Aug. 20, 1940. H. J. ROSE ET AL 2,212,405

ICE CUBE DISPENSING DEVICE FOR REFRIGERATORS

Filed Dec. 11, 1937 4 Sheets-Sheet 1

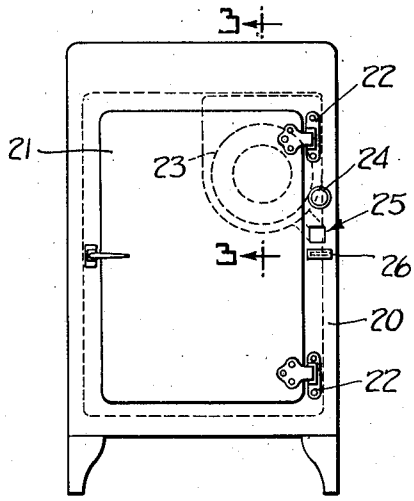


Fig. 1.

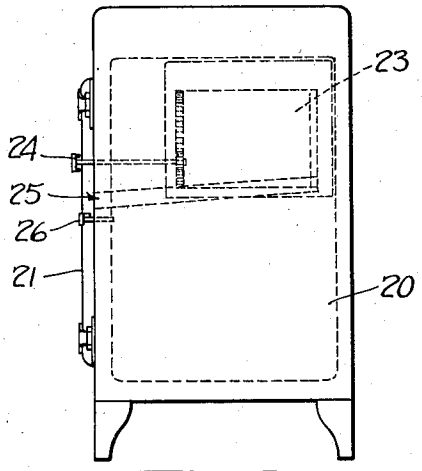


Fig. 2.

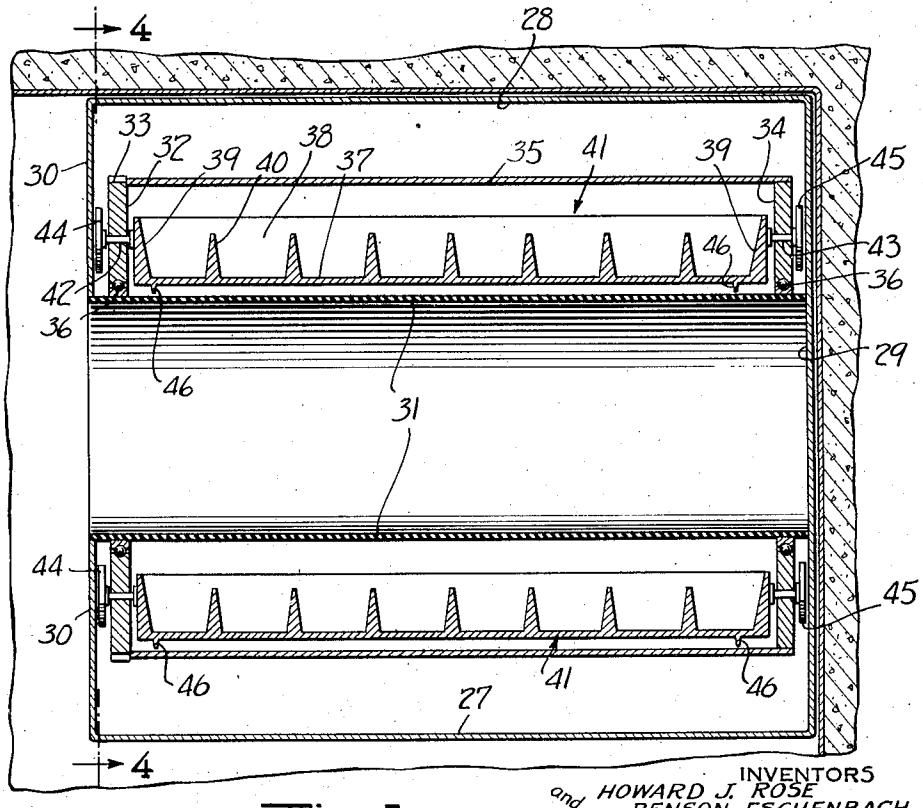


Fig. 3.

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ICE CUBE DISPENSING DEVICE FOR REFRIGERATORS

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Fig. 4.

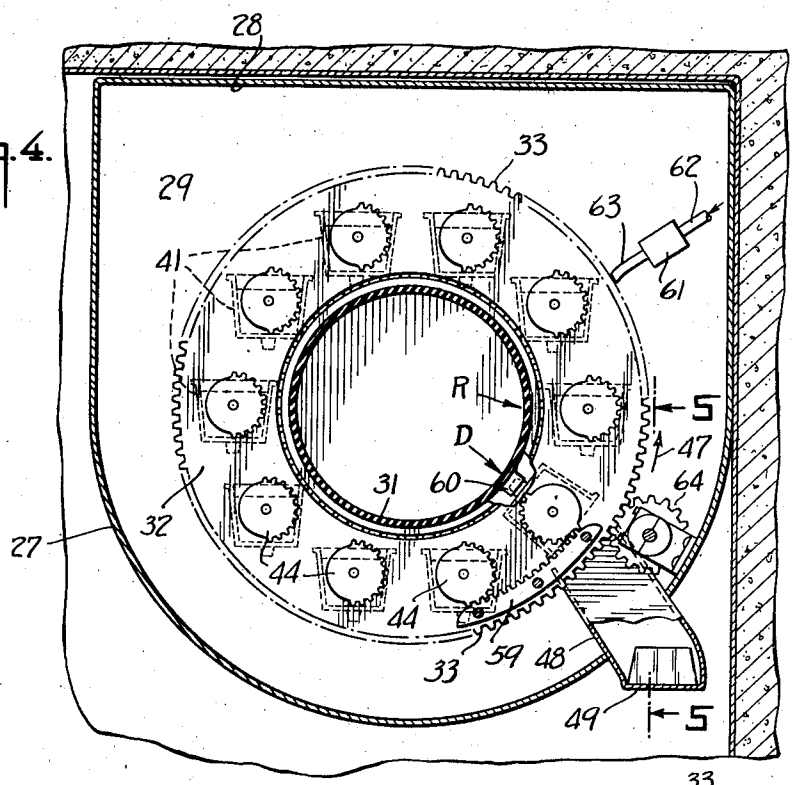
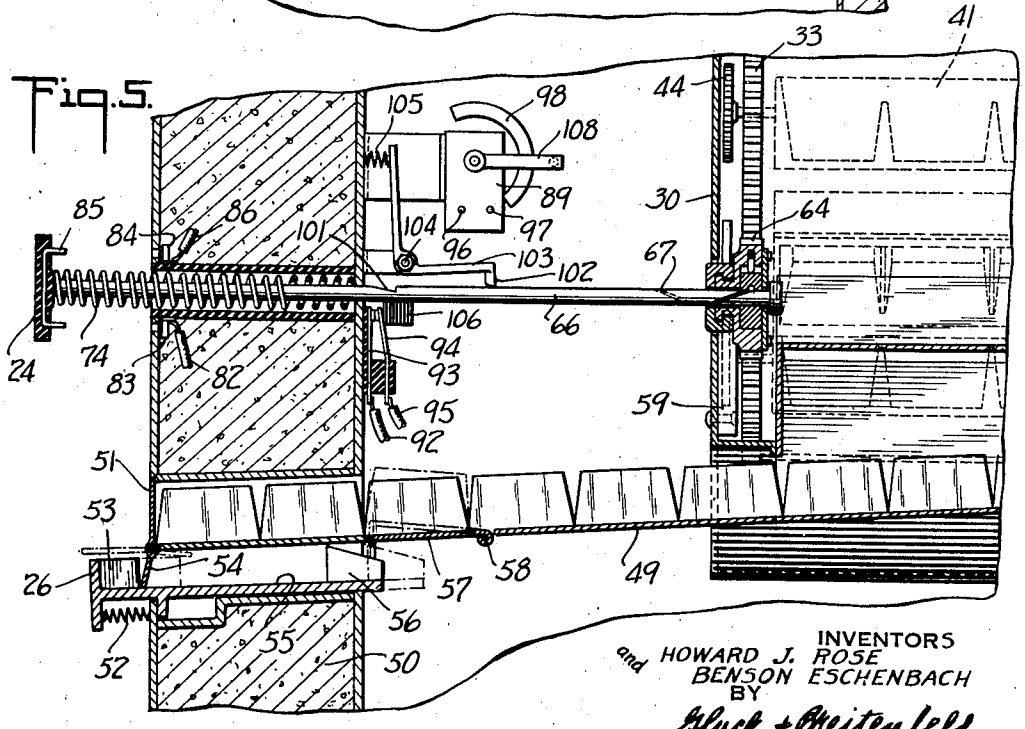


Fig. 5.



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Fig. 6.

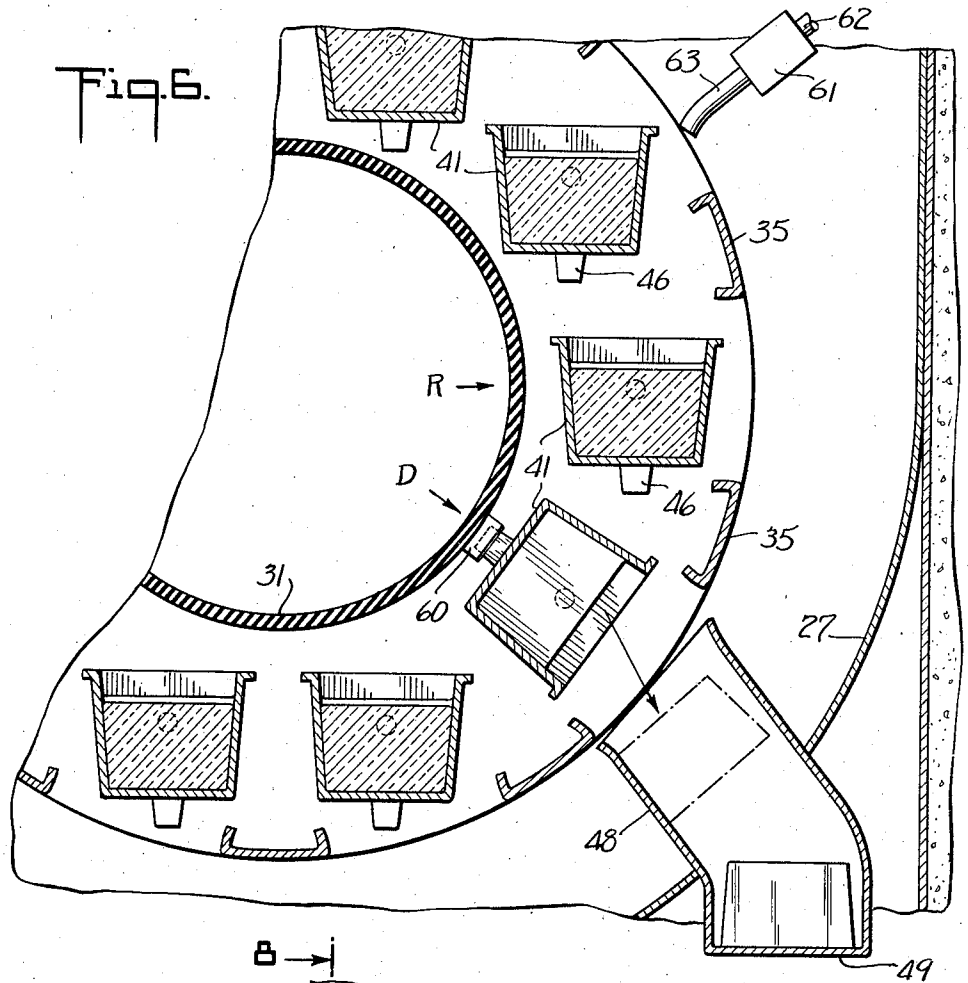
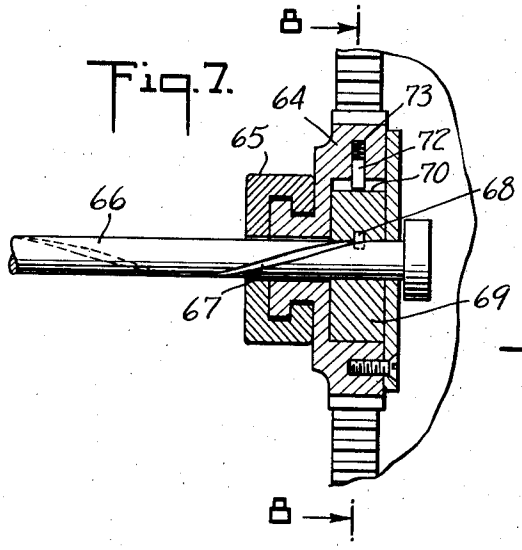


Fig. 7.



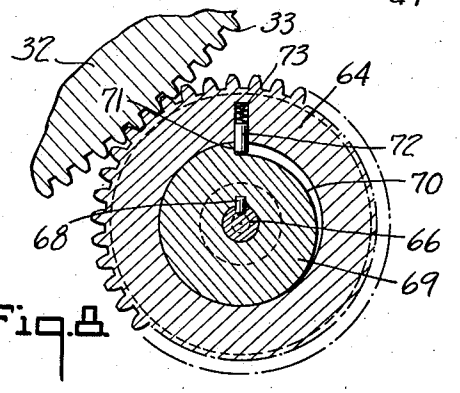


Fig. 8.

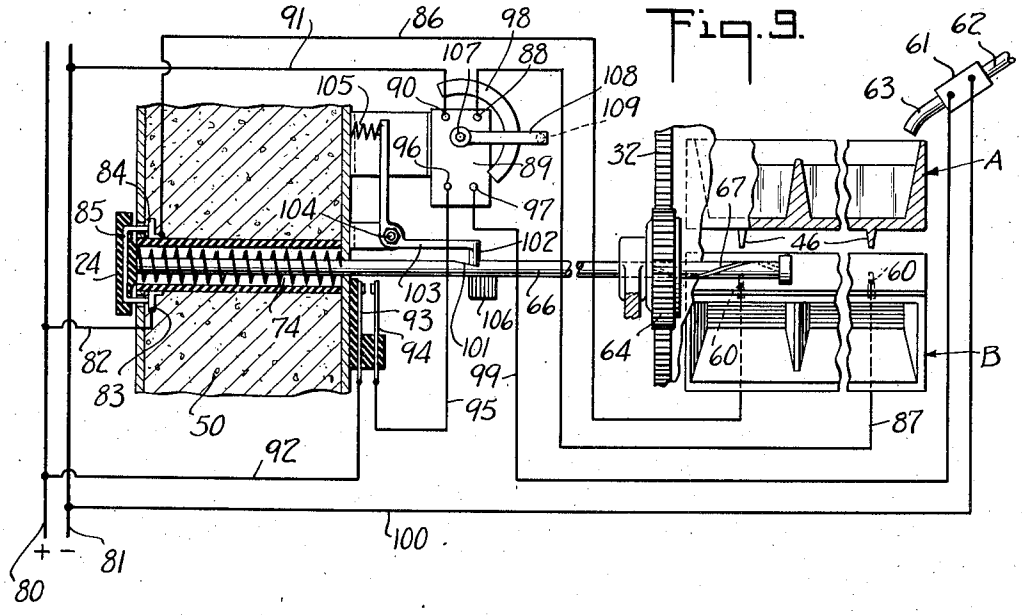
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ICE CUBE DISPENSING DEVICE FOR REFRIGERATORS

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Fig. 9.



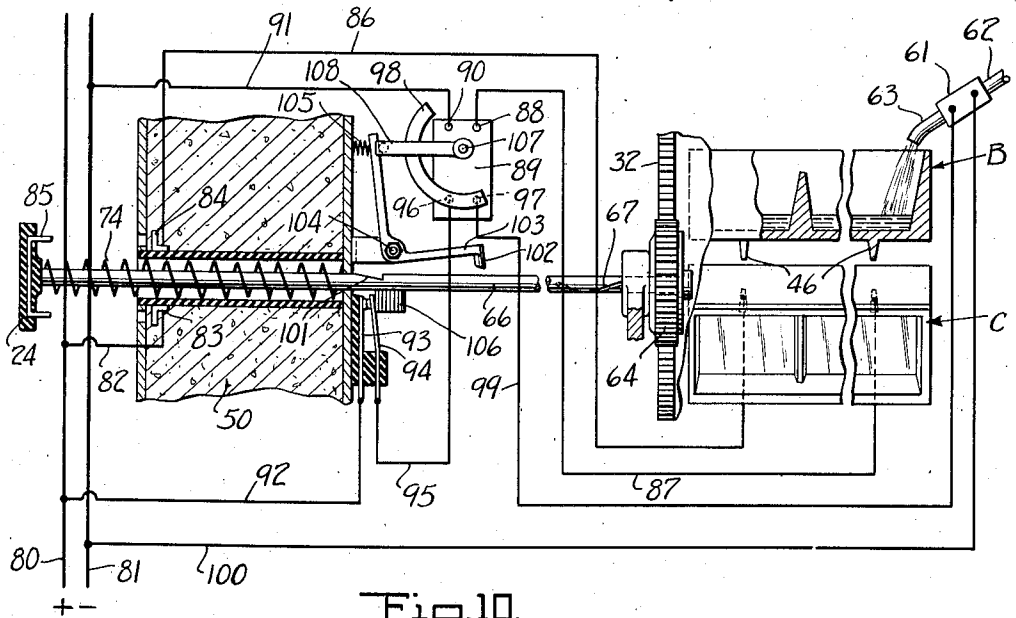


Fig. 10.

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UNITED STATES PATENT OFFICE

2,212,405

ICE CUBE DISPENSING DEVICE FOR REFRIGERATORS

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Application December 11, 1937, Serial No. 179,240

10 Claims. (Cl. 62—108.5)

Our present invention relates generally to refrigerators, and has particular reference to refrigerators of the household type in which means for freezing a series of ice cubes is customarily provided.

It is a general object of our invention to provide an improved arrangement of parts whereby the withdrawal of ice cubes if and when desired is greatly facilitated. More particularly, it is an object of our invention to provide a means exteriorly controllable with respect to the refrigerator as a whole for automatically bringing about a delivery of ice cubes into an accessible position.

In accordance with our invention, the person desiring ice cubes is required to do nothing more than to operate an exteriorly controllable member, such as a plunger that is pushed or pulled or a handle that is turned, as a result of which a predetermined number of ice cubes are automatically released from the interior of the refrigerator and discharged or delivered to a position where the person may have ready access to them from the exterior of the refrigerator.

Certain phases of our invention permits its use in a manner which may not be quite so entirely automatic.

Briefly, our invention contemplates the mounting of a series of ice cube trays to permit successive movement of the trays to a discharging station, at which station means are provided for controlling the release of ice cubes from the tray that is brought to that station. Preferably, a discharge chute is so arranged that it will receive the released cubes and transmit them to an accessible position.

Our invention also contemplates the successive advancement of the ice cube trays to a refilling station, with means provided at that station for introducing a new charge of water to the empty tray that moves to said station.

It is a particular feature of our invention to provide a coordinated series of means for releasing cubes at the discharging station, for advancing the trays, and for actuating the refilling means at the refilling station, whereby the entire operation may, if desired, be rendered almost completely automatic.

In the preferred embodiment herein illustrated and hereinafter to be described, it is another feature of our invention to provide a means for automatically turning a tray upside down as it approaches the discharging station, so that the subsequent release of the ice cubes will permit them to fall by gravity into the discharge chute or other receptacle. The invention is so devised that as the tray advances from the discharging station to the refilling station it is automatically restored to upright position, so that it will be in readiness to receive a new charge of water.

In accordance with our invention, none of the series of trays is at any time completely empty, the maximum capacity for ice cubes being thus made use of at all times.

Preferably, the discharging means comprises an arrangement for applying heat to the tray at the discharging station; and, preferably, this heating means, as well as the refilling means, is electrically controlled.

We achieve the foregoing objects, and such other objects as may hereinafter appear or be pointed out, in the manner illustratively exemplified in the accompanying drawings wherein—

Figure 1 is a front elevational view of a typical refrigerator with which our present invention has been incorporated, this view being somewhat diagrammatic;

Figure 2 is a side elevational view of the same;

Figure 3 is an enlarged cross-sectional view taken substantially along the line 3—3 of Figure 1;

Figure 4 is a cross-sectional view taken substantially along the line 4—4 of Figure 3;

Figure 5 is an enlarged cross-sectional view taken substantially along the line 5—5 of Figure 4;

Figure 6 is a view similar to Figure 4 on a greatly enlarged scale;

Figure 7 is an enlarged fragmentary view of the mechanism shown at the right in Figure 5;

Figure 8 is a cross-sectional view taken substantially along the line 8—8 of Figure 7;

Figure 9 is a greatly enlarged view similar to Figure 5, diagrammatically showing the electrical controls and one step in the functioning of the apparatus; and

Figure 10 is a view similar to Figure 9, showing the parts in the positions they assume during the completion of the functioning of the apparatus.

The refrigerator 20 of Figures 1 and 2 may be provided with the usual door 21 hinged as at 22. Within the upper portion of the refrigerator, preferably toward one side, is the ice cube apparatus to which the present invention specifically relates, this apparatus being designated generally in Figures 1 and 2 by the reference numeral 23.

At any convenient accessible portion on the

exterior of the refrigerator, preferably on the front wall, as shown in Figures 1 and 2, we provide an exteriorly controllable member 24 which we have shown in the form of a button or knob adapted to be pushed inwardly when the apparatus is to be caused to function. In a similar accessible position, we provide an outlet 25 for the ice cubes that are to be released from the apparatus 23 and delivered to the person desiring them. Preferably, a manually controllable member 26 is provided to facilitate the ultimate dispensing of the ice cubes.

In the embodiment herein illustrated, the ice cube apparatus 23 is mounted within a suitable closed chamber having the side and bottom walls 27, the top wall 28, the rear wall 29, and the front wall 30. The front wall is annular in shape, its inner circular edge joining the front edge of a tubular wall member 31.

Rotatably mounted upon the tube 31 is a supporting framework for the ice cube trays themselves. This frame work may consist of a forward disc 32 having the peripheral gear teeth 33, and the rearward disc 34, these discs being interconnected by the longitudinal spacers 35. The entire framework is suitably mounted to rotate freely around the tube 31, and we have illustratively shown ball or roller bearings 36 for accomplishing this purpose.

A series of ice cube trays extend in spaced parallel relation between the discs 32 and 34 and, preferably, each tray accommodates only a single row of ice cubes. Thus, each tray is preferably provided with a bottom wall 37, side walls 38, end walls 39, and fins or partitions 40 for freezing the water in the form of separate tubes. The trays are designated generally by the reference numerals 41, and the detailed description of the tray shown at the upper portion of Figure 3 will serve as an adequate description of all the trays.

Each tray is pivotally supported between the discs 32 and 34, and we have illustratively shown journals 42 and 43 projecting forwardly and rearwardly, respectively. Mounted on at least one of these journals is a mutilated gear 44. We have illustratively shown each of the forward journals 42 carrying such a gear, and we have also shown each of the rearward journals 43 carrying a similar gear 45. It will be noted that these gears are on the exterior of the discs 32 and 34, respectively.

Each tray also carries a pair of electrical contacts 46, preferably projecting from the bottom wall 37. As will be presently described, these contacts are intended to provide for the passage of a heating current through the tray to heat the accommodated ice cubes and cause a release of the cubes. Where the tray is made of suitable metal and is suitably insulated from its journals or other supporting elements, the tray itself may enter into the electrical heating circuit so that the passage of current through the tray will cause it to heat up due to its inherent resistance. If desired, however, the contacts 46 may communicate with any suitable type of heating wire or coil mounted in association with the tray and insulated from the tray for accomplishing the same purpose. For the sake of simplicity, we have omitted the details of any such heating means, since its arrangement and function will be obvious from the description given.

The supporting framework carrying the trays is adapted to be rotated stepwise in the direction of the arrow 47 of Figure 4, whereby the trays are successively advanced to a discharging station designated D and then to a refilling station designated R. At the discharging station, a discharge chute 48 is provided, this chute being so constructed and arranged that it will receive all of the ice cubes released from the tray at the discharging station. These cubes will fall onto the inclined bottom wall 49 of the chute, this wall extending to and through the front wall 50 of the refrigerator (see Figure 5). At the extreme outer end of the chute we prefer to provide a hinged door 51 which is normally in the closed position shown in full-lines in Figure 5, but which is adapted to be swung into the dot-and-dash position by inward movement of the control knob 26. A compression spring 52 normally urges this knob outwardly, but inward movement of the knob presses a projection 53 against the tail portion 54 of the door to open the latter. The knob 26 is mounted on a rod or plate 55 whose inner end carries the wedge member 56 adapted to bear upwardly against the movable portion 57 of the chute 49. The portion 57 is pivoted, as at 58; and when the wedge 56 moves this portion into the dot-and-dash position of Figure 5, it elevates the ice cube above it into the dot-and-dash position of Figure 5, thereby impeding the advancement of all the cubes arranged behind it. The cubes in front of the portion 57, which we have illustratively shown as being two in number, are, however, free to slide out through the front of the refrigerator when the knob 26 is pushed inwardly.

Thus, assuming that the ice cubes from one of the trays have been released from the tray and have advanced down the chute 49, the person desiring the cubes will have a predetermined limited number delivered to him by merely pressing inwardly upon the member 26. Obviously, when this member is released, an additional limited number of cubes will slide forwardly against the door 51, so that on the next manipulation of the member 26 these additional cubes will be accessible to the person desiring them.

Referring again to Figure 4, attention will now be directed to the fixed rack 59 carried by the front wall 30 and arranged to be encountered by the gears 44 as the trays are rotated in the direction of the arrow 47. This interengagement of the gears 44 with the rack 59 causes each tray, as it approaches the discharging station, to be bodily rotated from its normal upright position to the inverted or upside down position shown in dotted lines in Figure 4 and shown in full lines in Figure 6. As the tray leaves the discharging station, the release of the corresponding gear 44 from the rack 59 causes the tray to return, by its own weight, to the normal upright position, it being understood that the trays are pivoted along an axis disposed above their center of gravity.

Where gears 45 are arranged behind the rear disc 34, as shown in Figure 3, a corresponding rack would be secured to the rear wall 29. This second rack is not shown in the drawings, but is the counterpart of the rack 59, the use of two racks and two sets of mutilated gears serving more efficiently to effect the desired rotation of the individual trays.

As a result of the automatic rotation of each tray into the upside down position, as it reaches the discharging station, the ultimate release of the ice cubes permits the latter to fall by gravity into the chute 48.

Fixedly mounted on the tube 31 are electrical contacts which are engaged by the contacts 46 when the tray assumes its upside down position.

One of these contacts is shown in Figure 4 and in Figure 6 and is designated by the reference numeral 60. The other contact (not shown) is engaged by the rearward contact 46 of the tray. The contacts 60 are arranged in an electrical circuit which will presently be described, but the mechanical details of this circuit are not illustrated in the drawings since the arrangement of the contact 60 in proper insulated relation in any desired electrical circuit is a matter well understood by those skilled in the art.

Arranged at the refilling station is a solenoid valve 61, normally closed, and adapted when opened to permit the flow of water through the conduit 62 (connected with any suitable supply) and through the outlet spout 63 into the tray receptively positioned at the refilling station.

The rotation of the trays is effected by the interengagement with the gear teeth 33 of a driving pinion 64. This pinion is suitably journaled in a bearing 65 which prevents axial shifting of the pinion. The latter is mounted in a special manner upon a rod 66 which projects forwardly through the front wall 50 of the refrigerator and terminates at its forward end in the control member 24.

Upon reference to Figures 7 and 8, it will be observed that the inner end of the rod 66 is provided with a worm groove 67 and that the latter is permanently in engagement with a pin 68 carried by a follower disc 69. This disc has an outer surface 70 conforming to a spiral so that a shoulder 71 is provided. Adapted to engage with this shoulder is a pin 72 mounted in the gear 64 and under the action of a compression spring 73.

As a result of this arrangement, movement of the rod 66 from the normal position of Figures 5 and 10 to the inner position of Figure 9 effects no rotation of the gear 64, because the advancement of the rod 66 moves the disc 69 in a counterclockwise direction (as viewed in Figure 8), whereby the pin 72 merely rides upon the surface 70.

However, return movement of the rod 66 from the position of Figure 9 to the normal position of Figure 5 moves the disc 69 in a clockwise direction (as viewed in Figure 8), as a result of which the shoulder 71 bears against the pin 72 and causes a clockwise rotation of the gear 64. This in turn effects a corresponding degree of rotation of the disc 32, and hence of the entire tray-carrying framework.

The inward movement of the rod 66 takes place against the action of a coiled spring 74; and the outward movement of the rod 66 (which effects an advancement of the ice cube trays) is caused to take place under the action of the spring 74.

Reference will now be had to Figures 9 and 10 in which the electrical circuits are illustrated, and in connection with which figures the operation of the device will hereinafter be explained.

Lead wires 80 and 81 are connected to any suitable source of current supply. Extending from the wire 80 is a connection 82 leading to a fixed contact 83. This contact and a corresponding fixed contact 84 serve as a pair of contacts which are mutually insulated and which are brought into electrical connection by a bridging member 85 carried by the control knob 24. From the contact 84 a lead 86 extends to one of the fixed contacts 60. From the other fixed contact 60 a lead 87 extends to one terminal 88 of a special electric motor 89 whose mode of operation will presently be described. From the other terminal 90 of this motor a lead 91 establishes a connection with the supply lead 81.

The circuit just described controls the heating of the tray at the discharging station.

A second circuit controls the operation of the solenoid valve 61. This circuit can be traced as follows. A lead 92 extends from the supply lead 80 to a fixed contact 93 arranged in cooperative relation to a resilient movable contact 94. A lead 95 extends from the contact 94 to a contact member 96, the latter serving with the adjacent contact member 97 as a normally insulated pair which may be brought into electrical connection by means of a movable bridging member 98. From the contact 97 a lead 99 extends to the solenoid valve 61; and from the latter a lead 100 extends back to the supply lead 81.

Before describing the operation of the device, we will point out that the rod 66 is provided with the notch 101 adapted to be engaged by the latch 102, the latter being part of a lever 103 pivoted at 104 and normally urged into the position of Figure 9 by the spring 105. We also draw attention to the fact that the rod 66 carries a projection 106 positioned so as to bear against the movable contact 94, as shown in Figure 10.

The motor 89 is of the well known slow-moving type, commonly employed in oil burner installations and other similar pieces of electrically controlled apparatus. Carried by the motor shaft 107 is an arm 108 which carries the bridging member 98 and which also carries a pin 109. Under normal conditions, the arm 108 is in the position of Figure 9. When the motor is energized, this arm travels slowly in a clockwise direction into substantially the position of Figure 10; and when the motor is deenergized, the arm 108 returns slowly to the position of Figure 9.

The trays diagrammatically shown in Figures 9 and 10 will be, for explanatory purposes, designated A, B, and C.

The operation of the device is substantially as follows. Under normal conditions, all of the ice cube trays, including the one which is in upside down position at the discharging station, are filled with ice cubes that have been formed by virtue of the low temperatures in the refrigerator. The knob 24 is normally in the position of Figures 5 and 10, as a result of which the heating circuit is normally broken by virtue of the separation of the contacts 83 and 84. The motor arm 108 is normally in the position of Figure 9, as a result of which the solenoid valve circuit is normally broken by virtue of the separation of the contacts 96 and 97.

Assuming now that a person desires to effect an operation of the device to discharge a supply of ice cubes from the refrigerator, all he has to do is to press the member 24 inwardly to the position of Figure 9. As soon as this has been done, the latch 102 engages within the notch 101 and holds the rod 66 in the position of Figure 9. During the inward movement of the rod 66, no rotative movement has been imparted to the gear 64. However, the establishment of a connection between the contacts 83 and 84 completes the electric circuit to the contacts 60, and through the latter to the contacts 46, as a result of which the tray B at the discharging station is caused to be heated. The resistances and the amount of current are so chosen that this heat is adequate within a relatively short period of time to release the ice cubes from the tray B

and to permit them to drop by gravity into the chute 48, as hereinbefore described. The person desiring the cubes is thereupon enabled to withdraw them by pressing upon the member 26, as hereinbefore described in connection with Figure 5.

Notwithstanding the fact that the user performs no other manual operations, the device is automatically restored to normal condition as follows.

In the first place, it should be observed that when the heating circuit is completed the circuit through the motor 89 is also completed, thereby energizing the motor and causing the arm 108 to move slowly from the position of Figure 9 to the position of Figure 10. During this movement, the bridging member 98 establishes a connection between the contacts 97 and 96; but, as yet, the solenoid valve circuit remains open because of the separation of the contacts 93 and 94.

However, as soon as the pin 109 bears against the lever 103, as shown in Figure 10, the latch 102 is withdrawn from the notch 101 and the spring 74 thereupon becomes operative to restore the rod 66 to its normal position, as shown in Figure 10. This movement of the rod 66 effects a rotation of the gear 64, thereby advancing the tray C to the discharging station previously occupied by the tray B, and advancing the now-empty tray B to the refilling station as indicated in Figure 10. At the same time, the tray A of Figure 9 is advanced one step beyond the refilling station.

During the advancement of the tray C to the discharging station, it is automatically turned upside down; and during the advancement of the empty tray B to the refilling station, it is automatically turned right side up.

It will be observed that this advancement of the trays does not take place until after the arm 108 has moved from the position of Figure 9 to the position of Figure 10; and during this period of time the heating means has completed its function of releasing the ice cubes from the tray B.

The return of the rod 66 to its normal position fulfills the additional function of bringing the contacts 94 and 93 together, as shown in Figure 10. This serves automatically to establish the electric circuit of the solenoid valve 61, which becomes operative to introduce a new charge of water into the tray B, as indicated in Figure 10. This circuit is automatically broken after a predetermined time duration by virtue of the fact that the arm 108 returns slowly to its normal position of Figure 9; and during the final part of this return movement, the bridging member 98 disconnects the contacts 96 and 97.

All the parts are thereupon restored to initial condition.

It will thus be seen that we have provided (*a*) a heating means for heating the tray at the discharging station to release the ice cubes from it; (*b*) a means for automatically restoring the heating means to inoperative condition; (*c*) a means automatically operative upon the functioning of said restoring means for advancing the emptied tray to the refilling station; (*d*) a means automatically operative by said tray-advancing means at the completion of its action for rendering the refilling means operative; (*e*) a means for automatically restoring the refilling means to inoperative condition; and (*f*) an exteriorly controllable means for initiating, at the outset, the operation of the heating means.

Obviously, we do not intend to restrict ourselves to the specific mechanical and electrical expedients herein illustrated and described by way of example. The trays might, for example, be arranged other than in a circular relationship and may conceivably be mounted so as to be advanced successively to a discharging station and to a refilling station in some other way than that illustratively exemplified by the gears 64 and 33.

The control member 24 may be of any other suitable character; the motor 89 may be replaced by any other suitable contrivance for effecting the desired operations in the desired sequence.

Furthermore, any one or more of the operations herein described may be caused to take place independently of others. It may, for example, be desirable to have one actuating member for energizing the heating means and an entirely separate member for actuating the tray advancement. Or it may be desirable to effect the refilling by independently controlled means; or to dispense with the mechanical refilling of the tray.

Similarly, in accordance with certain phases of our invention, it may not be necessary under all circumstances to have the tray at the discharging station in an upside down position before the heating means becomes operative; nor is it absolutely essential that the emptied tray be immediately refilled.

The sequence of operations may also be varied to suit differing requirements. For example, it may be desirable to advance the tray to the discharging position just prior to the functioning of the heating means, thus leaving the emptied tray at the discharging station until another tray is advanced to take its place.

In general, it will be understood that the mechanisms and electrical circuits herein illustrated and described are given merely by way of illustration to demonstrate a preferred fully automatic mode of operation. It is, therefore, intended that the details herein described and illustrated, and referred to in the appended claims, be interpreted in an illustrative and not in a limiting sense.

Having thus described our invention and illustrated its use, what we claim as new and desire to secure by Letters Patent is—

1. In a refrigerator, a series of ice cube trays, means for mounting said trays for successive movement so that each tray moves to a discharging station and then to a refilling station, and so that after each movement there is a tray at the discharging station and another tray at the refilling station, normally inoperative means at the discharging station for heating the tray at said station to release the cubes therein, normally inoperative tray-advancing means, normally inoperative refilling means at the refilling station for refilling the tray at said station, and exteriorly controllable means for rendering said normally inoperative means operative in the order stated, thereby effecting in succession a release of ice cubes from the tray at the discharging position, an advancement of the emptied tray to the refilling station, and a refilling of said tray at the refilling station.

2. In a refrigeraor, a series of ice cube trays, means for mounting said trays for successive movement so that each tray moves to a discharging station and then to a refilling station, normally inoperative means for heating the tray at the discharging station to release the cubes there-

in, normally inoperative tray-advancing means, normally inoperative refilling means at the refilling station, exteriorly controllable means for initiating the operation of said heating means, means for restoring the heating means to inoperative condition, means operative upon the functioning of said restoring means for actuating said tray-advancing means to advance the emptied tray from the discharging station to the refilling station, means operative by said tray-advancing means at the completion of its action for rendering the refilling means operative so as to refill said tray, and means for restoring the refilling means to inoperative condition.

3. In a refrigerator, the combination with the elements set forth in claim 2, of means operable as each tray approaches the discharging station for turning the tray upside down, and for restoring said tray to upright position as it leaves the discharging station and approaches the refilling station.

4. In a refrigerator, a series of ice cube trays, means for advancing them successively to and past a discharging station, means for normally maintaining each tray in upright position, and means operable upon each tray only at the discharging station for turning and holding the tray upside down to allow ice cubes to drop by gravity from said tray.

5. In a refrigerator, the combination set forth in claim 4, in which said tray-advancing means comprises a horizontal tube, and a tray-carrying framework mounted on said tube for rotational movement around the axis of said tube.

6. In a refrigerator, the combination set forth in claim 4, in which said tray-advancing means comprises a horizontal tube, and a tray-carrying framework mounted on said tube for rotational movement around the axis of said tube, and said framework comprises spaced annular discs, said trays being pivotally supported between said discs.

7. In a refrigerator, the combination with the elements set forth in claim 4, of heating means operable upon the tray at the discharging station.

8. In a refrigerator, the combination with the elements set forth in claim 4, of heating means operable upon the tray at the discharging station, said means comprising a normally open electric circuit, and means operated by the tray during its turning for closing said circuit.

9. In a refrigerator, a series of ice cube trays, means for advancing them successively to a discharging station and to a refilling station, means for normally maintaining each tray in upright position, means operable upon each tray only at the discharging station for turning and holding the tray upside down, and means at the refilling station for introducing a charge of water to said tray.

10. In a refrigerator, a series of ice cube trays, means for advancing them successively to and past a discharging station, means for releasing the cubes from the tray at said station, a discharge chute for receiving the released cubes and transmitting them to an accessible position, a normally closed door at the end of said chute, exteriorly controllable means for opening said door, and means operable by the door-opening means for impeding the advancement of all but a predetermined number of ice cubes.

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