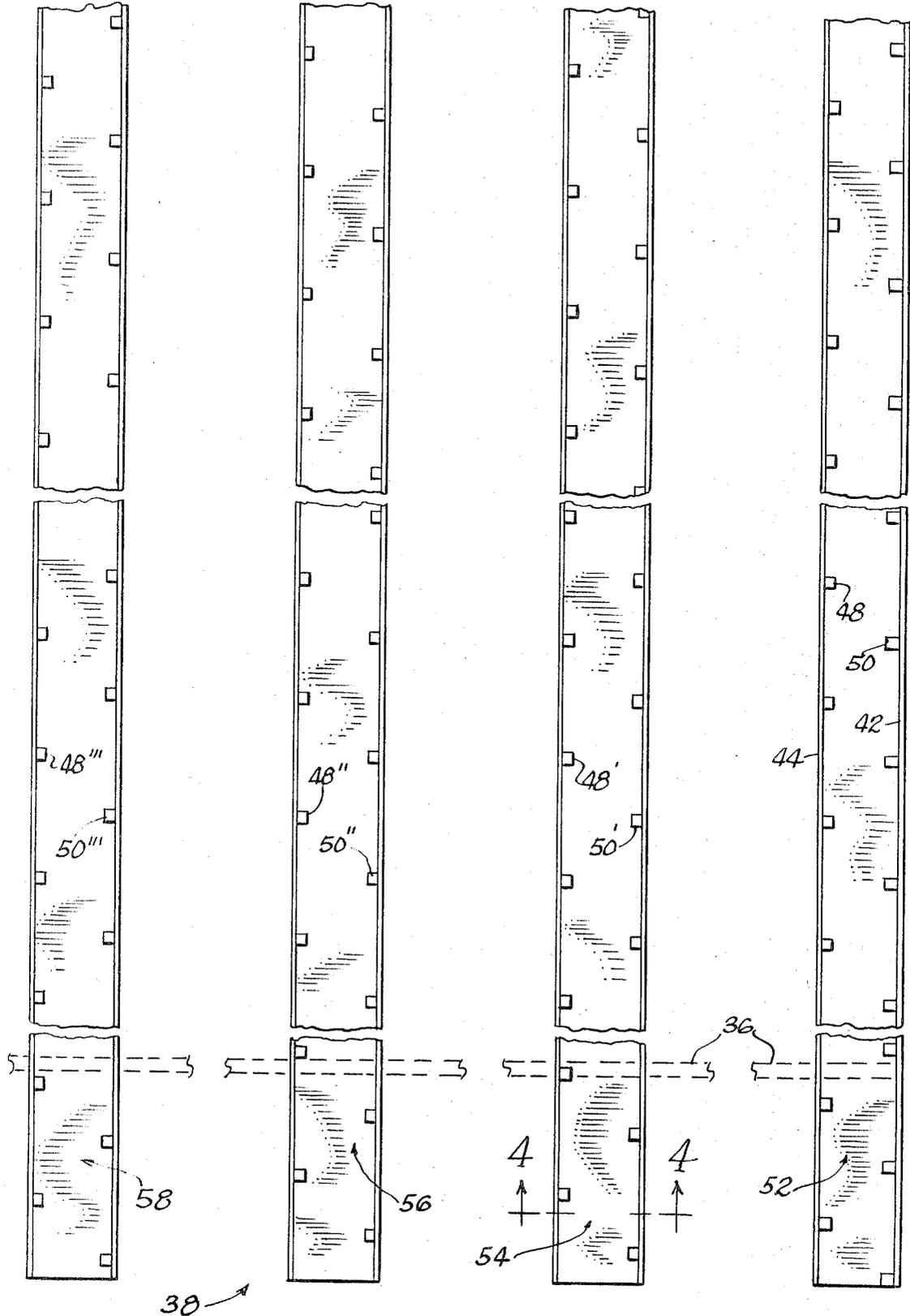


FIG. 4

FIG. 3



ICE RAKE FOR ICE MAKING APPARATUS

This invention relates to the manufacture of ice in bulk, and more particularly to apparatus for the manufacture, storage, and dispensation of large quantities of ice.

A variety of apparatus for use in the manufacture of large quantities of ice are now known to those skilled in the art. Representative ice-making machines are described in U.S. Pat. Nos. 3,074,252, 3,190,083, 3,246,481, 3,546,896, 3,587,241, and others. Commercial installations for the manufacture of ice, and particularly fragmented ice, generally include ice-making machines which actually form the ice and which are elevated above a bin, such as on a second floor of the installation. The ice makers discharge fragmented ice into a conveyor which in turn discharges the ice through an opening into the bin.

However, the automatic and sanitary handling of bulk, fragmentary ice once it is discharged into such a bin presents exceedingly difficult and specialized problems. Fragmented ice, when stored in a bin, can change characteristics during storage. For example, flakes of thin ice tend to break into smaller pieces akin to snow. Under certain temperature conditions, pieces of ice can fuse together. In addition, portions of ice in the lower part of a pile tend to fuse under the weight of a pile.

As a result of the foregoing special problems, fragmented ice in bulk cannot be regarded as being made up of discrete particles and is not even a product having definite handling properties. Fragmentary ice in bulk has no definite angle of repose. Consequently, fragmentary ice in bulk form is virtually incapable of flowing out of a large bin by gravity.

The inability of fragmented ice in bulk to flow with gravity has been previously recognized, and the art has sought to employ a device known as an ice rake for many years to facilitate the handling of ice. An ice rake is a type of a drag conveyor which contacts the top of a pile of the ice and is maintained in contact therewith by a system of cables by which the rake is suspended. The ice rake has been found to be the only mechanism for use in the handling and storage of bulk fragmentary ice. However, such ice rakes are subjected to extremely high stresses during use, with the result that breakage of the ice rake is a common occurrence. It is not uncommon for an ice rake to sustain breakage within ninety days of use.

Such ice rakes of the prior art are formed of a plurality of channel members which are displaced about a structural member, such as on a chain or the like. The channel members each have teeth fixed thereto, and the teeth on each of the channel members are in alignment. As the structural member is maintained just above the level of the ice in the bin, the structural members are advanced in either a forward or rearward direction in the bin to uniformly distribute the fragmented ice over the length of the bin. However, if the bin is being filled at a rate even slightly greater than the rate at which the rake is being raised, the rake tends to be buried in the ice. As the channel members having the teeth fixed thereto are displaced within the bin, the teeth tend to be broken off by ice which has become fused. Even where the teeth are not broken off, the aligned teeth tend to simply form continuous grooves in the surface layer of the ice in the bin, and the subse-

quently lowering of the entire ice-rake mechanism brings the channel members into contact with the top layer of ice, and results in breakage of the channel members or the mechanism by which such channel members are mounted.

It is accordingly an object of the present invention to provide apparatus for use in the manufacture, storage, and dispensation of bulk, fragmentary ice which overcomes the foregoing disadvantages, and it is a more specific object of the present invention to provide apparatus of the type described including an ice-rake mechanism which is capable of uniformly distributing bulk, fragmentary ice through a bin without generating stresses on the ice-rake mechanism sufficient to result in breakage.

These and other objects and advantages of the invention will appear more fully hereinafter, and, for purposes of illustration, but not of limitation, an embodiment of the invention is shown in the accompanying drawing in which:

FIG. 1 is a side view in elevation of the icemaking apparatus of this invention;

FIG. 2 is an end view in elevation of the apparatus shown in FIG. 1;

FIG. 3 is a view illustrating the staggered relationship of the teeth in the flites of the ice rake of this invention; and

FIG. 4 is a sectional view taken along the lines 4-4 in FIG. 3.

The concepts of the present invention reside in apparatus for use in the manufacture, storage, and/or dispensation of ice which includes means for generating fragmented ice in bulk and a bin positioned to receive the fragmentary ice from the generating means. In accordance with the practice of the invention, the bin is provided with an ice rake including a frame and a plurality of flites carried on the frame and movable along the frame. Each of the flites of the ice rake is in the form of a channel member, preferably having a U-shaped cross section.

It is an important feature of the present invention that the teeth mounted on the channel members of each flite of the ice rake be staggered from one flite of the rake to the next. In this way, the teeth of successive flites of the rake do not simply track in the grooves made by the teeth of the first flite, but travel in a path laterally offset from the teeth of the preceding flite. As a result, the successive passes of the teeth of the flites form grooves in the top layer of the ice which are spaced sufficiently close together to enable the flange portions of the flites to remove the ridges without causing damage to the rake mechanism. Thus, the use of staggered teeth on the ice-rake flites eliminate or significantly reduce the risk of breakage or damage to the ice-rake mechanism.

Referring now to the drawings for a more detailed description of the invention, there is shown in FIGS. 1 and 2 ice-making apparatus embodying the features of the invention. The apparatus includes a storage bin or compartment 10 having suitably insulated walls 11 and floor 13 which is supplied with bulk fragmentary ice by ice generating or forming means 12 which can advantageously be one of the ice-making machines of the type described in the foregoing U.S. patents. The bulk fragmentary ice is discharged as it is formed into a conveyor such as a screw conveyor 14 provided with auger

16 to convey the ice to a discharge chute or aperture 18 communicating with the bin.

As will be appreciated by those skilled in the art, the apparatus of the present invention contemplates one or several ice-forming units 12 to supply bulk fragmentary ice to the bin 10, depending somewhat on the size of the bin. For example, the ice-forming units can be positioned side by side as illustrated by units 12 and 12' in FIG. 2 and/or units can be distributed longitudinally along the bin 10.

Bulk, fragmentary ice can be discharged into the bin 10 at any point in the bin since the ice rake serves to distribute the ice over the length of the bin as more fully described hereinafter. Thus, the discharge opening 18 of the conveyor can be positioned near the forward end of the bin as illustrated in FIG. 1 of the drawing, or, if desired, it can be positioned at any other point along the longitudinal axis of the bin.

The ice contained in the bin can be discharged from the bin in a variety of ways. In the preferred embodiment illustrated in FIG. 1 of the drawing, the floor 13 of the bin is provided with a transversely extending conveyor 20 such as a screw conveyor which is positioned in a recess 22 formed in the floor 13 toward the forward end of the bin.

The bin is also provided with a door 24 which is mounted on a plurality of support arms 26 which are pivotally fixed to the forward wall 11 at 28. In this way, the door can be displaced upwardly away from the floor 13 and toward the wall 11 to which it is fixed as shown by the broken lines in FIG. 1. In the closed position shown in solid lines of FIG. 1, the door is positioned between the interior of bin 10 and the recess 22 to prevent ice in the bin from falling into the recess 22. As the door 24 is raised upwardly and toward the wall 11 of the bin, the door is advanced toward the wall 11 to expose the recess 22 to the bulk, fragmentary ice contained in the bin 10 to permit the ice to engage the conveyor 20 in recess 22 for removal of ice from the bin 10.

To prevent ice from falling behind the door 24, that is, between the door 24 and the wall 11, the floor 13 is preferably provided with a vertical wall member 30 which is positioned between the conveyor recess 22 and the forward wall 11 at a height sufficient to form a barrier, with the door 24, to prevent ice from becoming lodged behind the door.

The ice-rake mechanism of the present invention is shown in FIGS. 1 to 4 of the drawings. As is perhaps best illustrated in FIGS. 1 and 2 of the drawing, the ice rake includes a structural member or frame generally designated as 32. Each end of the frame 32 is provided with a pair of laterally spaced pulleys or sprockets 34. The pulleys or sprockets are rotatable and carry two or more spaced endless chains 36 or the like which are capable of traveling in a longitudinal path about the frame 32. Fixed to the chains 36 are a plurality of flites 38 of the ice rake which extend across substantially the entire width of the bin 10 (see FIG. 2) and which are spaced each from the other along the endless chains 36 longitudinally in the bin.

Each flite 38 of the rake includes a channel member formed of a base 40 and a pair of spaced flange elements 42 and 44, as seen in FIG. 4. Thus, the channel members have a generally U-shaped cross section, and extend substantially over the width of the bin 10. As is also shown in FIG. 4, the base 40 of the channel mem-

ber is fixed to the chains 36 in any convenient manner such that the flange elements extend away from the chains 36 and away from frame 32.

At least one of the pulleys 34 is adapted to be driven by a motor or the like 46, as can be seen in FIG. 2 of the drawing. It is generally preferred that the motor 46 be capable of driving the endless chains 36 having the rake flites fixed thereon in both directions. Thus, the flites 38 shown below the frame 32 in FIG. 1 of the drawings are capable of being advanced in a forward direction, that is, toward the bin door 24 as well as in the rearward direction, that is, away from the bin door 24.

As indicated above, one of the important features of the present invention resides in the use of rake teeth 48 and 50, as shown in FIG. 4 of the drawing, which are fixed to the flange members 44 and 42, respectively, of the rake flites. The teeth 48 and 50 as described above preferably take the form as narrow projections which can, for example, simply be welded to the channel members, as shown in FIG. 4 of the drawing. In order to prevent overstressing of the teeth 48 and 50, the teeth are generally of a fairly narrow width, for example, of the order of 1 to 3 inches, although wider or narrower teeth can be used as desired.

It is essential to the practice of this invention that the teeth on adjacent flites be staggered relative to each other. One suitable arrangement of such staggered teeth is shown in FIG. 3 of the drawing, which illustrates the use of four flites. For the sake of clarity, these four flites are illustrated in a side-by-side arrangement to demonstrate the staggered-teeth arrangement. As is shown in FIG. 3, flite No. 1, which is generally designated as 52 in the drawing, includes teeth 48 and 50 fixed to alternating flange elements 44 and 42, respectively. The adjacent flite, or flite No. 2, which is generally designated as 54, includes a plurality of teeth 48' and 50' which are out of longitudinal alignment with the corresponding teeth 48 and 50 of the first flite 52. In other words, the teeth 48 and 50 of flite 52 are staggered relative to teeth 48' and 50' of flite 54.

Similarly, the third flite, which is generally designated as 56, includes teeth 48'' and 50'' which correspond to teeth 48 and 50 of flite 52. Teeth 48'' and 50'' of flite 56 similarly correspond to teeth 48' and 50' of flite 54, except that teeth 48' and 50' are staggered relative to teeth 48' and 50' of the adjacent flite 54.

The fourth flite, which is generally referred to as 58 in FIG. 3 of the drawing, includes teeth 48''' and 50''' which correspond to the teeth of flites 52, 54, and 56. It is generally preferred that the teeth 48''' and 50''' of flites 58 be staggered relative to the teeth of at least one of the adjacent flites 56 and 52.

Thus, as the flites 52, 54, 56, and 58, fixed to the endless chains 36, are advanced in either the forward or rearward directions in the bin 10, the teeth 48 and 50 on each flite penetrate into the ice to cut tracks or grooves in the surface of the ice layer contained in the bin 10. Since the teeth of adjacent flites are staggered relative to each other, the teeth of successive flites do not simply track in the grooves formed by the teeth of the preceding flites, but, on the contrary, cut new grooves in the surface of the ice adjacent to those grooves cut by the teeth of the preceding flites to thereby form closely spaced ridges in the surface of the ice layer. These relatively narrow ridges can easily be

broken away as the flange members 44 and 42 of each flite contact the surface of the ice.

As will be appreciated by those skilled in the art, the staggering of the teeth of each flite serves to decrease the width of the ridges formed in the surface of the ice without increasing the number of teeth employed on the flites and consequently without increasing significantly the power required to drive the flites through the ice. Since the ridges formed in the surface of the ice are more closely spaced, they are characterized by less strength and are susceptible to being broken away and carried along by the flange elements of the rake as the channel members or flites of the rake are advanced in one direction or another in the bin.

In order to adjust the height or elevation of the rake within the bin so that the flange members on each flite of the rake on the under side of the frame 32 can be maintained just above the surface of the ice contained in the bin 10, the frame 32 of the ice rake can be suspended from the ceiling 61 of the bin by means of a pair of cables or the like 60 and 62, the ends of which are fixed to the rake and pass over pulleys 64 to a suitable motor-driven winch 66 or the like. By activating the winch 66, the frame 32 and consequently the flange elements 44 and 42 of each flite of the rake can be maintained at the desired level within the bin. As shown in FIG. 1, it is sometimes desirable to provide the longitudinal walls of the bin 10 with guide means 15 to prevent any forward or rearward movement of the rake while in use.

In the operation of the apparatus of this invention the rake is raised at a rate corresponding to the rate at which ice is fed to the bin from the discharge opening 18 during filling of the bin. As the bin is being filled with ice from the ice-making machine 12, the rake is activated to uniformly distribute the bulk fragmentary ice through the bin.

When it is desired to discharge ice from the bin by way of the conveyor 20, the door 24 is opened or raised to the position shown in broken lines in FIG. 1 whereby the ice is capable of contacting the conveyor screw 20 in the recess 22. When unloading the bin, the rake flites on the under side of the frame 32 are continuously advanced in the forward direction to continuously advance ice in the bin from the rearward end of the bin

toward the front whereby the ice is discharged by way of the conveyor 20. As the ice is being discharged from the bin, the rake is lowered by way of cables 60 and 62 to permit the flites of the rake to scrape the ice from the top of the bin and cause it to fall into the conveyor 20 in the recess 22 of the floor.

In view of the foregoing, it will be apparent that I have provided a new and improved apparatus for use in the manufacture, storage, and dispensation of fragmentary ice in bulk which facilitates the handling of ice both in the loading and unloading of storage bins. The ice rake of this invention represents a significant improvement in the art, since the ice rake embodying the features of this invention is subjected to significantly reduced stresses in use and consequently enjoys a drastically longer useful life.

It will be likewise apparent that various changes and modifications can be made in the details of construction, procedure, and use without departing from the spirit of the invention, especially as defined in the following claims.

I claim:

1. An ice rake mechanism comprising an elongate frame member, endless drive means movably mounted on the frame member to be rotatable about the frame member, and a plurality of horizontal flites fixed to the drive means for movement therewith, said flites including U-shaped channel members extending transversely to the frame member in a horizontal plane, each of the channel members including (at least one flange member extending away) spaced parallel flange members upstanding from the frame member, and a plurality of teeth fixed to (the) each flange member extending parallel thereto, with the teeth fixed to each flange (members) member (of adjacent flites) being staggered relative to each other, with said means being adapted to advance the flites relative to the frame member.

2. An ice rake mechanism as defined in claim 1 which includes means to suspend the ice rake mechanism in an ice storage bin.

3. An ice rake mechanism as defined in claim 1 wherein the drive means is adapted to drive the chain means in two longitudinal directions about the frame member.

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