United States Patent [19]

True, Jr. et al.

[11] **3,902,331**

[45] **Sept. 2, 1975**

[54] **ICE DISPENSING SYSTEM OF HOUSEHOLD REFRIGERATOR**

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[73] Assignee: **General Electric Company**, Louisville, Ky.

[22] Filed: **Feb. 19, 1974**

[21] Appl. No.: **443,739**

[52] **U.S. Cl.** **62/137**; 62/344; 62/420; 222/413

[51] **Int. Cl.**[2] **F25C 1/04**

[58] **Field of Search** 62/344, 353, 137; 222/413

[56] **References Cited**

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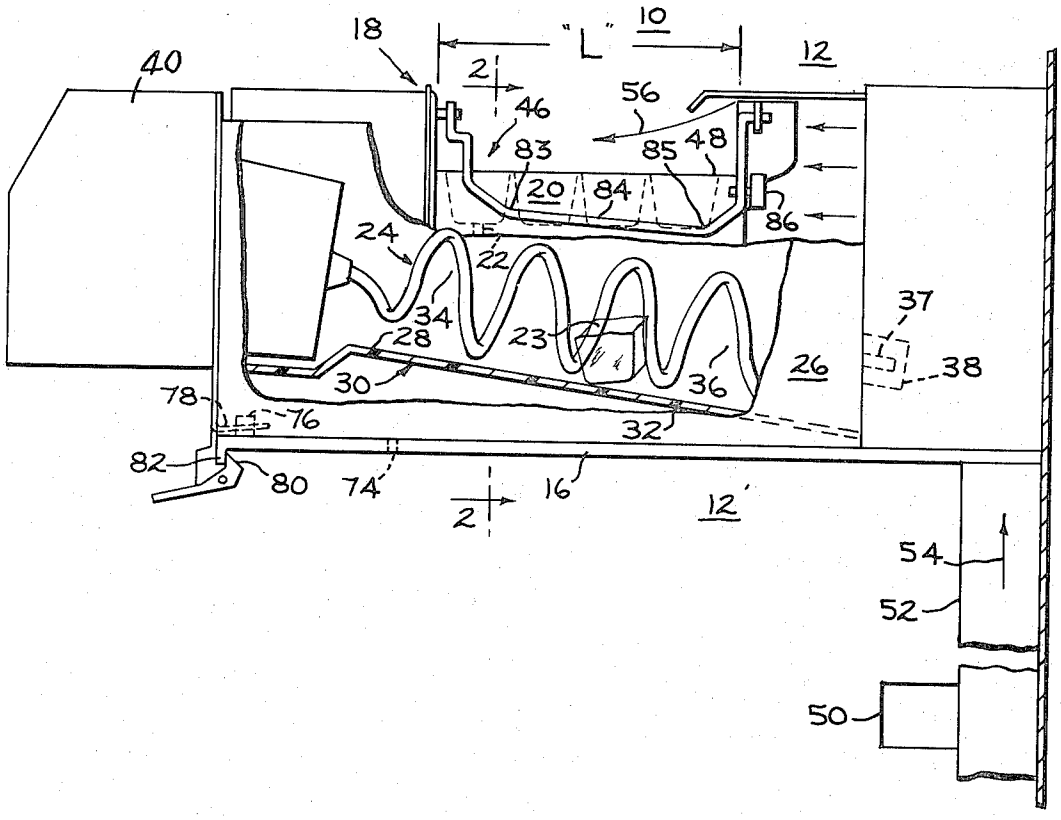
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Primary Examiner—William E. Wayner
Assistant Examiner—W. E. Tapolcai, Jr.

[57] **ABSTRACT**

An improved ice dispensing system of a household refrigerator has an upwardly sloping ice receptacle and rotatable dispensing means for improved control of ice delivery.

7 Claims, 7 Drawing Figures



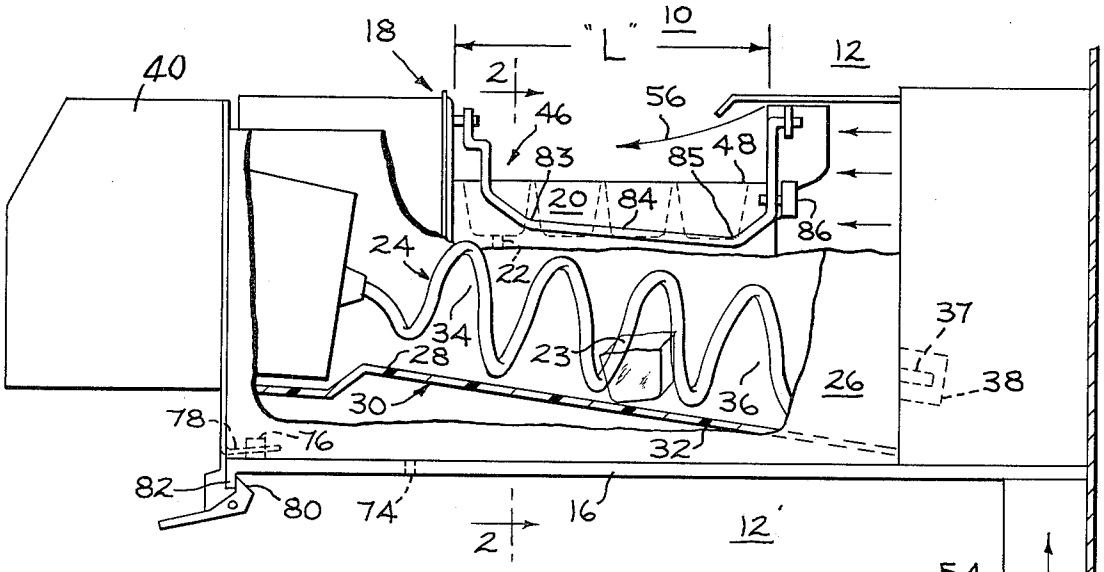


FIG. 1

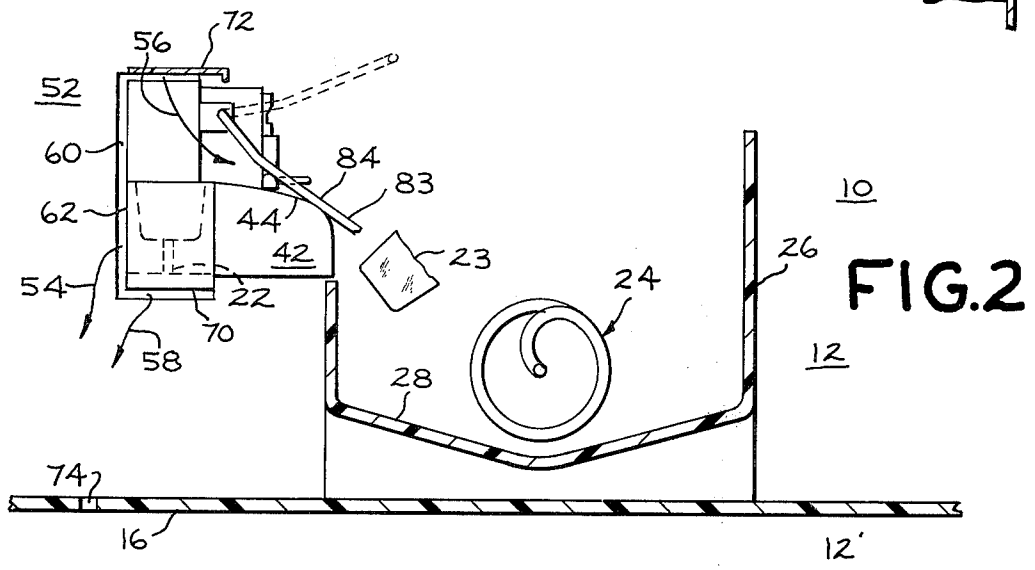


FIG. 2

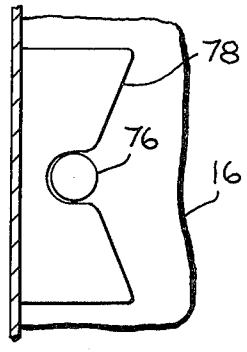


FIG. 6

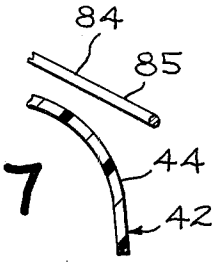


FIG. 7

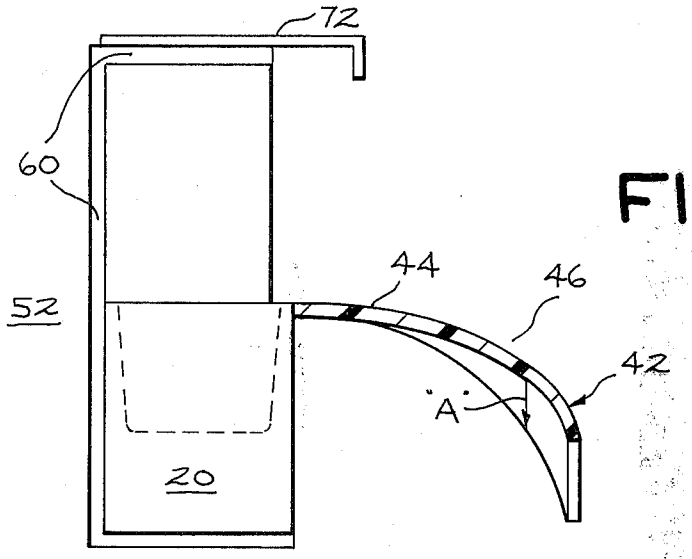


FIG. 3

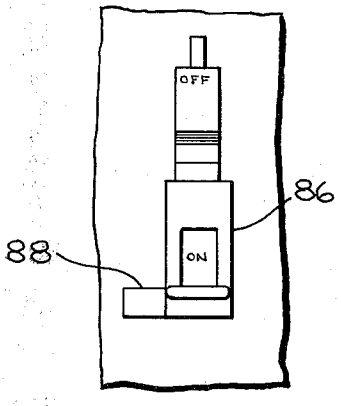


FIG. 5

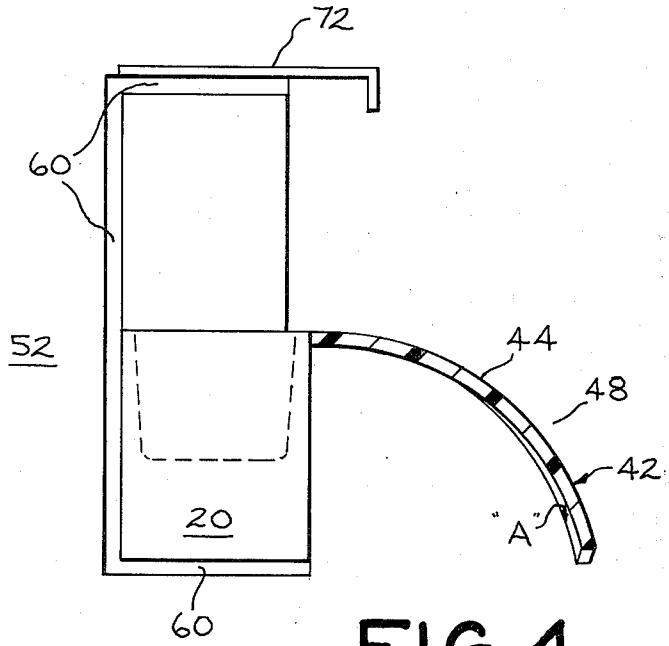


FIG. 4

ICE DISPENSING SYSTEM OF HOUSEHOLD REFRIGERATOR

BACKGROUND OF THE INVENTION

The present invention relates to an improved ice dispensing system of a household refrigerator of the general type disclosed in U.S. Pat. No. 3,640,089 which issued to L. L. Frazier on Feb. 8, 1972, U.S. Pat. No. 3,640,088 which issued to D. W. Jacobus et al. on Feb. 8, 1972, and U.S. Pat. No. 3,602,441 which issued to R. J. Alvarez on Aug. 31, 1971, for example. Briefly described, the systems comprise a mold for forming ice pieces, means for ejecting ice pieces from the mold, a receptacle for receiving and collecting ice pieces, and rotatable dispensing means positioned within the receptacle for discharging said ice pieces from the receptacle for subsequent recovery by an individual. For maximum enjoyment of such an ice service, it is desirable that the ice pieces in the receptacle and which are discharged therefrom be relatively fresh ice pieces and that the ice dispensing system, which includes the mold and associated equipment, operates to form ice pieces at a relatively high rate.

SUMMARY OF THE INVENTION

This invention resides in an improved ice dispensing system of a household refrigerator which has an upwardly sloping ice receptacle and rotatable dispensing means for improved control of ice delivery.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a diagrammatic, partially sectioned, side view of a portion of a household refrigerator having the improved apparatus of this invention;

FIG. 2 is a diagrammatic, partially sectioned, frontal view of a portion of the apparatus of this invention;

FIGS. 3 and 4 are diagrammatic, partially sectioned views showing the directing element configuration at two locations along the length of said directing element;

FIG. 5 is a diagrammatic view of the switch of the improved apparatus of this invention;

FIG. 6 is a diagrammatic view of a centering element of the receptacle of the improved apparatus of this invention; and

FIG. 7 is a diagrammatic view of a portion of the ice sensing element and the ice directing element.

DETAILED DESCRIPTION OF THE INVENTION

Referring to FIG. 1, a refrigerator **10** such as a household refrigerator, for example, has a freezing compartment **12**, a shelf **16** within the freezing compartment **12**, and an automatic ice dispensing system **18**. The automatic ice dispensing system **18** comprises an ice mold **20**, means **22** for ejecting formed ice pieces **23** from the mold **20** into a receptacle **26**, and a rotatable dispensing means **24** positioned within the receptacle **26** for moving ice pieces through the receptacle **26** and discharging said ice pieces from said receptacle **26**, as is known in the art.

The receptacle **26** is supported by the shelf **16** and, as shown in FIG. **2**, is positioned laterally adjacent and extends along the length of the mold **20**. The receptacle **26** has a floor **28** having forward and rearward end portions **30**, **32**. The floor **28** extends downwardly and rearwardly from the forward end portion **30** to said rearward end portion **32** for gravitationally urging ice pieces **23** within the receptacle **26** to the rearward end portion **32** of said receptacle **26**.

The rotatable dispensing means **24** is a helical element having an axis (not shown) such as a helical tube or auger, for example. The rotatable dispensing means **24** has forward and rearward end portions **34**, **36** and is removably connected at one end thereof (**37**) to a power supply **38** for rotating the rotatable dispensing means **24** and moving ice pieces **23** along the receptacle **26** and discharging said pieces therefrom via a housing **40** which can contain, for example, an ice crusher (not shown).

The rotatable dispensing means **24** extends upwardly and forwardly from said rearward end portion **36** to said forward end portion **34**. Preferably, the rotatable dispensing means **24** and the receptacle floor **28** are angularly inclined from the horizontal at a common angle preferably in the range of about 5° to about 15° from the horizontal to assure gravitational movement of the ice pieces **23** within the receptacle while maintaining the energy required by dispensing means **24** at a low value.

Referring to FIGS. **2–4**, an ice directing element **42** is connected to the mold **20** and extends laterally outwardly and downwardly therefrom. The ice directing element **42** is of curvilinear configuration which changes in configuration along its length for providing an upper surface **44** which slopes generally downwardly and rearwardly along the length (L) of said directing element **42**.

FIG. **3** shows a forward portion **46** of the ice directing element **42** which is adjacent a forward end portion **30** of the receptacle **26** in the installed position thereof and FIG. **4** shows a rearward portion **48** of the ice directing element **42** which is adjacent a rearward end portion **32** of the receptacle **26** in the installed position thereof.

In FIG. **3**, the slope of the forward portion **46** of the ice directing element **42** can be seen by observing the downward direction of arrow A which lies along a longitudinally extending segment of the directing element **42**. As one progresses rearwardly along a longitudinally extending segment of the directing element **42**, the rearwardly directed slope, as depicted by arrow A becomes less. Also referring to FIGS. **3** and **4**, it can be seen that the lateral cross sectional configuration of directing element **42** becomes more acute in the downward direction progressing rearwardly along the element **42**, i.e., changing from a modified elliptical configuration to a generally circular configuration.

These unique configurations of the directing element **42** are provided to facilitate gravitationally moving the ice pieces to a location at the rearward end portion **32** of the receptacle **26**. It should be understood, however, that the downward and rearward slopes of the ice directing element **42** can be uniform along the length thereof without departing from this invention.

Referring to FIGS. **1** and **2**, a cold air supply source **50** such as a compressor and refrigerant system, for example, is associated with the refrigerator **10** and is connected to means **52**, such as a duct work system, for directing cold air from the cold air supply source **50** into the freezing compartment **12**, separating the cold air into at least first and second, preferably first, second and third cold air streams **54**, **56** and **58**, and directing said cold air streams **54**, **56** and **58** along preselected portions of the mold for cooling the mold **20** and water

contained therein to a temperature at which the water will freeze in the mold **20**, thereby forming the ice pieces **23**.

The cold air stream **54** from means **52** is discharged through opening **60** and is separated by the mold **20** into the first cold air stream **54** which is directed along a first side **62** of the mold **20**, the second cold air stream **56** which is directed along a top **66** of the mold **20**, and the third cold air stream **58** which is directed along a bottom **70** of the mold **20**.

It has been discovered that if the cold air is not separated and directed against and along different portions of the mold **20**, the water in the mold will experience super cooling which will increase the time period required to form ice pieces **23**, as opposed to the desired operation of decreasing said time period. By so providing a plurality of cold air streams **54**, **56** and **58** and directing these air streams as set forth above by placement of the opening **60**, relative to the mold **20** and/or providing air deflecting elements **72** associated with the opening **60**, the rate at which ice pieces can be formed is significantly increased.

In order to further assure uniform controlled cooling of the ice dispensing system **18** and associated freezing compartments and controlled flow of said first, second and third cold air streams, means such as openings **74** are provided through shelf **16** for communicating the freezing compartments. These openings **74** additionally provide for air circulation between said compartments when the fan (not shown) of the cold air supply source **50** is not actuated.

In the preferred embodiment, the receptacle **26** and the rotational dispensing means **24** are easily detachable from the power supply **38** and removable as a unit from the freezing compartment **12**. It therefore becomes necessary to provide means for accurately and easily positioning and securing ice receptacle **26** — rotational dispensing means **24** relative to the mold **20**.

Referring to FIGS. **1** and **6**, at least one procrusion **76** extends upwardly from the shelf **16** and associates with a centering element **78** which is of a modified V configuration. At the seated position of the unit, as shown in FIG. **1**, the protrusion **76** is seated in the centering element **78** and at that position a latch **80** has engaged in edge portion **82** of the shelf **16**, thereby maintaining the receptacle **26** and associated dispensing means **24** at a pre-selected location relative to the mold **20**.

The preferred ice dispensing system **18** also has a pivotally movable ice sensing element **84** for sensing the elevation of the ice pieces **23** within the receptacle **26**. When the elevation of the ice pieces **23** has risen in the receptacle **26** to a preselected elevation, the sensing element **84**, in response to the ice pieces, is pivoted upwardly to a location at which a switch (not shown) is actuated which terminates the delivery of water to the mold and the formation of ice pieces **23**. Subsequent discharge of ice pieces **23** from the receptacle in response to demands of individuals using the system thereafter causes the elevation of the ice pieces **23** within the receptacle **26** to be lowered, thereby lowering the ice sensing element **84** which actuates the switch and initiates ice forming and harvesting operations. The ice sensing element **84** and associated switch means are well known in the art.

Referring to FIGS. **2** and **7**, the ice sensing element **84** can be of a configuration such that, at the lowermost elevation of element **84**, a forward portion **83** of element **84** (FIG. **2**) is in closer proximity to the immediately adjacent portion of the ice directing element **42** than is the rearward portion **85** of element **84** (FIG. **7**) relative to its immediately adjacent portion of the ice directing element **42**. This configuration of ice sensing element **84** increases the accuracy of sensing the elevation of ice pieces **23** in the receptacle **26** whereas, in the apparatus of the present invention, the receptacle floor **28** is not horizontal.

Referring to FIGS. **1** and **5** of the improved system, a sensing element switch **86** is mounted adjacent the ice sensing element **84**. The switch **86** is slidably movable between a first position (seen in FIG. **1**) at which a contacting element **88** of the switch **86** is spaced from the ice sensing element **84**, thereby permitting the ice sensing element to operate as set forth above, and a second position (see FIG. **2**) at which the switch has been moved upwardly, the contacting element **88** has contacted the ice sensing element **84** and pivotally moved it to the elevated position shown by the broken lines. At this second position, the ice sensing element **84** is at a sufficient elevation to actuate its associated switch to terminate ice forming operations. An individual can thereby easily denergize the ice forming apparatus during periods when the receptacle **26** is removed from the freezing compartment **12**.

In the method of this invention, ice pieces **23** are discharged from the mold **20** onto the upper surface **44** of the associated ice directing element **42**. Owing to the unique configuration of this surface **44**, the ice is urged by gravity toward a rearward end portion **32** of the receptacle **26**. The floor **28** of the receptacle **26** is also rearwardly sloping for urging the ice pieces by gravity toward the rearward end portion **32**.

Upon actuation of the rotational dispensing means **24** for recovering ice pieces from the receptacle **26**, as is known in the art, the helical configuration causes the earliest formed ice pieces, which are located at the lower, rearward portion of the receptacle, to move forwardly for delivery. This unique construction therefore provides control for assuring maintaining relatively fresh ice pieces in the receptacle. The separation and direction of the cold air streams to pre-selected locations on the mold increases the ice production rate of the apparatus and the contacting element **78**, latch **80**, and sensing element switch **86** increases the conveniences and enjoyment of using the system.

While there has been shown and described a number of embodiments of the present invention, it is to be understood that the invention is not limited thereto and it is intended by the appended claims to cover all such modifications falling within the spirit and scope of the invention.

Therefore, we claim:

1. In a refrigerator having a freezing compartment and an automatic ice dispenser within the freezing compartment, said automatic ice dispenser comprising an ice mold, means for ejecting ice pieces from the mold, a receptacle for receiving the ice pieces from the mold, and a rotatable dispensing means positioned within the receptacle for moving the ice pieces through the receptacle and discharging said ice pieces from said receptacle, the improvement comprising:

said receptacle having a floor having forward and rearward end portions with said floor extending up-

wardly and forwardly from said rearward end portion to said forward end portion;

said receptacle dispensing means having an axis and forward and rearward end portions with the axis of said rotatable dispensing means extending upwardly and forwardly from said rearward end portion to said forward end portion; and

an ice directing element connected to the mold and extending laterally outwardly and downwardly therefrom, said ice directing element being of curvilinear configuration having an upper surface extending generally downwardly and rearwardly as measured along the length of said directing element.

2. An apparatus, as set forth in claim **1**, wherein the floor of the receptacle is at an angle in the range of about **5°** to about **15°** relative to the horizontal.

3. An apparatus, as set forth in claim **1**, including a cold air supply source;

first means for directing cold air from the cold air supply source into the freezing compartment, separating the cold air stream into at least first and second cold air streams and directing said first cold air stream along a first side of the mold and the second cold air stream along a top of the mold.

4. An apparatus, as set forth in claim **3**, wherein the first means includes means for separating a third cold air stream and directing said third cold air stream along a bottom of the mold.

5. An apparatus, as set forth in claim **1**, including means for positioning the receptacle at a preselected location in the freezing compartment and maintaining said receptacle at said preselected location.

6. An apparatus, as set forth in claim **1**, including a shelf supporting the receptacle, said shelf having openings for the passage of air therethrough.

7. An apparatus, as set forth in claim **1**, including a pivotally movable ice sensing element for sensing the elevation of the ice pieces within the receptacle; and

switching means for contacting the sensing element, pivoting said sensing element upwardly to an elevated position, and maintaining said element at said elevated position.

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