United States Patent

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[54] APPARATUS FOR STORING HOLLOW ICE BODIES

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[51] **Int. Cl.** **F25c 5/18,** B65 1/06

[58] **Field of Search** 222/410, 146; 62/344, 381; 221/277; 2/253; 209/105, 100

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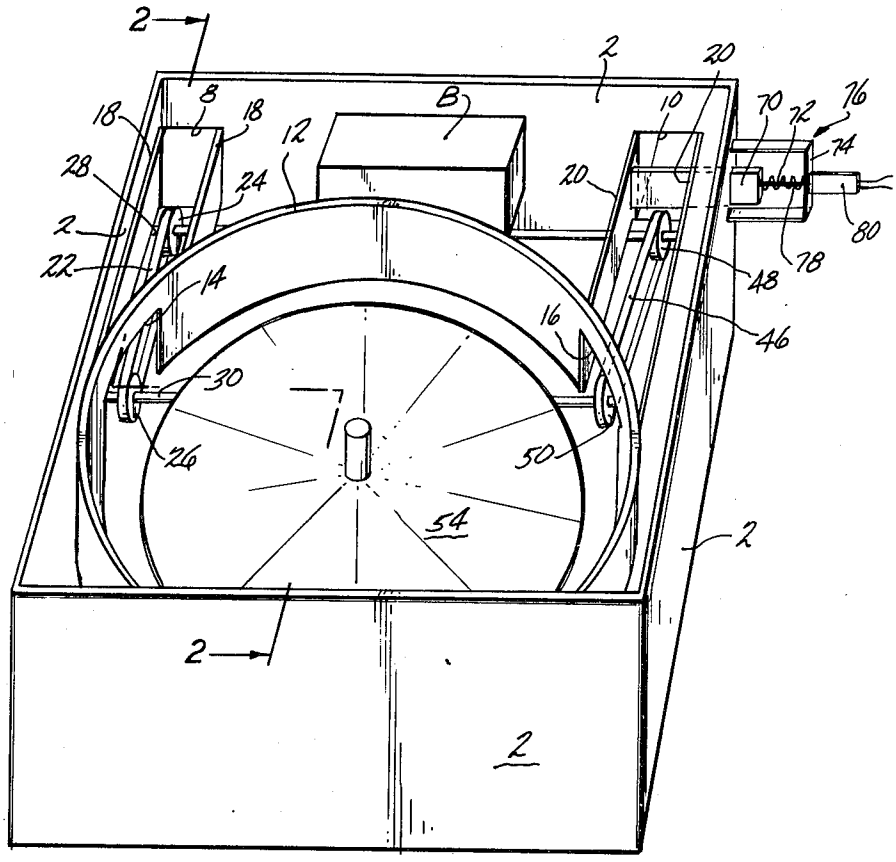
[57] **ABSTRACT**

Storage of frangible, hollow bodies of ice which are used as targets for shooters is accomplished by feeding the bodies so as to tumble them or change their relative attitudes with respect to each other thus preventing the stored bodies from adhering to each other. A conical supporting plate or floor is mounted in a chamber and constantly rotates therein. An annular side plate is mounted in the chamber, the side plate being spaced apart a predetermined distance from the side edge of the supporting plate, and the side plate is preferably immobilized in the chamber. Bodies are fed onto the supporting plate where they migrate toward its edge due to its conical shape. The combination of the moving supporting plate and immobile sideplate acting upon the bodies causes them to move through the chamber and to tumble as they move.

7 Claims, 3 Drawing Figures



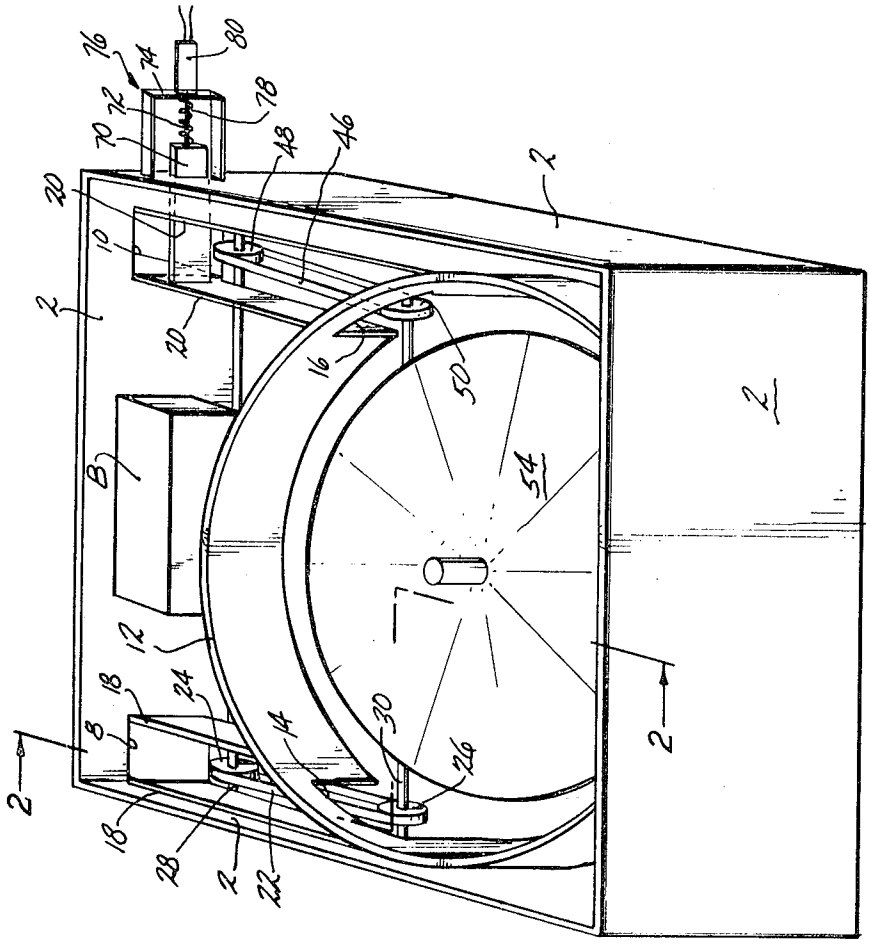


FIG - 1

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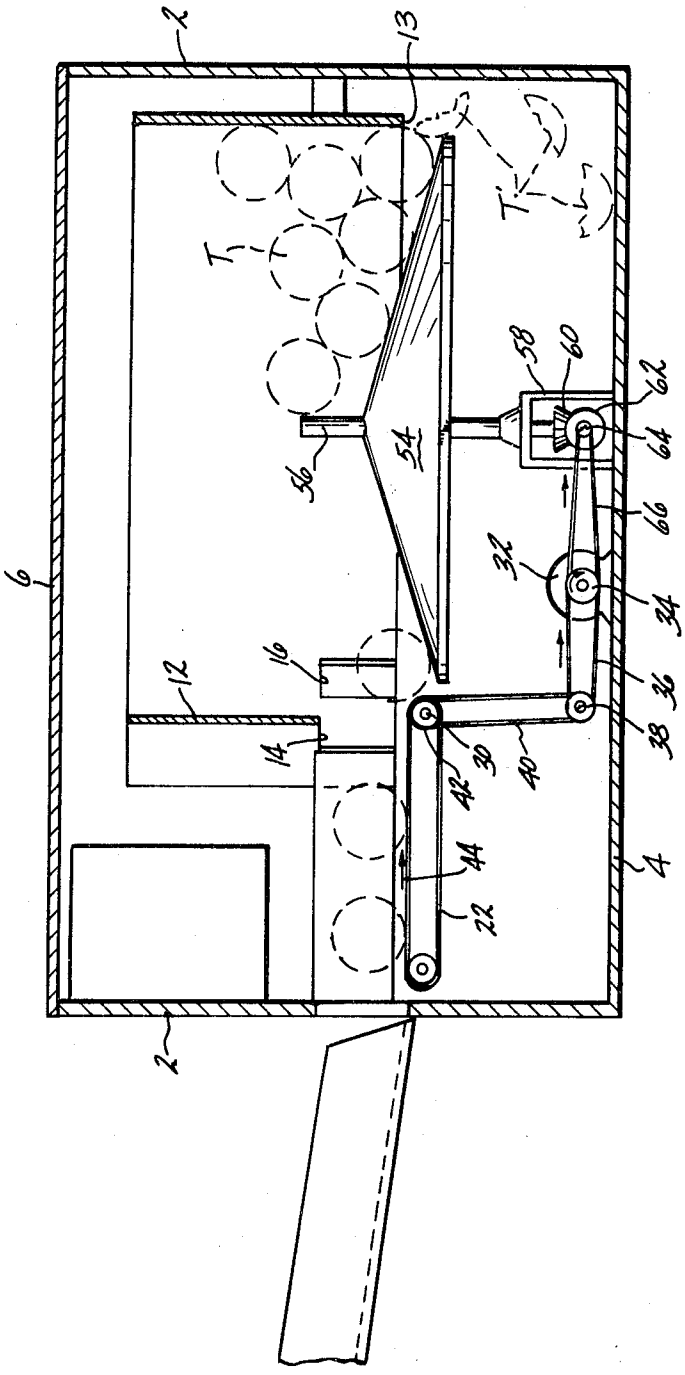

FIG-2

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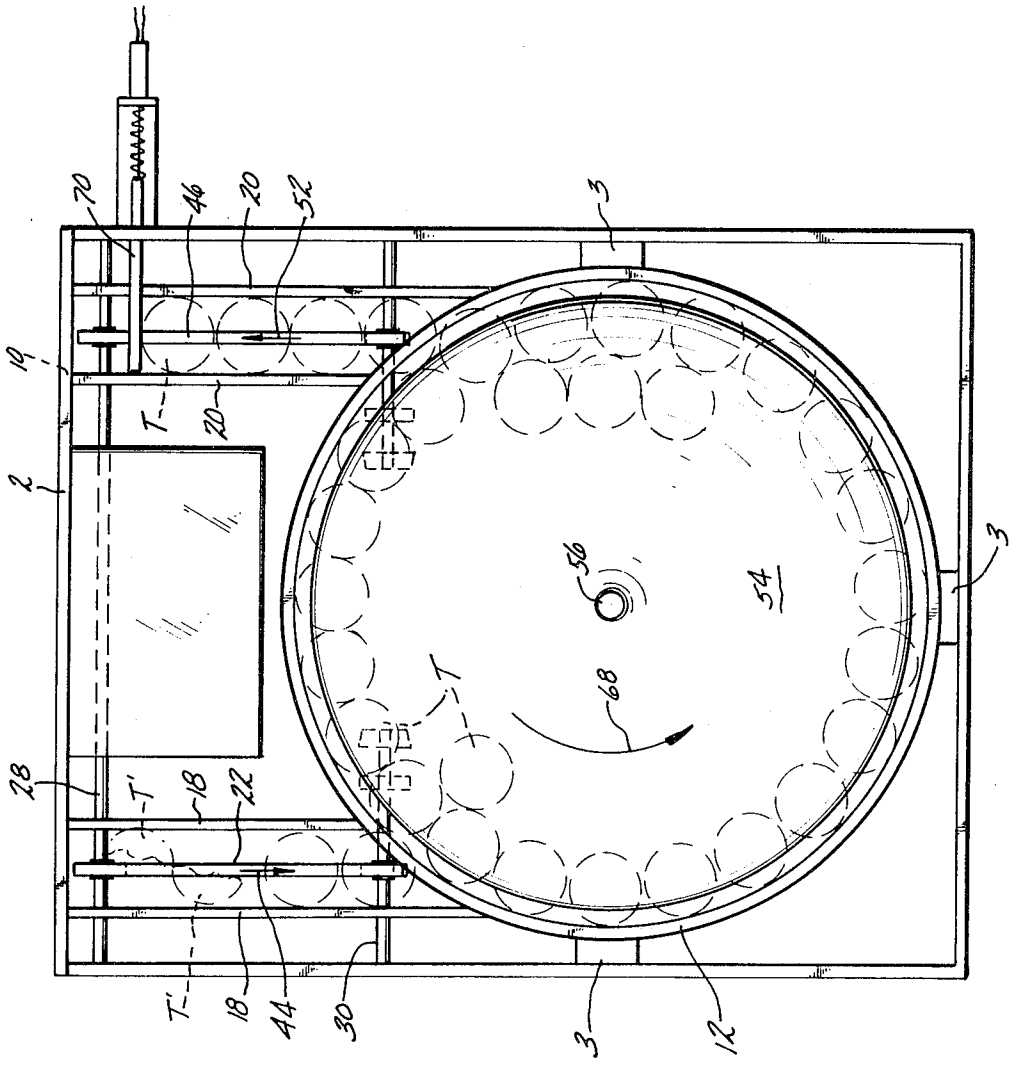

FIG-3

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APPARATUS FOR STORING HOLLOW ICE BODIES

This invention concerns the handling of hollow, frangible bodies of ice which are preferably used as targets for shooters. More particularly, the storage of a large quantity of targets after formation but before use is contemplated by this invention. The targets are preferably in the form of hollow spheres of ice of the type disclosed in U.S. Pat. application Ser. No. 812,782 to Edward H. Hadden, filed Apr. 2, 1969.

It has been found that hollow spherical bodies of ice possessing superior frangibility characteristics are highly desirable for use as targets for shooters. Such targets are inexpensive to produce, eliminate the problem of cleaning up broken target pieces, and can be made at the shooting range thus eliminating transportation costs, and packaging problems inherent with such frangible items.

While such targets can be produced at the shooting range at a steady rate, the rate of use of the targets can fluctuate widely. It will be readily appreciated that the rate of use of the targets at any given time can fluctuate from no usage at all, to a rate which is greater than the rate of production. Thus the problem of providing a reserve supply of such targets which can serve a high rate of demand and which can be replenished during periods of low demand has been encountered. Since the targets are made of ice and possess thin, frangible walls, they cannot be merely piled in a freezer since they could then easily adhere together, break, or develop flat or thin zones in their walls. The storage of such targets must be accomplished so that targets can be easily, and preferably automatically removed from storage for use, can be easily and continuously fed into the storage area, and can be prevented from sticking or adhering to each other or being damaged in any way while in storage. Furthermore, it is highly desirable to provide for automatic discarding or removal from storage of targets which have been broken either in storage or prior to being admitted to storage.

The apparatus of this invention provides for storage of the thin walled, frangible spheres of ice by providing a refrigerated chamber in which the temperature is maintained below the freezing point of water. The chamber includes an inlet opening and an outlet opening through which ice spheres are introduced into, and removed from the storage area respectively. An annular sidewall is provided within the chamber, and the bottom of the storage area within the chamber is preferably in the form of a cone confined within the annular sidewall. Means are provided for continuously rotating the conical bottom wall of the storage area so that spheres which are disposed within the storage area are continuously tumbled toward the periphery of the conical bottom wall of the storage area by gravity and by the relative movement of the bottom wall with respect to the annular sidewall. The annular sidewall also includes an inlet opening and an outlet opening aligned with the inlet and outlet openings in the chamber respectively. Sidewalls are provided between the respective inlet openings and outlet openings to form inlet and outlet chutes through which entering and exiting spheres are passed en route to and from the storage area. The bottoms of the inlet and outlet chutes are formed by endless conveyor belts having a width which is substantially less than the diameter of the spheres. In this manner substantial gaps in the inlet and outlet chutes are formed to provide for discharge of broken pieces of targets that have been damaged when made, or while in storage. There is also a substantial annular space between the periphery of the conical bottom wall of the storage area and the annular sidewall thereof, so that fragments of broken targets will tend to migrate, through gravity and movement of the bottom wall, toward this annular space where such fragments can fall off of the bottom wall and out of the storage area.

It is, therefore, an object of this invention to provide for the storage of hollow, fragile bodies of ice which are used as targets.

It is a further object of this invention to provide apparatus for storage of ice bodies of the character described wherein the ice bodies will be prevented from adhering to each other while they are stored.

It is yet another object of this invention to provide an apparatus of the character described wherein ice targets can be continually introduced into and withdrawn from the storage area in an automatic manner.

It is another object of this invention to provide apparatus of the character described wherein the stored targets are continually tumbled thus changing their respective attitudes or positions with respect to each other.

It is a further object of this invention to provide apparatus of the character described wherein fragments of broken targets which may get into the storage area are automatically removed therefrom by gravitational action.

These and other objects and advantages of the apparatus of this invention will become more readily apparent from the following detailed description of a preferred embodiment thereof, along with the accompanying drawings, in which:

FIG. 1 is a perspective view of a preferred embodiment of the storage apparatus of this invention;

FIG. 2 is a side sectional view of the apparatus of FIG. 1 taken along line 2—2 and showing the configuration of the bottom wall of the storage area; and

FIG. 3 is a top view of the apparatus of FIG. 1 clearly showing the inlet and outlet chutes.

Referring to FIGS. 1 and 2, a preferred embodiment of the storage apparatus of this invention includes a storage chamber having sidewalls 2, a bottom wall 4, and a top wall 6. A conventional heat exchange unit is contained in a box B mounted on one of the sidewalls 2 and is operative to lower the temperature within the storage chamber to below preferably about 30° F. The temperature in the storage chamber is preferably maintained within the range of about 18° F. to about 27° F. to maintain the frangibility of the targets as a preferred level. A conventional thermostatic control (not shown) is associated with the refrigeration unit to maintain this preferred temperature range.

One of the sidewalls 2 is provide with an inlet opening 8 and an outlet opening 10. An annular sidewall 12 is mounted in the storage chamber to provide therein the lateral boundary of a storage area. An inlet opening 14 and an outlet opening 16 are disposed in the annular sidewall 12. A pair of sidewall members 18 extend between the inlet openings 8 and 14, and a pair of sidewall members 20 extend between the outlet openings 10 and 16. The sidewalls 18 form the sides of an inlet chute, and the sidewalls 20 form the sides of an outlet chute within the storage chamber. An endless belt 22 which is mounted on a pair of guide rollers 24 and 26 forms the bottom of the inlet chute. The roller 24 rotates about a shaft 28, and the roller 26, which is a drive roller, rotates with a drive shaft 30. An electric motor 32 can be mounted in the chamber and is operative to rotate a hub 34 on which is mounted an endless belt 36. The belt 36 rotates a pulley wheel and shaft 38 on which is mounted a second endless belt 40 which is also mounted on a drive pulley 42 connected to the drive shaft 30. The endless belt 22 is thus driven in the direction of the arrow 44.

An endless belt 46 mounted on a pair of rollers 48 and 50, the latter of which is a drive roller, is provided with a similar arrangement operative to drive the endless belt 46 in the direction of the arrow 52, with the endless belt 46 forming the bottom of the outlet chute.

A conically shaped member 54 is secured to a shaft 56 which passes through a mounting bracket 58 secured to the bottom wall 4 of the chamber. A first bevel gear 60 is secured to the bottom of the shaft 56 in meshing engagement with a second bevel gear 62 secured to a drive shaft 64 journaled in the chamber. An endless belt 66 driven by the motor hub 34 causes the drive shaft 64 to rotate, thus rotating the bevel gears 62 and 60 and the shaft 56. The conical member 54 is thus caused to rotate in the direction of the arrow 68 (see FIG. 3). The conically shaped member 54 thus forms the bottom or floor of the storage area within the storage chamber, the annular member 12 forming the sidewall of the storage area. It is

noted that the sidewall 12 of the storage area is fixed to the sidewalls 2 of the storage chamber by means of brackets 3, so that the conical bottom wall 54 moves with respect to the sidewall 12.

As is most clearly shown in FIG. 3, the width of the endless belts 22 and 46 is substantially less than the distance between the sidewalls 18 and 20 of the inlet and outlet chutes respectively. In this manner, a substantial space in the inlet and outlet chutes is present so that fragments of broken targets can fall through to the bottom of the storage chamber and not be fed onto the rotating floor 54 of the storage area. In FIGS. 2 and 3 targets T are shown in phantom as they are fed into, stored in, and fed out of the storage area. FIG. 3 illustrates how fragments T' of a broken target are able to pass between the belt 22 and sidewalls 18 of the inlet chute and fall to the bottom of the storage chamber, and thus are prevented from entering the storage area. It is noted, and best illustrated by FIG. 2 that the conical shape of the storage area floor 54 combines with the force of gravity to cause the spherical targets T to tend to roll toward the periphery of the floor 54 and against the annular sidewall 12. The lower edge 13 of the annular sidewall 12 is offset from the periphery of the floor 54 a predetermined distance sufficient to provide a gap through which fragments T' of any targets which may become broken in the storage area can fall to the bottom of the storage chamber. Since the floor of the storage area 54 rotates and the annular wall 12 of the storage area is immobile, the targets positioned within the storage area are constantly in motion, their respective attitudes being constantly shifted with respect to each other. Relative movement between the floor 54 and the sidewall 12 causes a rotation or tumbling of all targets contacting both the floor 54 and the sidewall 12, and the rotating or tumbling targets in turn cause other targets contacting them to also rotate or tumble. The rotational movement of the floor 54 also draws targets out of the inlet chute, and tends to force targets into the outlet chute. The movement of the belts 22 and 46 in the inlet and outlet chutes respectively, tends to move targets respectively toward and away from the rotating floor 54.

An outlet gate 70 extends across the outlet chute and is normally operative to prevent targets from passing through the outlet opening 10 in the chamber sidewall 2. An operating rod 72 is connected to the gate 70, the rod 72 passing through an aperture in the vertical wall 74 of a frame 76 mounted on a sidewall of the chamber. A spring 78 is mounted on the rod 72 and sandwiched between the gate 70 and the frame wall 74 so that the spring 78 tends to bias the gate 70 toward toward an outlet chute-closed position. A solenoid 80 is connected to the rod 72 and is operative when actuated to pull the rod 72 and gate 70 against the bias of the spring 78 to open the outlet chute to permit a target to pass through the outlet opening 10 to some further station for use. Actuation of the solenoid 80 is of momentary duration so that only one target at a time can pass by the gate 70. It is noted that movement of the outlet chute belt 46 will tend to push the targets in the outlet chute against the gate 70 which is generally immobile. In this manner the targets in the outlet chute will be kept in a state of continuous motion, wherein their attitudes will constantly be changing with respect to each other. Since all of the targets in the storage area are kept in constant linear and angular motion, targets will not adhere to each other and can be continuously fed into and out of the storage area.

The storage apparatus of this invention thus permits a large number of targets formed from frangible spheres of ice to be stored without becoming stuck or adhered to each other. Continuous feeding of targets into and out of the storage area is readily accomplished in a smooth and easy manner without interfering with the continuous motion of the stored targets. Furthermore, fragments of broken targets are automatically discharged from the storage area and from the inlet and outlet chutes without interfering with the continuous motion and feeding of undamaged targets.

Since many changes and variations of the disclosed embodiments of the invention may be made without departing from the inventive concept, it is not intended to limit the invention otherwise than as required by the appended claims.

What is claimed is:

1. Apparatus for storing frangible, spherical bodies of ice, said apparatus comprising:
   a. housing means providing a storage chamber;
   b. means operative to cool said storage chamber to a temperature below the melting point of ice;
   c. first wall means in said storage chamber providing a sidewall of a storage area, said sidewall having a substantially circular configuration;
   d. second wall means in said storage chamber providing a bottom wall of said storage area;
   e. means providing an inlet chute opening into said storage area through said sidewall thereof, said inlet chute including means operative to move ice bodies through said inlet chute in a first predetermined direction toward said storage area;
   f. means providing an outlet chute opening into said storage area through said sidewall thereof, said outlet chute including means operative to move ice bodies through said outlet chute in a second predetermined direction away from said storage area; and
   g. means in said storage chamber operative to substantially continuously move ice bodies both angularly and linearly within said storage area, said means being operative to move ice bodies in said first predetermined direction in the area of said inlet chute to positively move ice bodies in said storage area away from said inlet chute, and said means being operative to move ice bodies in said second predetermined direction in the area of said outlet chute to positively move ice bodies in said storage area toward said outlet chute.

2. The apparatus of claim 1, wherein said inlet and outlet chutes each includes a pair of spaced apart sidewalls defining the width of said chutes, and driven endless belt means defining a bottom for said chutes, said belt means having a width which is substantially less than the width of said chutes and substantially less than the diameter of ice bodies passing through said chutes to permit fragments of broken ice bodies to fall out of said chutes between said sidewalls and said belt means under the influence of gravity.

3. The apparatus of claim 1, wherein said second wall means is conical in configuration to cause spherical bodies of ice disposed thereon to migrate toward the periphery of said second wall means and toward said sidewall under the influence of gravity.

4. The apparatus of claim 3, wherein the periphery of said conical bottom wall is spaced apart from said sidewall to provide a gap therebetween sufficient to prevent whole ice bodies from passing therethrough, and sufficient to permit fragments of broken ice bodies to pass therethrough to leave said storage area.

5. Apparatus for storing frangible, spherical bodies of ice, said apparatus comprising:
   a. housing means providing a storage chamber;
   b. means operative to cool said storage chamber to a temperature below the melting point of ice;
   c. first wall means in said storage chamber providing a sidewall of a storage area, said sidewall having a substantially circular configuration;
   d. second wall means in said storage chamber providing a bottom wall of said storage area, said second wall means being substantially conical in configuration with the central portion of said second wall means being elevated above the periphery thereof to cause spherical bodies of ice disposed thereon to migrate toward the periphery of said second wall means and toward said first wall means under the influence of gravity;
   e. means operably connected to said second wall means and operative to rotate said second wall means about its axis

in a predetermined direction to move ice bodies on said second wall means linearly in said predetermined direction;

f. inlet chute means including a pair of spaced apart sidewalls opening through said sidewall of said storage area, said inlet chute means including a bottom wall comprising a driven endless belt operative to move ice bodies through said inlet chute means toward the periphery of said conical bottom wall and generally in said predetermined direction taken where said inlet chute means opens into said storage area to smoothly feed ice bodies from said driven endless belt onto the periphery of said conical bottom wall; and

g. outlet chute means including a pair of spaced apart sidewalls opening through said sidewall of said storage area, said outlet chute means including a bottom wall comprising a driven endless belt operative to move ice bodies through said outlet chute means away from the periphery of said conical bottom wall and generally in said predetermined direction taken where said outlet chute means opens into said storage area to smoothly feed ice bodies from said periphery of said conical bottom wall into said outlet chute means.

6. The apparatus of claim 5, wherein said endless belt in said inlet and outlet chute means has a width which is substantially less than the distance between said spaced apart sidewalls of said inlet and outlet chute means, and substantially less than the diameter of the ice bodies passing through said chutes to permit fragments of broken ice bodies to fall out of said chutes between said chute sidewalls and said endless belts under the influence gravity.

7. The apparatus of claim 5, wherein the periphery of said conical bottom wall is spaced apart from said sidewall to provide a gap therebetween sufficient to permit fragments of broken ice bodies to fall therethrough to leave said storage area while preventing whole ice bodies from passing therethrough.

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