Feb. 29, 1944. W. T. HEDLUND 2,342,860

REFRIGERATION

Filed May 10, 1938 2 Sheets-Sheet 1

Fig. 2.

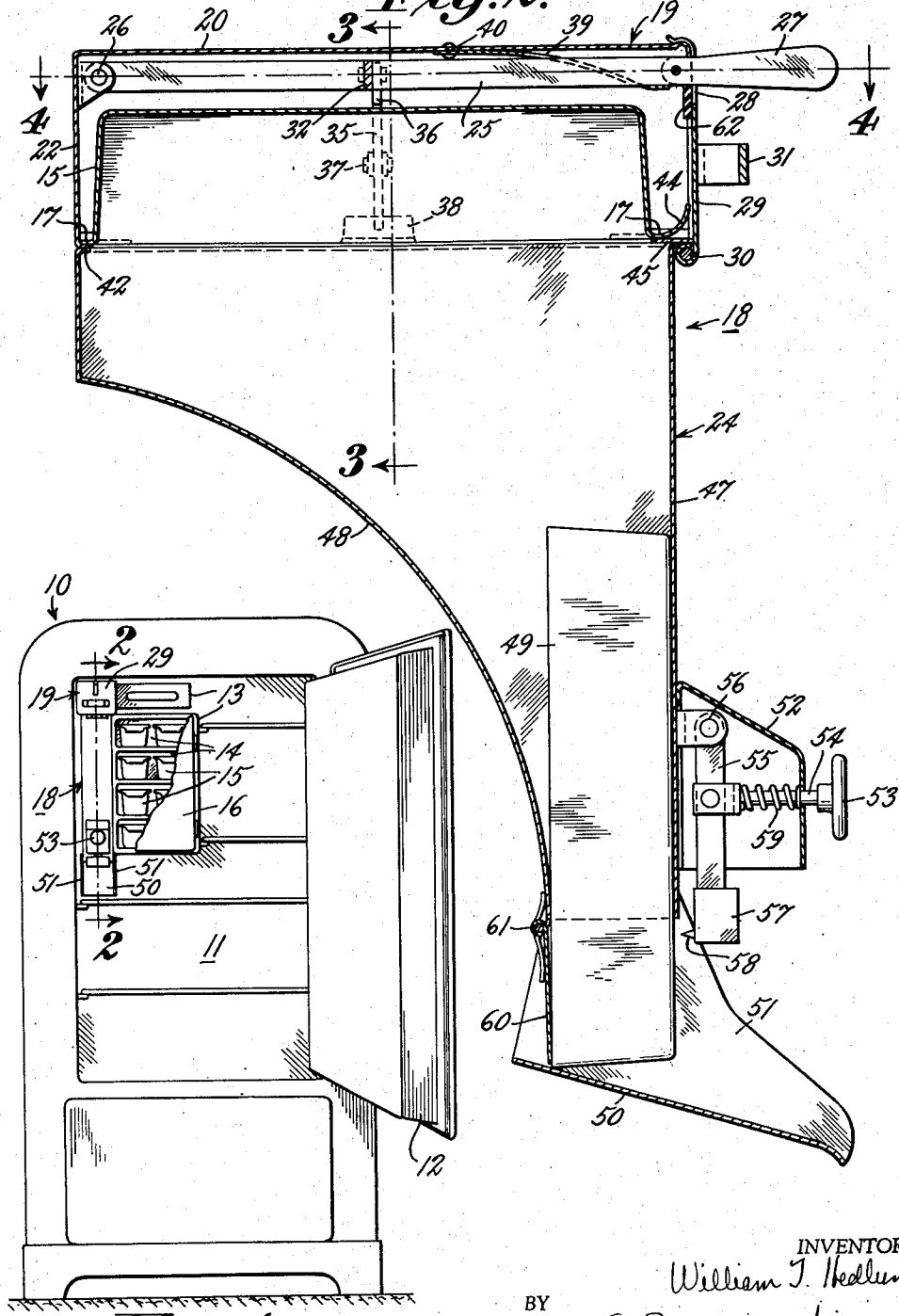


Fig. 1.

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Fig. 4.

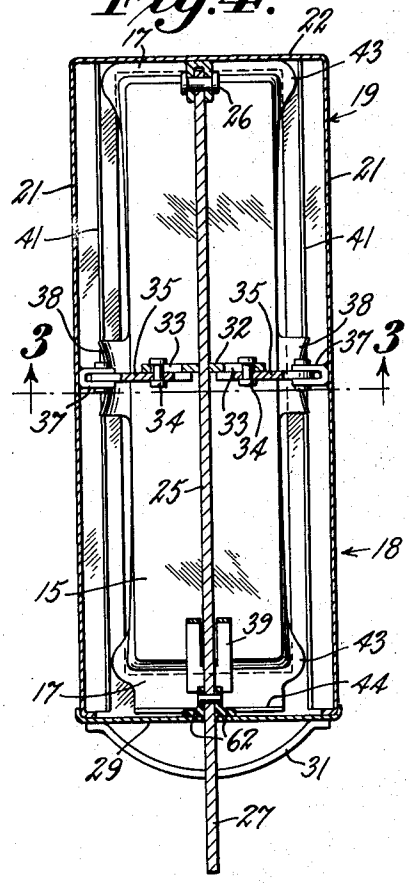


Fig. 5.

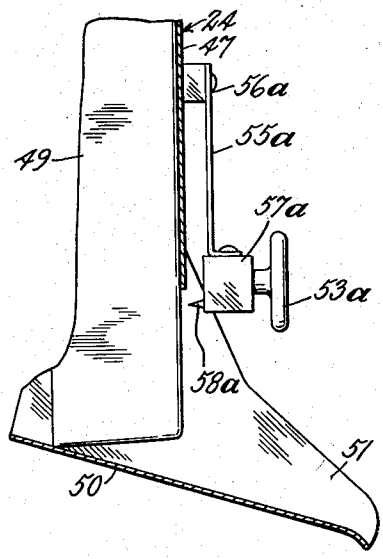


Fig. 6.

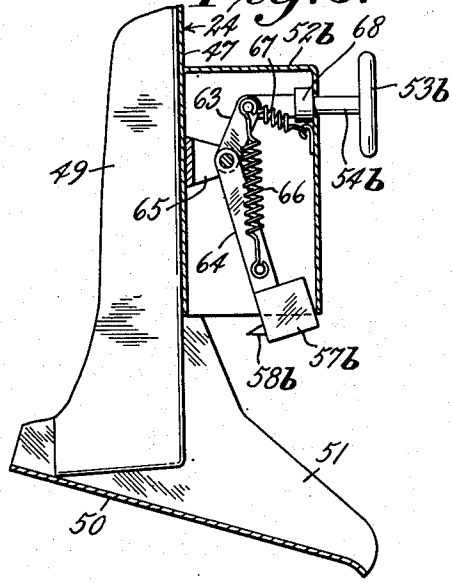
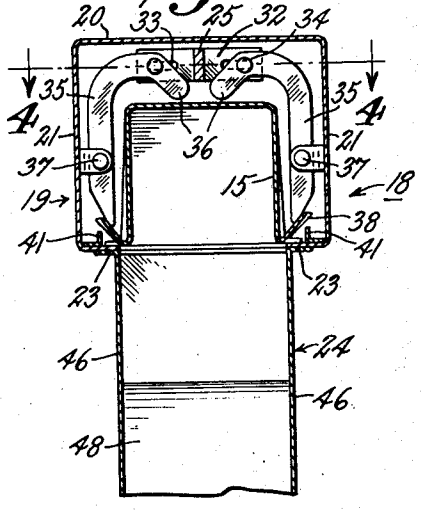


Fig. 3.



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2,342,860

REFRIGERATION

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Application May 10, 1938, Serial No. 206,976

18 Claims. (Cl. 62—105)

This invention relates to refrigeration and more particularly to the production of ice cubes in household refrigerators, and it is an object of the invention to provide an improved device for producing ice cubes at will from ice blocks which are formed in a freezing compartment of a household refrigerator.

This is accomplished by forming ice blocks in shallow trays, and, when one or more ice cubes are made, an ice block is removed from a tray without any handling of the ice block. Thereafter the ice block is chopped up into a number of smaller pieces or cubes of the desired size for use in cooling beverages and the like. The severing of an ice block into smaller pieces is also effected without any handling of the ice block, and any number of ice cubes or pieces may be made depending upon the quantity of ice cubes needed at any particular time.

The invention, together with the above and other objects and advantages thereof, will be better understood from the following description taken in conjunction with the accompanying drawings forming a part of this specification, and of which:

Fig. 1 is a front elevation of a refrigerator with the door thereof open and illustrating an ice cube device embodying the invention;

Fig. 2 is an enlarged vertical sectional view taken on line 2—2 of Fig. 1 to illustrate the device more clearly;

Fig. 3 is a fragmentary vertical sectional view taken on line 3—3 of Fig. 2;

Fig. 4 is a horizontal sectional view taken on line 4—4 of Fig. 3; and

Figs. 5 and 6 are fragmentary views illustrating modifications of the ice severing or chopping mechanism shown in Fig. 2.

Referring to Fig. 1, the invention has been shown in connection with a household refrigerator 10 having a thermally insulated storage space 11 into which access is afforded by a door 12. Within the storage space is disposed a cooling element or evaporator 13 which forms a part of suitable refrigeration apparatus and produces a refrigerating or cooling effect to freeze ice. The cooling element is provided with a plurality of ice freezing compartments 14 adapted to receive shallow trays 15 containing water or other matter to be frozen. The ice freezing compartments 14 may be provided with a door 16, as shown in Fig. 1.

The trays 15 are preferably formed with a resilient bottom and side walls. The trays 15 may be made of a suitable metal, such as aluminum or stainless steel, for example, and at the upper edge of each end wall is provided a flange 17.

The ice cube device 18 embodying the invention is disposed in storage space 11 at one side of cooling element 13. The device 18 includes an upper casing 19 having a top 20, lateral side walls 21, and a rear end wall 22. The casing 19 is supported in storage space 11 in any suitable manner. The side walls 21 are bent inwardly at their lower edges to provide flanges or ledges 23, as shown most clearly in Figs. 3 and 4.

To the open bottom of casing 19 is secured a shell 24 having a slide or chute for an ice block which is loosened from a tray 15 supported in an inverted position in casing 19. The mechanism for mechanically breaking the ice bond to permit an ice block to fall from tray 15 includes a lever 25 which extends lengthwise within the upper part of casing 19 and is pivotally connected at 26 to the rear end wall 22. The lever 25 is provided with a handle portion 27 which is adapted to extend through a vertical slot 28 in a door 29. The door 29 is pivotally connected at its lower edge at 30 to the front of casing 19. This pivotal or hinged connection may include a coil spring or the like (not shown) whereby the door 29 will automatically close when it is released. The door 29 is provided with a handle 31 to facilitate opening thereof when a tray is inserted in or removed from casing 19.

Approximately at the mid portion of lever 25 a cross-bar 32 is secured thereto. This may be accomplished by providing lever 25 and cross-bar 32 with cooperating notches whereby they may be inter-locked together. To provide an absolutely rigid connection, lever 25 and cross-bar 32 may be welded together in their inter-locked position.

The opposite sides of cross-bar 32 are formed with elongated openings 33 which receive flanged pins 34 fixed to the upper parts of bell-cranks 35. The upper parts of bell-cranks 35 are provided with downwardly extending ends 36, as shown most clearly in Fig. 3. The bell cranks 35 are disposed adjacent the side walls 21 and pivotally connected thereto at 37. When the tray 15 is placed in an inverted position in casing 19, the lower tapered ends of the bell-cranks project into the spaces formed between the tray side walls and flanges or tabs 38 at the tray side walls.

As shown in Figs. 2 and 4, a stiff resilient leaf spring 39 is secured at 40 to the top 20 of casing 19. The spring 39 is provided to keep lever 25 in its upper position and may be U-shaped with the closed end thereof bearing against the under side of lever 25. The parallel sides of the U-shaped spring 39 are located at opposite sides of lever 25. With lever 25 in its upper position, the lower tapered ends of bell-cranks 35 are automatically located above the ledges 23 so that they will project inside of the tray tabs 38 when a tray is placed in an inverted position in casing 19.

For accurately locating tray 15 in casing 19, guides 41 may be provided on the ledges 23, as shown in Figs. 3 and 4. The guides 41 extend

from the forward end to the rear end of casing 19 and the tray is moved into position between the guides. As shown in Fig. 2, the flange 17 at the rear of the tray abuts the rear end wall 22 and is seated on a ledge 42 at the rear of the casing. The tray flange 17 is formed with rounded corners 43, as shown in Fig. 4, which are adapted to contact guides 41 and thereby accurately locate tray 15 in an inverted position in casing 19.

The tray flange at the forward or front end is made wider and also curved to provide a handle or grip 44 for the tray, as best shown in Figs. 2 and 4. The flange or handle 44 is adapted to seat on a front ledge 45 extending across the front of casing 19.

The shell 24 below casing 19 is approximately the width of the ice tray 15 and is formed with vertical side walls 46, a front vertical wall 47, and a curved vertical rear wall 48 which serves as a slide or chute for an ice block loosened from tray 15. The lower end of shell 24 is provided with an opening which is approximately the same size in cross-section as the ice block 49. When an ice block falls in shell 24, as shown in Fig. 2, the lower end thereof strikes an inclined slide or stop 50 which is spaced from the lower end of shell 24. The stop 50 may be formed with sides 51 which are secured in any suitable manner to the lower end of the shell.

To the front wall 47 of the shell 24 is secured the ice block severing mechanism which is partially enclosed in a small housing 52. This mechanism includes an operating knob 53 which is fixed to a horizontal operating member or rod 54 which extends through an opening in the front of housing 52. The rod 54 is pivotally connected to a vertical lever 55 which in turn is pivotally connected at its upper end at 56 to the front wall 47 of shell 24. The lower end of lever 55 is provided with an inertia head 57 to which is fixed a sharp impact member or horizontal knife edge 58. A coil spring 59 is disposed about rod 54 so that, when knob 53 is pulled outward, the spring 59 is compressed. When knob 53 is released, the impact member 58 is driven against the ice block 49.

The impact member or knife edge 58 may take various forms, such as a row of sharp points or one or more narrow blades, for example, whereby a plane of severance is started and the ice block is chopped up when the impact member is carried by the inertia head 57 into impact with the ice block.

The operation of the device just described is as follows: The trays 15 are filled with water and placed in the ice freezing compartments of the cooling element 13. After the water has been frozen and when it is desired to make ice cubes for immediate use, one of the trays 15 is removed from cooling element 13 and placed in casing 19 in an inverted position.

In sliding the ice tray 15 on the ledges 23, the guides 41 accurately position the ice tray so that the lower tapered ends of bell-cranks 35 project into the spaces between the side walls of the tray and the flanges or tabs 38, as shown in Fig. 3. The handle 27 is now pressed downward against the action of spring 39 whereby the left-hand bell-crank 35 turns in a clockwise direction and the right-hand bell-crank turns in a counter-clockwise direction. The lower tapered ends of bell-cranks 35 engage the flanges 38 and cause outward flexing of the tray side walls. At the same time the upper ends 36 of the bell-cranks bear against the tray bottom to flex the latter, thereby mechanically breaking the ice bond and loosening the ice block from tray 15. When the handle 27 is released, it is moved upward by the action of spring 39, whereby the bell-cranks 35 are moved back to their normal position to permit removal of tray 15 and the insertion of the next tray 15 containing a frozen ice block.

The ice block 49 falling from tray 15 strikes the curved rear wall 48 of shell 24 and is guided to the upright or vertical position shown in Fig. 2, the slide 50 limiting downward movement of the ice block a definite distance below the bottom opening of shell 24. The knob 53 is then pulled outwardly whereby the spring 59 is compressed and the inertia head 57 and impact member 58 are moved away from the ice block 49. When knob 53 is released the inertia head 57 and impact member 58 are driven forward by the action of spring 59, thereby severing the ice block to form an ice cube. The ice cube thus formed slides on the inclined slide 50 below the front end of which the user may position a glass adapted to receive the ice cube.

After an ice cube is formed, the ice block 49 automatically moves downward until the lower end thereof again strikes the slide 50. The knob 23 may again be pulled outward and released to form another ice cube. With the arrangement just described, no handling of ice is necessary and the desired number of ice cubes may be formed for immediate use in one or more glasses adapted to contain a beverage to be cooled.

Although the trays 15 may be provided with straight longitudinal side walls, the mechanical breaking of the ice bond is facilitated considerably by forming the trays with longitudinal side walls which are bent inward slightly. An ice tray of this character is shown in Fig. 4. When the lower tapered ends of bell-cranks 35 engage the tabs 38 and move outwardly by pulling or pushing down lever 25, the longitudinal side walls of tray 15 are also moved apart and straightened, whereby mechanical breaking of the ice bond is readily effected.

When the longitudinal side walls of tray 15 are bent inwardly, as just described, the tray may be supported in an inverted position in casing 19 in such a manner that the longitudinal side walls are clear of the ledges 23. With such an arrangement, the inverted tray is supported at the rear and front cross ledges 42 and 45 of casing 19, as shown in Fig. 2. The longitudinal side walls of the tray may be clear of the side ledges 23, except at the corners of the tray. By supporting the tray in this manner, flexing of the tray bottom is facilitated when the downwardly extending ends 36 of bell-cranks 35 are moved against the tray bottom by downward movement of lever 25. Simultaneously with the application of force on the tray bottom, the longitudinal side walls of the tray are moved apart, as described above.

To prevent melting of an ice block when a tray containing such a block is inserted in casing 19, the latter may be arranged in thermal contact with the upper part of cooling element 13, as shown in Fig. 1. The shell 24 may also be arranged in thermal contact with the lower part of cooling element 13 to prevent melting of an unused portion of an ice block.

In order to avoid the formation of frost within casing 19 and shell 24, the circulation of air therein may be prevented by the provision of the door 29 at the front of casing 19, and a pivoted

closing member 60 at the lower end of shell 24, as shown in Fig. 2. The closing member 60 may be urged to its closed position by a coil spring 61 when the lower end of shell 24 is empty. A suitable gasket 62 formed of rubber or the like may be provided on lever 25 and positioned thereon so that slot 28 in door 29 will be closed when the door is released and moves to its closed position. With this arrangement an ice tray containing an ice block may be placed in an inverted position in casing 19 so that ice cubes may be made when desired by simply pressing down on handle 27, and thereafter pulling knob 53 and releasing the same as many times as necessary to provide the desired number of ice cubes.

In Fig. 5 is illustrated a modification of the ice chopping or severing mechanism shown in Fig. 2. In this modification an impact member or knife edge 58a is provided on an inertia head 57a. The inertia head 57a is secured to the lower end of a stiff resilient leaf spring 55a which is secured at its upper end at 56a to the front wall 47 of shell 24. The inertia head 57a is provided with an operating knob 53a.

When an ice block has fallen into shell 24 after being loosened from a tray in casing 19, ice pieces or cubes are readily made by pulling knob 53a outwardly and then releasing the same. When knob 53a is released the inertia head 57a and impact member 58a are driven forward by the action of spring 55a, whereby the ice block is severed and an ice cube is formed.

In Fig. 6 is diagrammatically illustrated a further modification of an ice chopping or severing mechanism which is snap-acting. The mechanism is enclosed in a housing 52b mounted on the front wall 47 of shell 24. An operating knob 53b is fixed to a rod 54b which extends through an opening in housing 52b. The rod 54b is pivotally connected to an arm 63 of a toggle which also includes an arm 64. The inner ends of toggle arms 63 and 64 are pivotally connected at 65 to the front wall 47 of shell 24. The outer ends of arms 63 and 64 are connected by a coil spring 66, and to the lower end of arm 64 is fixed an inertia head 57b which carries a knife edge or impact member 58b.

To operate the ice chopping mechanism in Fig. 6, knob 53b is pushed inward whereby arms 63 and 64 are straightened. When arms 63 and 64 pass dead-center position they are driven toward front wall 47 by the action of spring 66. With such movement impact member 58b is driven against the ice block, thereby severing the latter to form an ice cube.

To return toggle arms 63 and 64 back to the position shown in Fig. 6 when operating knob 53b is released, a coil spring 67 is connected to the upper end of arm 63 and to the front wall of housing 52b. The rod 54b is provided with a stop 68 to limit the movement of upper toggle arm 63 toward the right. Movement of lower toggle arm 64 toward the right is limited by inertia head 57b contacting the front of housing 52b.

If desired, a receptacle for ice cubes may be located below the slide 50 when it is not convenient to position a glass or a number of glasses below the slide to receive the ice cubes. Such a receptacle may be supported in any suitable manner below the slide, and, when the desired nnmber of ice cubes is collected, it may be removed from its support for immediate use.

Although the invention has been described with reference to the structure shown in the accompanying drawings, it will be apparent that various modifications and changes may be made without departing from the spirit and scope of the invention, as pointed out in the following claims.

What is claimed is:

1. In refrigeration apparatus, a holder for supporting a tray containing frozen matter in an inverted position, means to prevent melting of the frozen matter while said tray is being supported by said holder, and manually operable mechanism to distort said tray and break at will the frozen bond between said tray and the frozen matter contained therein.

2. Refrigeration apparatus comprising structure including a holder for an ice block, mechanism supported by said structure to chop an ice block while being held by said holder, said mechanism including an ice severing element having a reciprocatory movement, and means to prevent melting of an ice block held by said holder.

3. In refrigeration apparatus, the combination with a tray containing a block of frozen matter, of mechanism to mechanically loosen said block from the tray while the latter is in an inverted horizontal position, thereby permitting said block to fall by gravity, an impact member to sever said block into smaller pieces, means to guide said block whereby the latter assumes a vertical position adjacent said impact member, and a stop to limit downward movement of said block and permit successive portions thereof to move past said impact member after a lower part of the block has been severed by said member.

4. In a refrigerator having a thermally insulated storage space and a cooling element therein, a device to make ice cubes including a casing having a portion in heat exchange relation with said cooling element, said casing being adapted to support a tray in an inverted position, mechanism to flex said tray to break the ice bond and loosen an ice block in said tray, an impact member to sever the ice block, said casing having a passage for guiding the ice block past said impact member, and a stop to limit movement of the ice block, said stop permitting a severed piece of ice to fall clear of said block by gravity and allowing successive portions of the ice block to move past said impact member.

5. In a refrigerator having a thermally insulated storage space and a cooling element therein, a device to make ice cubes including a casing having a portion thereof in heat exchange relation with said cooling element, said casing being adapted to support a tray containing a block of frozen matter in an inverted position, mechanism to flex said tray to loosen the block of frozen matter in said tray, an impact member to sever the block into smaller pieces, and means to feed successive portions of the block by gravity past said impact member after the block is loosened from the tray.

6. In a refrigerator having a thermally insulated storage space and a cooling element therein, an ice cube making device including a casing disposed within said space, said casing being adapted to support a tray containing a block of ice in an inverted position, mechanism to flex said tray to break the ice bond and loosen said ice block from said tray, an impact member to sever said block into a number of smaller pieces, said casing having a chute whereby the ice block falls from said tray and assumes a vertical position adjacent said impact member, and a stop to limit downward movement of said block and permit successive portions thereof to move past

said impact member after a lower part of the block has been severed by said impact member.

7. In refrigeration apparatus, the combination with a shallow ice tray having resilient bottom and side walls, of means independent of the tray to move one or more side walls of the tray, means independent of the tray to flex the bottom of the tray, and mechanism for actuating both of said aforementioned means.

8. In refrigeration apparatus, the combination with a metallic ice tray having resilient bottom and side walls, of means to move the side walls of the ice tray, means to flex the bottom of the tray, and common means for actuating both of said aforementioned means.

9. In refrigeration apparatus, the combination of means to hold a tray containing ice in an inverted position, a member to receive and hold the ice loosened from said tray, an impact member, and means operatively associated with said impact member in which energy may be stored and subsequently released to cause said impact member to move with sufficient force against the ice to sub-divide the ice into a number of similar size ice pieces.

10. Refrigeration apparatus comprising, in combination, a holder for guiding an ice block along a predetermined path, an impact member, mechanism to support said impact member, said mechanism being constructed and arranged to keep said impact member clear of the ice block and being capable of storing energy to throw said impact member against the ice block with an impact to sever the ice block, and said holder being so constructed and arranged that the ice block is capable of moving past said impact member in such a manner that the ice block may be sub-divided into a number of similar size ice pieces by said impact member.

11. Refrigeration apparatus comprising, in combination, a holder for an ice block, a stop to limit gravity movement of the ice block in said holder, an impact member, mechanism to support said impact member, said mechanism being constructed and arranged to keep said impact member clear of the ice block and being capable of throwing said impact member against the ice block with an impact to sever the ice block intermediate its ends, said stop permitting a severed piece of ice to fall clear of the block by gravity and allowing the block again to fall by gravity against the stop whereby another ice piece similar in size to the first piece may be severed from the ice block by said impact member.

12. A method of making a number of similar size ice pieces which consists in the steps of forcibly loosening an ice block from a tray while the tray is in an inverted position in a region at or below freezing, and thereafter subdividing the ice block into a number of similar size ice cubes for use in cooling beverages and the like, said steps of loosening of the ice block from the tray and subsequent subdividing thereof into smaller pieces being characterized by the fact that handling of the ice block is avoided.

13. A method of making ice cubes which consists in forcibly loosening an ice block from a tray at will, feeding the ice block by gravity a predetermined distance past a severing region, and subdividing the ice block into ice cubes of uniform size at said severing region as successive portions of the ice block move the predetermined distance past said severing region.

14. Refrigeration apparatus comprising, in combination, a movable impact member, a holder for guiding an ice block past said impact member, structure including means for supporting said movable impact member with respect to said holder, said structure including a part and an operating element for said member and being so constructed and arranged that energy is stored in said part when said operating element is manually moved and such stored energy is effective to throw said impact member against the ice block with sufficient force to sever the ice block as it is guided past said impact member.

15. Refrigeration apparatus including means providing a region which is normally maintained at or below freezing temperature, structure in said region to support an ice tray in an inverted position, and mechanism for mechanically breaking an ice bond at will between the tray and ice frozen therein while the tray is in an inverted position.

16. Refrigeration apparatus including structure for holding a tray in an inverted position, manually operable mechanism movable from a first position to a second position to produce force for mechanically breaking at will the frozen bond between the tray and its frozen contents while the tray is in an inverted position, and said mechanism in said first position being ineffective to produce force to break said frozen bond while the tray is held by said structure in an inverted position.

17. Refrigeration apparatus including structure for holding a tray in an inverted position, manually operable mechanism movable from a first position to a second position for mechanically breaking the frozen bond between the tray and its frozen contents while the tray is held by said structure in an inverted position, and resilient means normally urging said mechanism to said first position when said mechanism is released.

18. In refrigeration apparatus, structure including a receptacle for an ice block having a depth from one surface to an opposite surface in a range normally produced in a freezing compartment of a household refrigerator, an element arranged to be supported by said receptacle for subdividing the ice block, said element being movable from a position clear of the ice block toward and into the latter, said structure being so constructed and arranged that relative movement of the ice block and said element can be effected, said element being supported on said receptacle in such a manner that during its movement toward and into the ice block at the one surface it is always pointed toward the opposite surface so that said element will be capable, if desired, of causing a substantially clean fracture of the ice block from the one surface to the opposite surface, said element due to said relative movement with the ice block being operable at different regions along said one surface of the ice block to fracture and subdivide the latter into smaller pieces, and mechanism operable to store energy and subsequently release such stored energy to cause said element to move forcibly into one surface of said ice block to effect fracture thereof.

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