Aug. 13, 1968 W. J. BUCHSER 3,396,552

ADJUSTABLE WATER LEVEL CONTROL FOR ICE MAKER

Filed Aug. 23, 1967

Fig. 1.

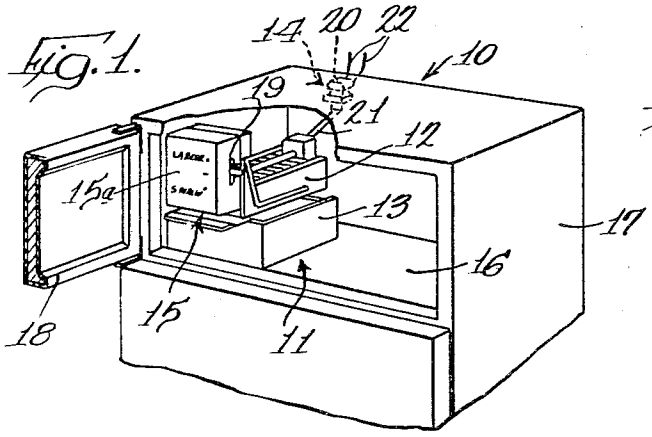


Fig. 3.

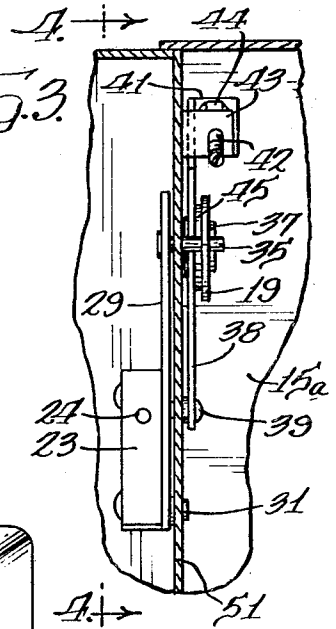


Fig. 2.

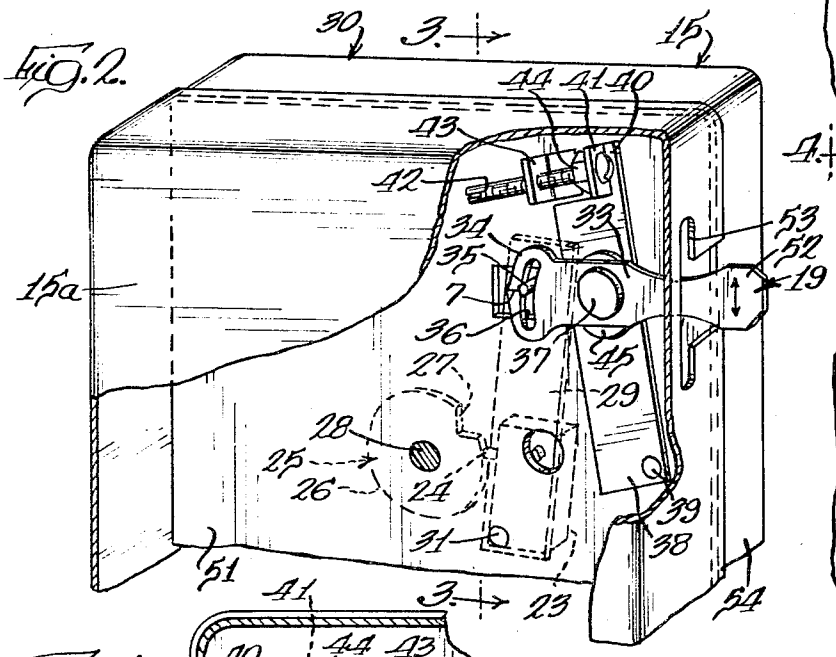


Fig. 5.

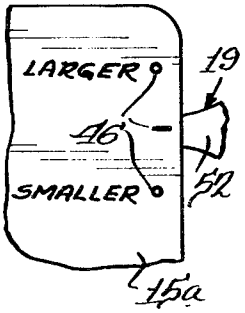


Fig. 4.

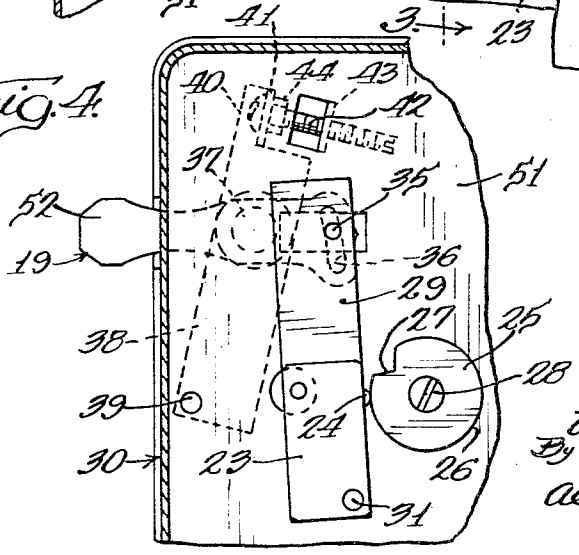
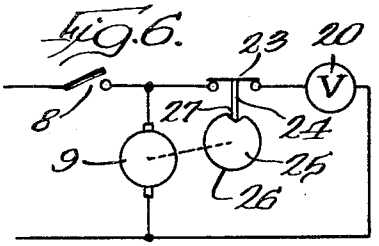


Fig. 6.



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3,396,552

ADJUSTABLE WATER LEVEL CONTROL FOR ICE MAKER

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14 Claims. (Cl. 62—233)

ABSTRACT OF THE DISCLOSURE

An adjustable water level control for domestic ice makers wherein water is delivered to the mold through a solenoid valve which is controlled by a switch to provide a desired quantity of water in the mold. The switch is mounted in adjustable relationship to a timing cam to provide adjustability of the amount of water delivered to the mold. A readjustment lever is provided which is accessible from exteriorly of the housing enclosing the control for permitting the user to readjust over a limited extent the amount of water delivered to the mold so as to vary the size of the ice bodies made in the mold or accommodate the apparatus to local abnormal conditions, such as high or low water pressure.

This invention relates to ice makers and in particular to means for controlling the quantity of water delivered to an ice maker mold.

In one known form of ice maker, ice bodies are formed in a suitable mold and delivered into a collecting bin. Upon completion of the delivery operation, the mold is refilled automatically by a water supply means having a solenoid valve controlled by the control mechanism of the ice maker to deliver a preselected quantity of water to the mold. Because of manufacturing tolerances and the like, it has been customary to provide means for adjusting the period of delivery of the water to the mold. This adjustment is conventionally made by the manufacturer who tests the apparatus under the expected operating conditions and adjusts the control to provide a preselected quantity of water in the mold to provide ice bodies of the normally desired volume. Illustratively, in one conventional ice body maker, the factory control is set to provide approximately 100 to 140 cubic centimeters of water to the mold.

It has been found that at times the factory adjustment is not quite correct for the actual installation condition such as abnormal pressure conditions in the water supply. Further, at times the user wishes to have ice bodies of a size different from those provided by the normal supply of water to the mold. The present invention comprehends a new and improved means for controlling the delivery of water to an ice body maker mold which permits the user to effect a desirable readjustment in the water delivery volume selected by the manufacturer thereby to obtain ice bodies of the desired size.

Thus, a principal feature of the present invention is the provision of a new and improved ice body maker.

Another feature of the invention is the provision of such an ice body maker having new and improved means for controlling the delivery of water to the mold thereof.

A further feature of the invention is the provision of such an ice body maker having new and improved water delivery control means including means permitting the ultimate user to readjust the control for effecting a desired readjustment of the quantity of water delivered to the mold upon installation of the ice body maker.

A yet further feature of the invention is the provision of such an ice body maker having a mold and means for delivering water to the mold and including control means for controlling the time of delivery to the mold for

providing a preselected level of water therein including a switch means, movable means for actuating the switch means for a period of time as an incident of movement thereof, means for adjusting the relationship between the switch means and the actuating means for adjusting the period of actuation of the switch means, a housing enclosing the control means, and means accessible from exteriorly of the housing for readjusting the relationship between the switch means and actuating means through a range of adjustment less than that of the adjusting means.

Another feature of the invention is the provision of such an ice body maker wherein the readjusting means comprises an improved simplified structure providing a mechanical advantage for facilitated readjustment of the water delivery by the user.

A yet further feature of the invention is the provision of such an ice body maker having new and improved means permitting the user to select the size of the ice bodies as desired.

Other features and advantages of the invention will be apparent from the following description taken in connection with the accompanying drawing wherein:

FIGURE 1 is a fragmentary perspective view of a refrigeration apparatus having an ice body maker embodying the invention;

FIGURE 2 is a fragmentary enlarged perspective view of the control means of the ice body maker with portions broken away to facilitate illustration thereof;

FIGURE 3 is a fragmentary vertical section taken substantially along the line 3—3 of FIGURE 2;

FIGURE 4 is a fragmentary vertical section taken substantially along the line 4—4 of FIGURE 3;

FIGURE 5 is a fragmentary front elevation view of a portion of the ice body maker control housing illustrating the ice body volume selection lever and volume indicia on the front of the housing; and

FIGURE 6 is a schematic wiring diagram of the water fill circuit of the ice body maker.

In the exemplary embodiment of the invention as disclosed in the drawing, a refrigeration apparatus generally designated **10** is shown to include an ice body maker generally designated **11** having a mold **12**, a collecting bin **13**, a water delivery means generally designated **14**, and a control **15** within a housing having a removable cover **15***a*. The ice body maker **11** is disposed within a refrigerated chamber **16** defined by a conventional refrigeration apparatus cabinet **17** and having a door **18**. As shown in FIGURE 1, the control **15** is disposed within a housing at the front of the chamber **16** and includes a manually operable volume selection lever **19** for controlling adjustably the amount of water delivered to the mold **12** from the water supply means **14** and thereby the volume of the ice body, as will be brought out in greater detail hereinafter.

In the illustrated embodiment, the water supply means **14** includes a solenoid valve **20** for controlling delivery of water from a suitable source of pressurized water (not shown) through a duct **21** to the mold **12**. As shown schematically in FIGURE 1, a pair of wires **22** are connected to the solenoid **20**. These wires are connected to a suitable switch **23** in the control **15** so that when switch **23** is closed, the solenoid will be energized to permit water to flow into the mold **12**. Control **15** provides a control of switch **23** to effect the desired delivery of the water by maintaining the switch **23** closed for an adjustable preselected period of time. More specifically, as shown in FIGURES 2 and 6, the switch **23** includes a plunger-type operator **24** which rides against a cam **25**. The switch **23** is arranged to be held open when the operator **24** is on a high portion **26** of the cam and to close when the operator **24** enters a low V-shaped portion **27** of the cam. The cam is carried on a shaft **28**

which is suitably driven by a motor **9** to rotate the cam at a substantially fixed rate. The time during which switch **23** is closed is a function of the rate of rotation of the cam and the disposition of the switch relative to the cam whereby the operator **24** is more or less quickly switched as the operator rides down into and upwardly from the low V-shaped portion **27** of cam **25**. Switch **23** is closed once during each ice maker cycle to refill mold **12** after the ice bodies have been ejected. A cycle of operation is initiated by the closing of a thermally responsive switch **8**. For a more detailed description of the operation of the ice maker control reference may be made to U.S. Patent No. 3,299,656 issued to William J. Linstromberg et al. on Jan. 24, 1967, and assigned to the applicant's assignee.

To provide an adjustment of the time of water delivery to the mold **12**, the switch **23** is mounted on a carrier **29** (see FIGURE 4) which is pivotally mounted by a pivot pin **31** on a transverse wall **51** within a housing **30** for the control **15**. The lever **19** includes an outer portion **52** projecting through an opening **53** in the side wall **54** of the housing **30**, a mid-portion **33** (see FIGURE 2), and an inner portion **34** movably connected to the carrier **29** by a pin and slot connection including a pin **35** on the carrier **29** and a slot **36** in the inner portion **34** of the lever **19**. The mid-portion **33** of lever **19** is pivotally connected by a suitable pivot **37** to a second lever **38** pivotally mounted on wall **51** by a pivot **39**. The distal end **40** of the lever **38** is provided with a turned flange **41** carrying a screw **42** which is threaded through a turned flange **43** on wall **51**. Threaded adjustment of screw **42** causes a corresponding pivoting of the lever **38** about the pivot **39**. The adjustment effected by the screw **42** may be fixed by a nut **44** thereon abutting the flange **41**.

The slot **36** is eccentric relative to the axis of pivot **37** and, thus, pivotal movement of the lever **19** about the pivot **37** causes a movement of pin **35** selectively to the left or to the right, as seen in FIGURE 2, thereby selectively readjusting the position of carrier **29** in a counterclockwise, or clockwise, direction. The setting of the lever **19** may be maintained releasably by means of a friction washer **45**, of rubber or the like, which as shown in FIGURE 3 may be disposed between lever **19** and lever **38**. Suitable indicia such as the words "Larger" and "Smaller" at opposite ends of the path of travel of lever **19** and indicated at **46** may be provided on the control housing front cover **15***a* to indicate to the user the direction of adjustment for increasing or decreasing the quantity of water delivered to the mold and thereby the volume of the ice body as effected by adjustment of volume selection lever **19**.

The position of switch **23** as mounted on carrier **29** is adjusted at the factory by a suitable threaded adjustment of screw **42**, for example, with the use of hand tools, with the lever **19** disposed in a preselected index position such as the approximate mid-position shown in FIGURE 2 as indicated by an index mark **7** on lever portion **34**. Illustratively, the screw **42** may be adjusted so that during the cycling of the cam **25** an average quantity of water, such as approximately 130 to 140 cubic centimeters, will be delivered to mold **12** from a water supply of conventional home water supply pressure. The adjustment of screw **42** effects the adjustment of the switch **23** disposition relative to the cam **25** by means of the connection of pivot pin **37** to the carrier pin **35** through the lever portion **34**. An adjustment of the screw **42** tending to pivot the lever **38** in a counterclockwise direction, as seen in FIGURE 2, correspondingly pivots the carrier **29** in a counterclockwise direction about its pivot **31** by the action of the edges of slot **36** against the pin **35**. Alternatively, where the screw adjustment causes a clockwise pivoting of the lever **38** about pivot pin **39**, the pin **35** is urged in a clockwise direction about the axis of pin **31** to move the switch **23** away from the cam **25**.

Upon installation of the refrigeration apparatus, for example, in a home, the ultimate user may readjust the water delivery and thereby the size of the ice body or cube by manipulation of the projecting portion **52** of lever **19** by hand, without removing the housing cover and without the use of hand tools. If the user wishes to increase the quantity of water delivered to the mold, the lever portion **52** is raised thereby causing the pin to be received in a portion of the slot **36** closer to the pivot **37** and correspondingly pivoting the carrier **29** in a clockwise direction (FIGURE 2) about pivot **31** to move the switch **23** away from the cam **25**. Alternatively, if a smaller quantity of water is desired in the mold **12**, the user merely readjusts the lever downwardly, thereby disposing the pin **35** in a portion of the slot **36** spaced further from the axis of pin **37** and correspondingly pivoting the carrier **29** in a counterclockwise direction about the pin **31** to dispose the switch **23** closer to the cam **25**. The amount of readjustment effected by lever **19** is preselected to be less than the adjustment effected by the screw **42** so that the user may not over-adjust the water delivery, as may occur where the user is required to effect any desired adjustment by utilizing the screw **42**. Further, by providing an accessible portion of the lever **19**, the user may make the adjustment readily, as desired without interfering with the closed or sealed condition of the control housing, and without the use of hand tools, and may vary the adjustment from time to time, as desired. The user may readily vary the size of the ice bodies made by the ice maker **11** as well as adjust the water delivery to the local conditions.

In using domestic ice makers, experience has shown that at different times the user may have a desire or need for ice bodies or cubes of different sizes. Assuming equal total cube volumes, relatively small cubes will expose more cold surface area to a substance to be chilled than will relatively large cubes and, therefore, small cubes will more quickly cool a beverage than will the same volume of ice in the form of relatively large cubes. Also in the illustrated ice maker, smaller ice bodies will separate easier during the harvesting portion of the cycle. On the other hand, the ice bodies or ice cubes when used to chill beverages or food will take longer to melt if they are relatively large in size. Therefore, at different times there may be sound reasons for adjusting the ice maker to select a different size of ice body or ice cube. To this end the present invention makes it possible for the user of a domestic ice maker to select any desired cube size within the range which is practical for the ice maker. Merely by manually moving the cube size selection lever to the desired index position the user of the ice maker can obtain ice cubes of the desired size.

The present invention has another advantage from the service standpoint which may not be recognized at first glance. In refrigerators equipped with domestic ice makers experience has shown that frequently the ice cubes produced by the ice maker on initial operation in the user's home are not of the proper size. This off-size characteristic is frequently due to inadequate water pressure in the home. On the other hand, the mold may overfill due to excess water pressure or variations in parts, or a combination of these two conditions causing icicles to form on the mold due to capillary action. If the ice bodies or cubes are not of proper size, the user customarily will request a service call to correct the situation. Such service calls can be a substantial expense. However, with the present invention, if the user determines that the cubes are not of the desired size, he may easily adjust the cube size without disassembly of the ice maker and without use of tools merely by movement of the cube selection lever to the desired index position. Thus the expense of a service call can be avoided.

In the illustrated embodiment, the lever **19** is arranged to provide for an increase in the delivery of the water of approximately 5 to 15 percent from the middle por-

tion of the lever **19** and a decrease of approximately 25 percent of the total quantity of water normally delivered as set by the adjustment of the screw **42** at the factory. Thus, the overall adjustment effected by lever **19** may be approximately one-third the total quantity of water delivered at the normal factory-set condition.

Thus, the present invention comprehends an improved ice body maker providing to the user improved facility in the use thereof in adjusting the water delivery to compensate for variations in local conditions without requiring a service call and, further, to permit ready selection of the size of the ice bodies made by the ice body maker as desired. The ice body maker **11** is extremely simple and economical of construction, and the adjustment thereof is extremely simple and may be readily made by relatively unskilled persons, while yet providing accurate control of the water delivery as desired. Dual adjustment means are provided, comprising first adjustment means internally of the control housing and adjustable at the factory by the use of hand tools, and second adjustment means or readjustment means accessible from exteriorly of the control housing and adjustable by the user without the use of tools.

While I have shown and described one embodiment of my invention, it is to be understood that it is capable of many modifications. Changes, therefore, in the construction and arrangement may be made without departing from the spirit and scope of the invention as defined in the appended claims.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. In an ice body maker having a mold and means for delivering water to the mold, a water level control comprising:

a control means including switch means for controlling the time of water delivery to the mold to provide a preselected level of water therein, movable means for actuating said switch means for a period of time as an incident of movement thereof;

first adjustment means for adjusting the relationship between said switch means and said movable means for adjusting the period of actuation of said switch means;

a housing enclosing said control means; and

second adjustment means movable independently of at least one portion of said first adjustment means and accessible from exteriorly of the housing for changing said relationship between said switch means and said movable means through a range of adjustment less than that of said first adjustment means thereby to obtain ice bodies of a desired volume.

2. The ice body maker structure of claim **1** wherein said movable means comprises a cam.

3. The ice body maker structure of claim **1** wherein said second adjustment means comprises a lever and means providing a mechanical advantage connecting the lever to said switch means for providing a small adjustment thereof as a result of a relatively large repositioning of said lever.

4. The ice body maker structure of claim **1** wherein said second adjustment means comprises a lever carried by said first adjustment means.

5. The ice body maker structure of claim **1** further including means for releasably retaining the second adjustment means in different adjusting dispositions.

6. The ice body maker structure of claim **1** wherein said second adjustment means is arranged to provide a readjustment of the water delivery of approximately one-third of the total adjustment provided by said first adjustment means.

7. The ice body maker structure of claim **1** wherein said second adjustment means is arranged to provide a readjustment of the water delivery to increase the total delivery approximately 5 to 15 percent.

8. The ice body maker structure of claim **1** wherein said second adjustment means is arranged to provide a readjustment of the water delivery to decrease the total delivery approximately 25 percent.

9. The ice body maker structure of claim **1** wherein said first adjustment means is contained within said housing and is adjustable by the use of tools; wherein said second adjustment means includes a manually operable portion accessible from exteriorly of said housing for manually selecting ice bodies of a desired volume; and wherein said housing is provided with indicia adjacent said manually operable portion of said second adjustment means for indicating to a user the direction of adjustment to increase or decrease the volume of said ice bodies.

10. The ice body maker structure of claim **1** wherein said first adjustment means comprises a carrier, means for movably mounting the carrier in said housing, means for mounting said switch means on said carrier, and means for adjustably positioning the carrier to adjustably dispose said switch means relative to said movable means, and said second adjustment means comprises means for readjusting the disposition of said carrier.

11. The ice body maker structure of claim **10** wherein pin and slot means are provided interconnecting said second adjustment means and said carrier.

12. The ice body maker structure of claim **10** wherein said means for adjustably positioning the carrier comprises a lever pivotally carried in said housing, and means in said housing for adjustably positioning the lever, said readjusting means having a portion connecting said lever to said carrier.

13. The ice body maker structure of claim **10** wherein said means for adjustably positioning the carrier comprises a first lever pivotally carried in said housing, and means in said housing for adjustably positioning the first lever, said readjusting means comprising a manually operable second lever carried by said first lever and having a portion connected to said carrier.

14. The ice body maker structure of claim **10** wherein said second adjustment means is provided with indexing means for establishing a preselected relationship between said second adjustment means and said carrier during adjustment of said first adjustment means.

References Cited

UNITED STATES PATENTS

3,299,656 6/1965 Linstromberg et al. __ 62—353 X

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