UNITED STATES DISTRICT COURT
SOUTHERN DISTRICT OF IOWA
CENTRAL DIVISION

MAYTAG CORPORATION, Plaintiff, v. WHIRLPOOL CORPORATION. Defendant.	Civil Action No. 4:03-CV-10568 Judge Ronald E. Longstaff **JURY TRIAL DEMANDED**

AMENDED COMPLAINT FOR PATENT INFRINGEMENT

COMES NOW, Plaintiff, Maytag Corporation, ("Maytag"), and, pursuant to Fed. R. Civ. P. 15(a) amends its Original Complaint, and for its Amended Complaint against Defendant Whirlpool Corporation ("Whirlpool") states and alleges as follows:

PARTIES, JURISDICTION AND VENUE

1. This is an action for patent infringement arising under the patent laws, Title 35, United States Code. The Court has jurisdiction under 28 U.S.C. §§ 1331 and 1338(a). Venue is proper in this district in accordance with 28 U.S.C. § 1391 and 28 U.S.C. § 1400(b).

2. Plaintiff Maytag is a Delaware corporation having its principal place of business at 403 West 4th Street North, Newton, Iowa 50208-0039.

3. Defendant Whirlpool is a Delaware corporation having its principal place of business at 2000 North M-63, Benton Harbor, Michigan 49022-2692, and is registered to do business in Iowa and is doing business in this district and elsewhere.

COUNT I
PATENT INFRINGEMENT OF U.S. PATENT NO. 5,056,688

4. Maytag realleges and incorporates by reference paragraphs 1 through 3 as if set forth herein.

5. On October 15, 1991, United States Letters Patent No. 5,056,688 entitled "ICE CUBE AND CRUSHED ICE DISPENSER" was duly and legally issued in the name of Glen E. Goetz, Brian D. Towle and Michael J. Eveland, and the entire right, title and interest in and to said patent has been assigned to Maytag, including the right to sue, as reflected by an assignment recorded in the United States Patent and Trademark Office. A copy of the aforesaid patent is attached hereto as Exhibit 1.

6. Defendant Whirlpool has manufactured, used, sold, and/or offered for sale, and is continuing to manufacture, use, sell and/or offer for sale within this district and elsewhere ice cube and crushed ice dispensers and refrigerators embodying such, which infringe one or more claims of United States Patent 5,056,688.

7. Plaintiff Maytag has been damaged by Defendant's infringement of United States Patent 5,056,688 and will continue to be damaged in the future unless Defendant is preliminarily and permanently enjoined from infringing said patent.

8. Plaintiff and/or its predecessor-in-interest has properly marked its own articles of manufacture with its patent number in accordance with 35 U.S.C. § 287.

9. Upon information and belief, Defendant Whirlpool is aware that said patent has been duly and legally issued, and is aware or should be aware that Defendant's manufacture, use sale and offer for sale of ice cube and crushed ice dispensers and refrigerators embodying the same infringe United States Patent No. 5,056,688.

10. Upon information and belief, Defendant's infringement of U.S. Patent No. 5,056,688 is now and has been intentional, willful, and deliberate.

COUNT II
INFRINGEMENT OF U.S. PATENT NO. 6,120,685

11. Maytag realleges and incorporates by reference paragraphs 1 through 10 as if set forth herein.

12. On September 19, 2000, United States Letters Patent No. 6,120,685 entitled "WATER FILTERING SYSTEM WITH REPLACEABLE CARTRIDGE FOR A REFRIGERATOR" was duly and legally issued in the name of David A. Carlson and Kurt Charles Senner, and the entire right, title and interest in and to said patent has been assigned to Maytag, including the right to sue, as reflected by an assignment recorded in the United States Patent and Trademark Office. A copy of the aforesaid patent is attached hereto as Exhibit 2.

13. Defendant Whirlpool has manufactured, used, sold, and/or offered for sale, and is continuing to manufacture, use, sale and/or offer for sale within this district and elsewhere a water filtering system with a replaceable cartridge and refrigerators embodying such, which infringe one or more claims of United States Patent 6,120,685.

14. Plaintiff Maytag has been damaged by Defendant's infringement of United States Patent 6,120,685 and will continue to be damaged in the future unless Defendant is preliminarily and permanently enjoined from infringing said patent.

WHEREFORE, Plaintiff Maytag prays for the following relief:

a. A judgment that Defendant has infringed United States Patent No. 5,056,688;

b. A judgment that Defendant has infringed United States Patent No. 6,120,685;

c. An injunction preliminarily and permanently enjoining and restraining Defendant, its officers, directors, agents, servants, employees, attorneys and all others acting under, in concert with, or through it, directly or indirectly, from infringing United States Patent No. 5,056,688;

d. An injunction preliminarily and permanently enjoining and restraining Defendant, its officers, directors, agents, servants, employees, attorneys and all others acting under, in concert with, or through it, directly or indirectly, from infringing United States Patent No. 6,120,685;

e. A judgment that Defendant's infringement of United States Patent No. 5,056,688 has been willful and deliberate;

f. A judgment requiring Defendant to pay damages under 35 U.S.C. § 284 for the infringement of United States Patent No. 5,056,688. including treble damages with both prejudgment and post-judgment interest;

g. A judgment requiring Defendant to pay damages under 35 U.S.C. § 284 for the infringement, of Patent No. 6,120,685 with both prejudgment and post-judgment interest;

h. A judgment and order directing Defendant to pay the costs of this action (including all disbursements) and attorneys' fees as provided by 35 U.S.C. § 285, with interest; and

i. Such other and further relief as this Court may deem just and equitable.

DEMAND FOR JURY TRIAL

Plaintiff Maytag demands a trial by jury of all issues triable of right by jury.

Dated this 27th day of February, 2004.

Respectfully submitted,

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Jeffrey D. Harty
Christine Lebrón-Dykeman
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ATTORNEYS FOR PLAINTIFF
MAYTAG CORPORATION

EXHIBIT 1

United States Patent [19]

Goetz et al.

[11] **Patent Number: 5,056,688**

[45] **Date of Patent: Oct. 15, 1991**

[54] **ICE CUBE AND CRUSHED ICE DISPENSER**

[75] Inventors: **Glenn E. Goetz**, Amana; **Brian D. Towle**, Belle Plaine; **Michael J. Eveland**, Cedar Rapids, all of Iowa

[73] Assignee: **Amana Refrigeration Inc.**, Amana, Iowa

[21] Appl. No.: **459,503**

[22] Filed: **Jan. 2, 1990**

[51] **Int. Cl.**[5] **G01F 11/20**

[52] **U.S. Cl.** **222/146.6**; 222/240; 222/413; 62/320

[58] **Field of Search** 222/239–242, 222/413, 146.6; 62/320, 266, 342–344, 351

[56] **References Cited**

U.S. PATENT DOCUMENTS

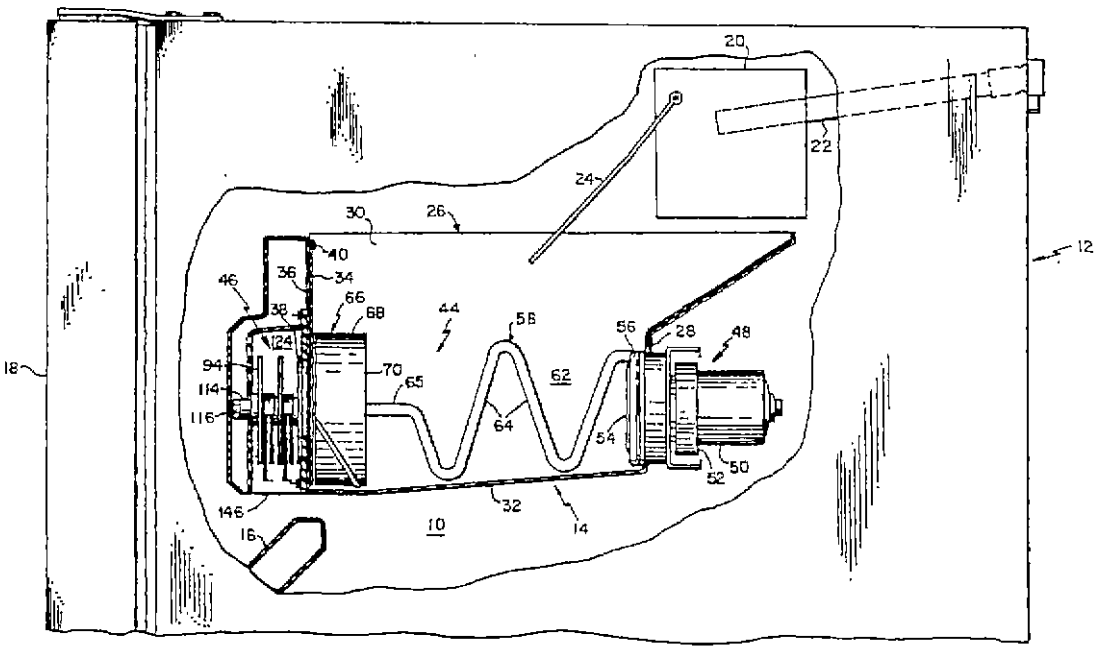
3,537,273	11/1970	Alvarez	62/266
3,602,441	8/1971	Alvarez	241/101
3,640,088	2/1972	Jacobus et al.	222/146.6
3,824,805	7/1974	Prada	62/320
3,843,067	10/1974	Prada	241/190
3,902,331	9/1975	True, Jr. et al.	62/344
4,176,527	12/1979	Linstromberg et al.	62/320
4,619,380	10/1986	Brooks	222/240
4,627,556	12/1986	Brooks	222/240
4,736,600	4/1988	Brown	222/146.6
4,972,999	11/1990	Grace	62/320

Primary Examiner—David M. Mitchell
Assistant Examiner—Lesley Morris
Attorney, Agent, or Firm—William R. Clark; Richard M. Sharkansky

[57] **ABSTRACT**

A selective ice cube and crushed ice dispenser having a crusher section including a crusher arm mounted to a horizontal shaft axially rotatable in either direction, and a stationary crusher arm mounted to one side of the shaft. When the shaft is driven in one direction, ice pieces fed to the crusher section are caught and crushed between the rotating and stationary crusher arms. However, when the shaft is driven in the opposite direction, the ice pieces escape down the side of the shaft opposite the stationary crusher arms thereby avoiding being crushed. The ice piece feed within the ice piece receptacle is also rotatably driven by the shaft and is operable to feed ice pieces to the crusher section regardless of which direction the shaft is being driven.

12 Claims, 6 Drawing Sheets



EXHIBIT

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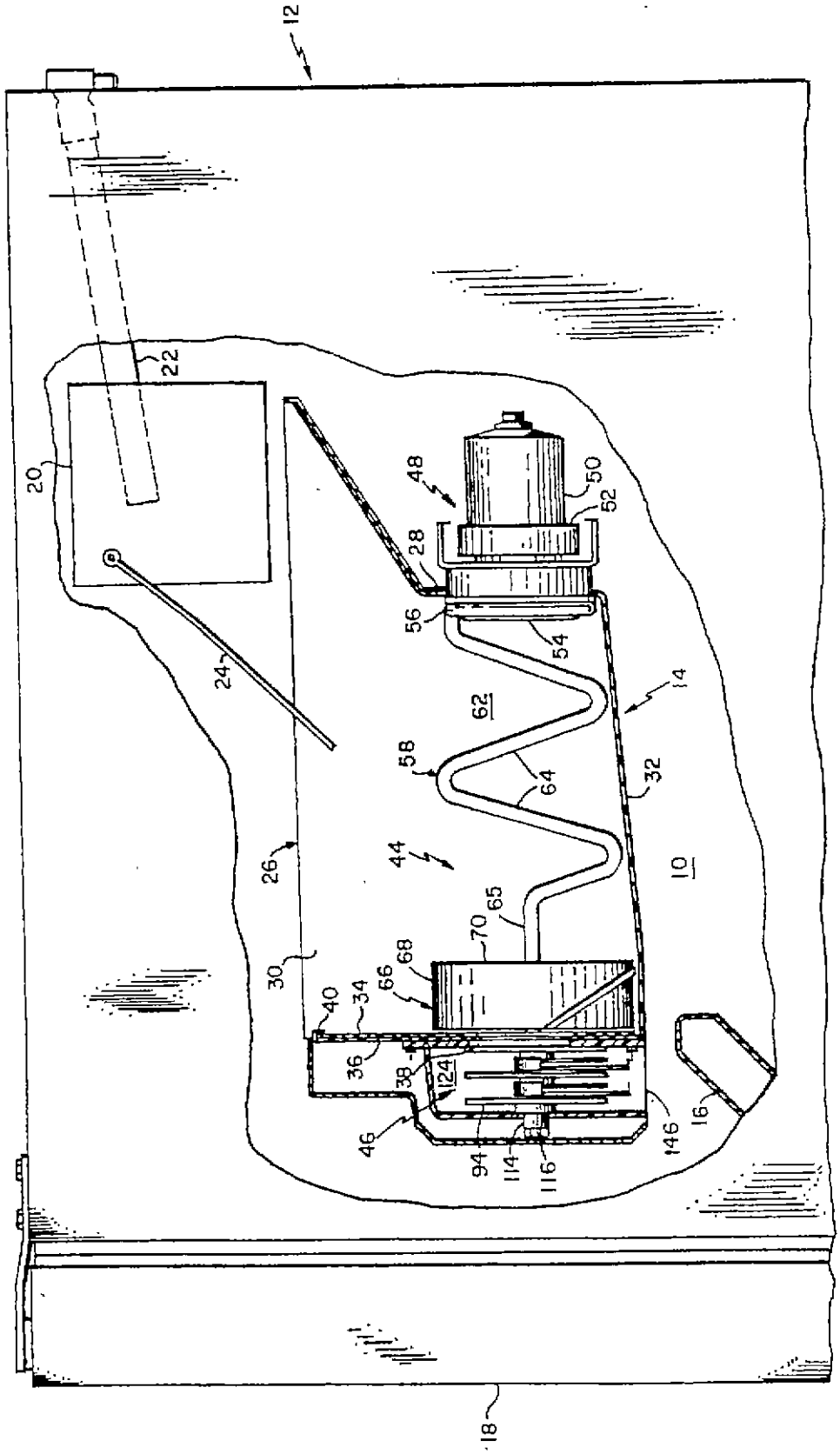
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FIG. 1

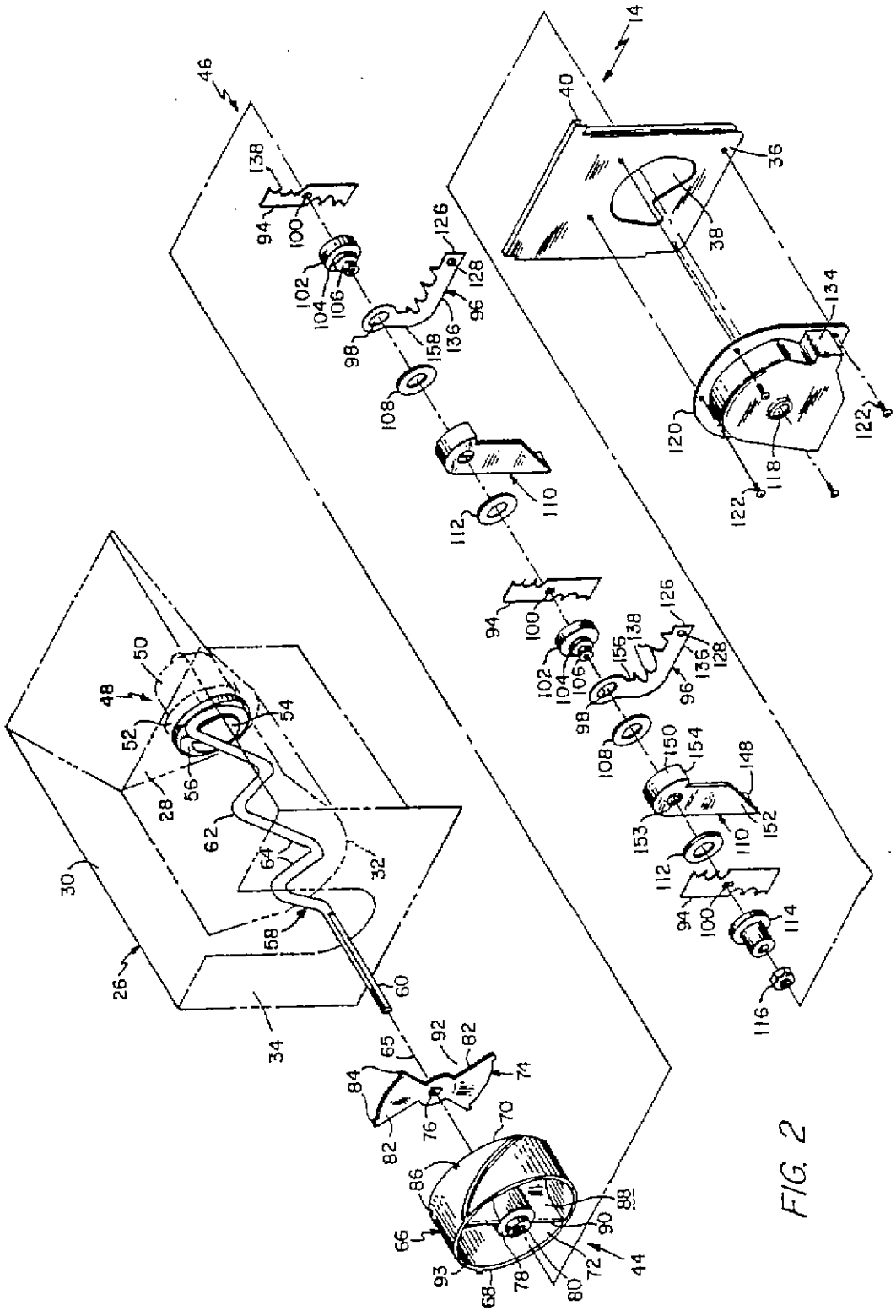
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FIG. 2

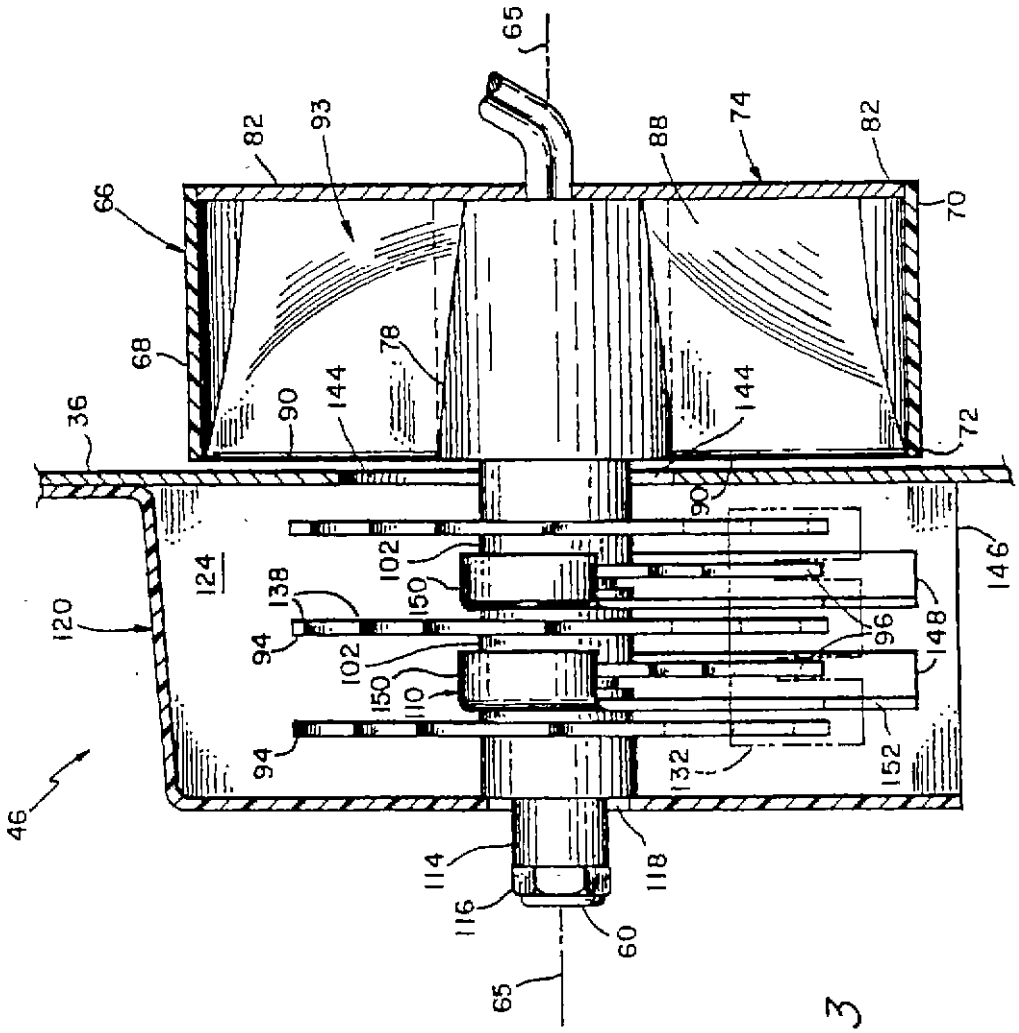
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FIG. 3

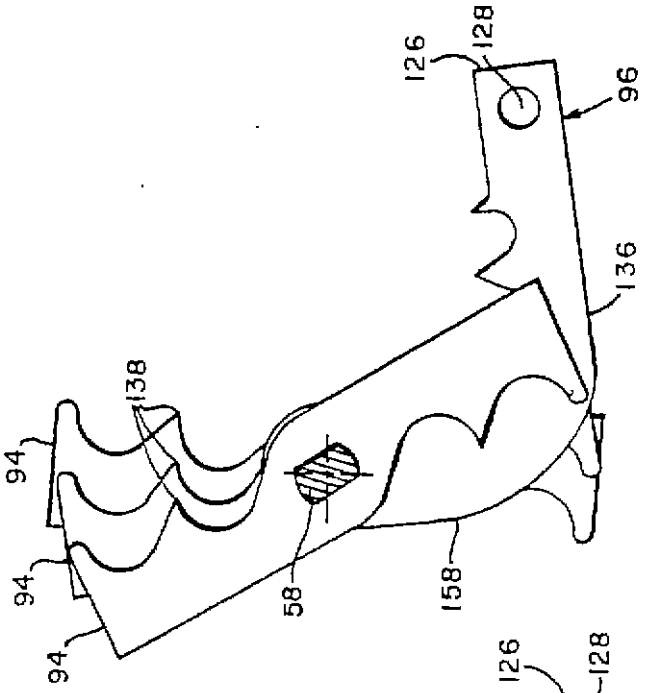

FIG. 4C

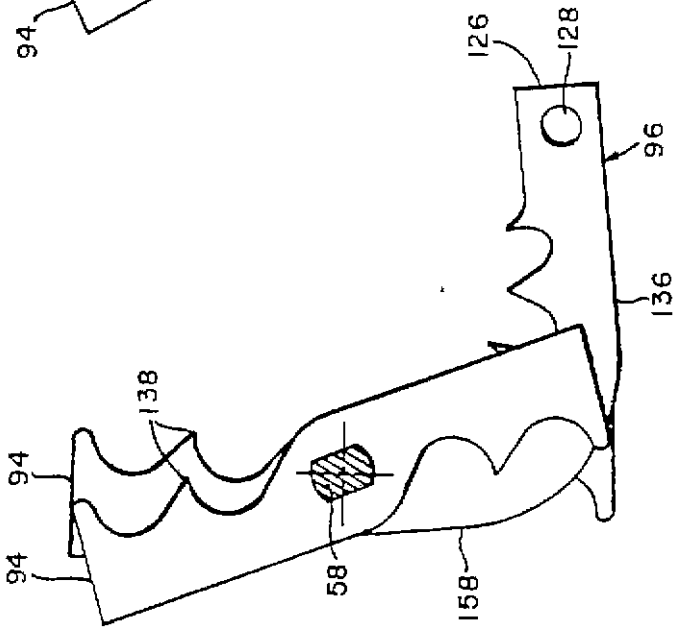

FIG. 4B

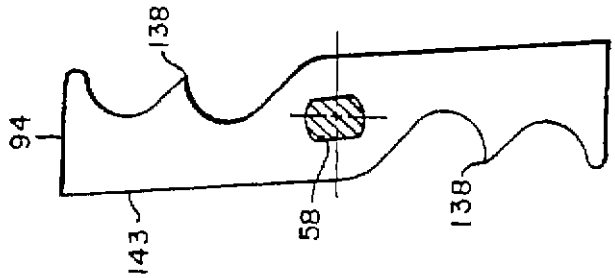

FIG. 4A

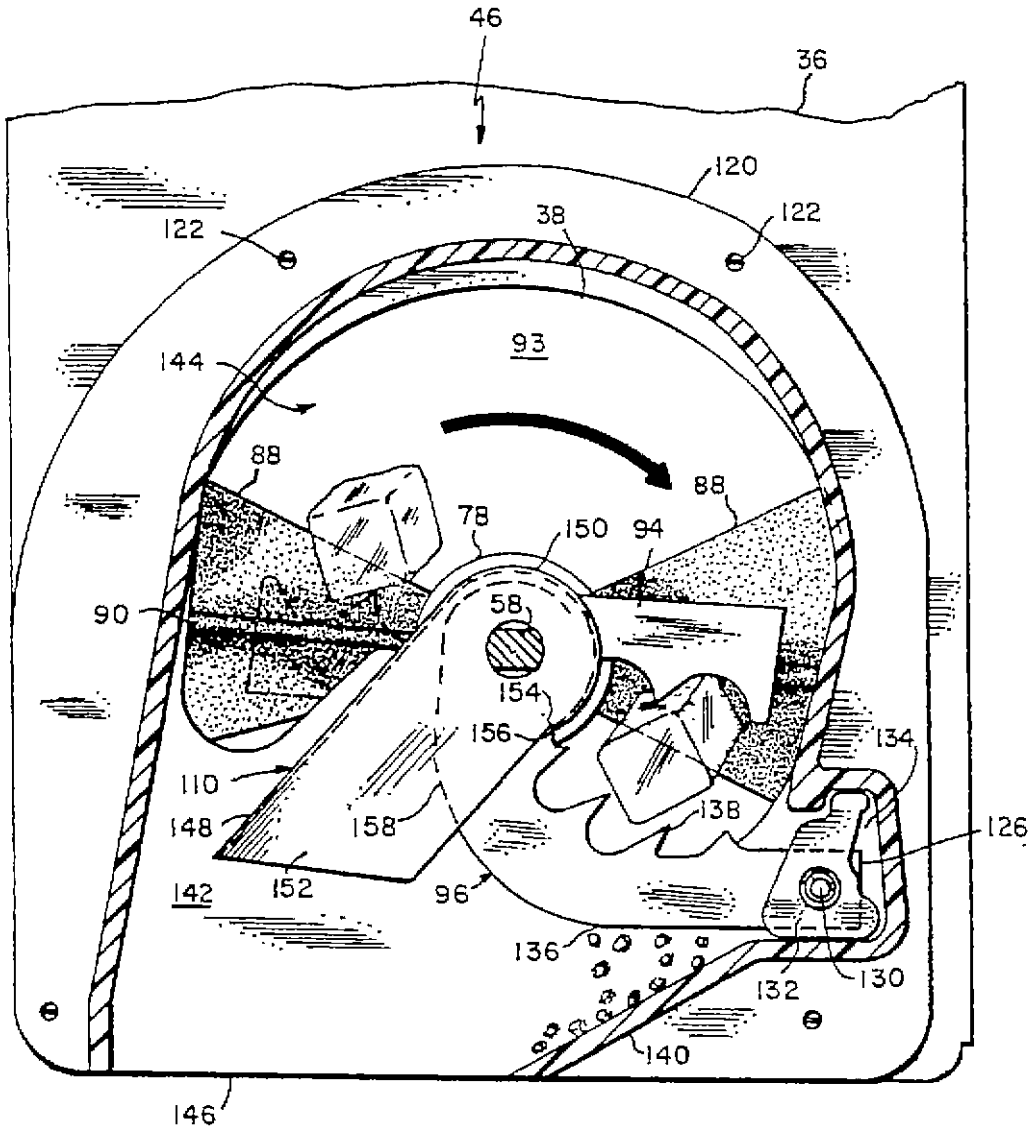
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FIG. 5A

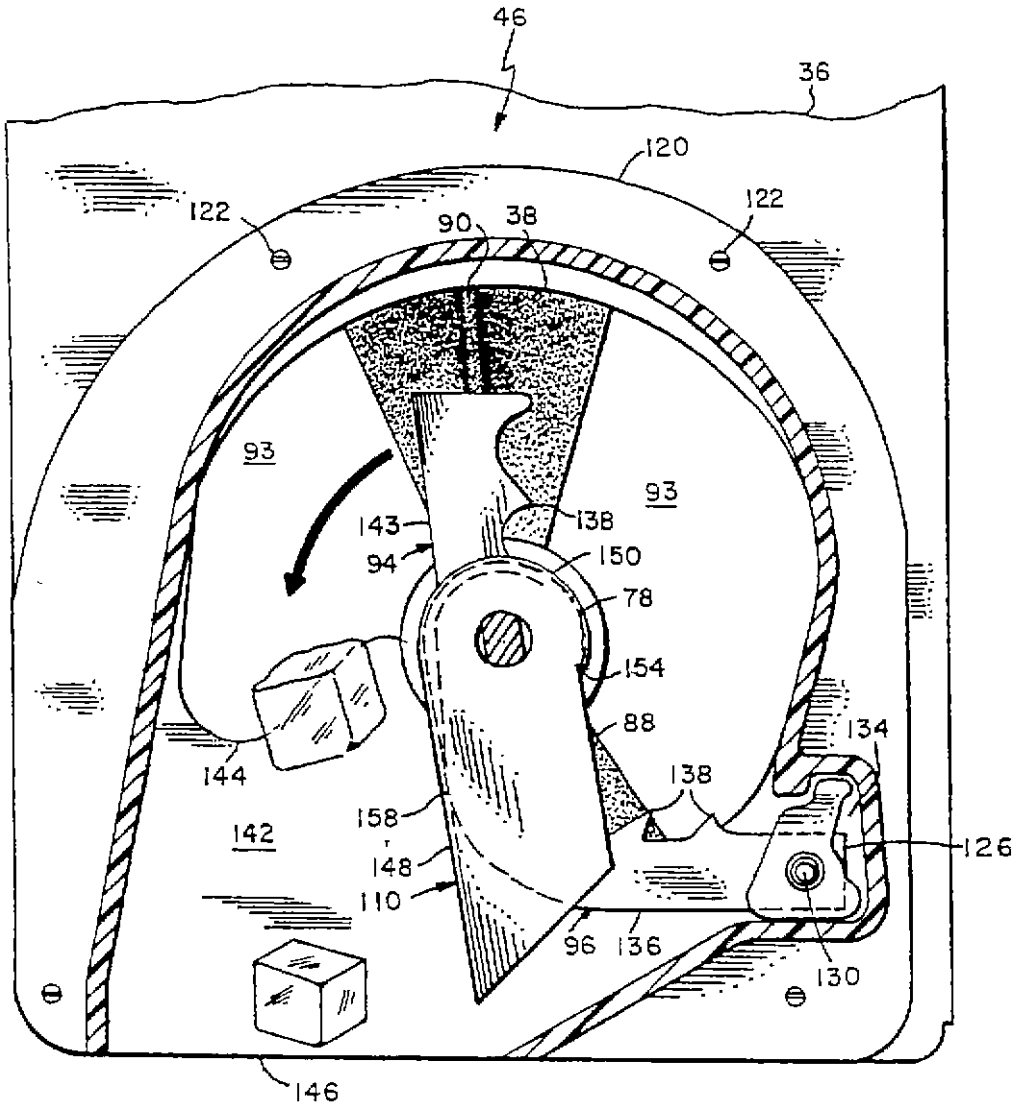
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FIG. 5B

ICE CUBE AND CRUSHED ICE DISPENSER

BACKGROUND OF THE INVENTION

The field of the invention generally relates to ice dispensers, and more particularly relates to ice dispensers that can selectively dispense either whole ice pieces or crushed ice.

Through-the-door ice dispensers have been used in conventional household refrigerators for many years, and typically are located in the freezer section of a side-by-side refrigerator. Such dispensers make it very convenient for the user to fill a glass with ice, and also eliminate the need to open the freezer door and let ambient air into the freezer section. Early ice dispensers are described in U.S. Pat. No. 3,422,994 issued Jan. 21, 1969, U.S. Pat. No. 3,437,244 issued Apr. 8, 1969, and U.S. Pat. No. 3,602,441 issued Aug. 31, 1971. Briefly described, such dispensers include a receptacle or bucket that receives and stores ice pieces or cubes from an automatic ice maker. A feed section or lift wheel at the front of the ice bucket includes a horizontal cylindrical collar that contains a metering helix such as a spiraled vane or a double bladed screw auger. When the lift wheel is rotated in response to depressing an actuater on the outside of the freezer door, the metering helix lifts ice pieces up and through a discharge opening in the front end of the receptacle from where they fall down a chute into the user's glass. The lift wheel maintains the delivery rate of the ice pieces within prescribed limits for user convenience, and also provides a moderate flow rate of ice pieces independently of the fill level of ice pieces within the receptacle.

In order to move or convey ice pieces into the lift wheel, a horizontal wire auger having a helically coiled portion is positioned lengthwise in the bucket. The rear end of the wire auger is connected to a driving motor while the front end of the wire auger is connected to the lift wheel so as to provide rotational drive to the lift wheel. When the wire auger is rotated, a transition pool of continuously moving ice pieces is delivered at the wire auger output allowing the ice pieces to fall into the metering helix within the collar of the lift wheel as they randomly present themselves in the proper position and orientation.

The prior art also recognized the desirability of providing crushed ice rather than whole ice pieces. To provide this feature, the ice pieces are typically delivered to an ice crusher section in front of the receptacle that includes a horizontal substantially cylindrical chamber having a set of stationary and a set of axially rotating blades or arms. Generally, the front end of the wire auger extends through the lift wheel into the chamber and the set of axially rotating blades are affixed to the wire thereby providing their rotational drive. The ice is crushed between the respective sets of blades, and falls down a chute into the glass.

It has also been found desirable to provide an ice dispenser wherein a user selection can be made between whole ice pieces and crushed ice. That is, it is desirable that the user has an option to operate the dispenser so that the ice pieces ar delivered whole or as crushed ice. One such selective ice dispenser is described in U.S. Pat. No. 3,602,441 issued Aug. 31, 1971. With the apparatus described therein, ice pieces are delivered from the lift wheel or feed section through the discharge opening to a chamber or transfer space having an outlet opening generally below the inlet opening. In one mode of operation, the ice pieces drop unaltered from the inlet to the outlet so as to provide whole ice pieces. In an alternate mode of operation, a deflector or flapper door diverts or guides the ice pieces such that they are caught and crushed between a set of rotating and a set of stationary blades in the conventional ice crushing fashion. In other words, the ice pieces are delivered whole or crushed depending on the positioning of the deflector. With such arrangement, structure including a hinged deflector, a solenoid, and a solenoid operated crank are required. Such additional parts add to the cost and detract from the reliability of the dispenser.

Another selective ice dispenser is described in U.S. Pat. No. 4,176,527 issued Dec. 4, 1979. In the apparatus described therein, an ice crusher includes first and second crusher arms mounted to a rotatable shaft. In one mode of operation, a stop is used to prevent rotation of the second crusher arm so that it temporarily becomes stationary while permitting the first crusher arm to continue rotation with the shaft. The relative motion between the crusher arms effects a crushing of the ice pieces so as to permit the ice to be delivered to the user in such form. In an alternate mode of operation, the stop is positioned so as to permit rotation of both the first and second crusher arms with the shaft, and the ice pieces are delivered whole or intact. This apparatus also requires additional parts including a solenoid to activate the stop.

SUMMARY OF THE INVENTION

It is an object of the invention to provide an improved ice dispenser that can selectively dispense either whole ice pieces or crushed ice.

It is a further object to provide such an ice dispenser that does not require a solenoid or a similar apparatus to effect the change from the crushing to the whole ice piece mode or vice versa.

It is also an object to provide simplified apparatus for selecting between crushed ice or whole ice pieces

It is also an object to provide an ice dispenser drive system that can be rotated clockwise or counterclockwise wherein, in one direction, crushed ice is dispensed and in the opposite direction, whole ice pieces are dispensed.

It is a further object to provide such an ice dispenser wherein the lift wheel delivers ice through the discharge opening regardless of its direction of rotation. It is an object that the delivery rate of ice pieces from the lift wheel be properly metered regardless of its direction of rotation.

It is a further object to provide ice pieces to the inlet of the lift wheel whether the lift wheel is being driven clockwise or counterclockwise.

It is also an object to provide a wire agitator that assists gravity feed from the ice bucket to the inlet of the lift wheel.

These and other objects and advantages are provided in accordance with the invention by an ice dispenser comprising a receptacle for storing ice pieces and including a front plate having a discharge opening, means for discharging ice pieces from the receptacle through the discharge opening, means for selectively crushing the ice pieces discharged from the receptacle through the discharge opening wherein the selective ice crushing means comprises at least one ice crusher arm mounted to a rotatable shaft and at least one stationary crusher arm wherein the selective ice crushing means

further comprises means for rotating the shaft and the rotatable crusher arm in a first direction to catch and crush discharged ice pieces between the rotating arm and the stationary arm and for rotating the shaft and the rotating crusher arm in a second direction opposite the first direction to permit discharged ice pieces from being crushed. It may be preferable that the discharging means comprise a lift wheel connected to and rotated by the shaft wherein the lift wheel has a collar and vanes for driving ice pieces towards the discharge opening regardless of the direction that the lift wheel is rotated. It may also be preferable that the rotating means comprise a reversible motor. Further, it may be preferable that the ice dispenser further comprise means connected to the shaft and positioned in the receptacle for agitating ice pieces in the receptacle to gravity feed toward the lift wheel.

The invention may also be practiced by the method of dispensing ice from an ice dispenser having a feed section for delivering ice pieces to a chamber having an inlet and a lower outlet including at least one crusher arm rotatably mounted to a horizontal rotatable shaft and at least one stationary crusher arm on one side of the shaft, comprising the steps of selectively crushing the ice pieces by rotating the shaft and the shaft mounted crusher arm in one direction to catch and crush ice pieces between the respective rotating and stationary crusher arms, and rotating the shaft and the shaft mounted crusher arm in the opposite direction to permit the ice pieces to fall down the side of the shaft opposite the stationary crusher arm so as to avoid being crushed.

In short, a reversible motor is provided so that when the rotatable crusher arms are rotated in one direction, ice pieces or ice cubes are caught between the rotatable crusher arms and the stationary crusher arm so as to crush the ice pieces. When the motor is reversed so that the rotatable crusher arms are driven in the opposite direction, the ice pieces are not caught or crushed between the respective rotating and stationary crusher arms. In order to feed ice pieces into the crusher section regardless of the direction that the shaft is rotated, a symmetrical feed wheel is used, and the ice pieces in the receptacle are agitated so as gravity feed to the feed wheel rather than being driven by a helically coiled wire or auger. With such apparatus, solenoids and other complicated mechanical apparatus is not required in order to provide the operator selection of crushed or whole ice piece dispensing.

BRIEF DESCRIPTION OF THE DRAWINGS

The foregoing objects and advantages will be more fully understood by reading the description of the preferred embodiment with referenced to the drawings wherein:

FIG. 1 is a partially broken away sectioned view of a refrigerator freezer compartment including an ice dispenser;

FIG. 2 is an exploded view of the ice dispenser;

FIG. 3 is an expanded side sectioned view of the collar and the crusher section of the ice dispenser;

FIGS. 4A-C show sectioned views of the ice dispenser shaft at various locations in the ice crusher section; and

FIGS. 5A and 5B depict the ice crusher section with the rotatable blades being driven in the clockwise and counter clockwise directions, respectively.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to the drawings wherein like reference numerals depict like parts throughout the several views, FIG. 1 shows a portion of a freezer compartment **10** of a conventional refrigerator **12** such as a so-called side-by-side model. Ice dispenser **14** can selectively deliver hole ice cubes or crushed ice down a chute **16** to a conventional ice dispenser delivery area (not shown) in freezer door **18** without opening door **18**. Within the upper portion of freezer compartment **10** is mounted an automatic ice maker **20** which may be of the well-known type presently provided in household refrigerators for the automatic production of ice pieces, generally referred to as ice cubes regardless of their particular shapes. As is well-known, water is supplied to ice maker **20** through tube **22** and, in response to sensor arm **24** indicating that plastic receptacle **26** or bucket is less than full of ice, ice maker **20** automatically in conventional manner, harvests a load of ice pieces dropping them into receptacle **26**, and then automatically refills with water to start the next cycle. When sensor arm **24** indicates that the receptacle is full of ice pieces, the automatic harvesting of ice is interrupted until such time as ice pieces are removed from receptacle **26**. As is well known, freezer compartment **10** is maintained at a sub-zero temperature so that the ice pieces are stored in receptacle **26** until needed by the user.

With reference also to FIG. 2, receptacle **26**, that is removably supported within freezer compartment **10**, has a back wall **28**, side walls **30**, and a bottom wall **32** that is downwardly sloped for its entire length towards a front wall **34** that has a front plate **36** with ice discharge opening **38**. Bottom wall **32** may preferably also be arcuate from side to side. Metal front plate **36** has a lip **40** that fits over the top of front wall **34**. Alternatively, front plate **36** could be integrally formed as part of front wall **34**.

Ice dispenser **14** generally includes an ice feed section **44** and a selective ice crusher section **46**, both of which are responsive or activated by drive section **48**. Drive section **48** includes a conventional reversible electric motor **50** and a speed reducing transmission **52** that is suitably coupled to a drive yoke **54** that engages a bent portion **56** of shaft **58**. Thus, as shown, reversible motor **50** can cause shaft **58** to rotate axially in either direction. That is, depending on the drive direction of motor **50** as selected by the user, shaft **58** rotates in either the clockwise or counterclockwise direction. Here, for purposes of explanation only, the convention of clockwise and counterclockwise is with respect to a front view. As will be described later herein, feed section **44** feeds ice through discharge opening **38** regardless of the direction of rotation of shaft **58** but crusher section **46** only crushes the discharged ice pieces when the shaft is driven in the clockwise direction. Therefore, suitable operator actuable polarity reversing apparatus (not shown) is provided to drive reversible motor **50** in the clockwise direction when crushed ice is desired and to drive reversible motor **50** in the counterclockwise direction when whole ice pieces are desired. Typically, reversible motor **50** may have a starting torque of 106 inch/lbs, and the output of transmission **52** may be driven at 21 revolutions per minute.

Metal shaft **58** extends horizontally the entire length of receptacle **26** and has an extension portion **60** that extends forwardly through discharge opening **38**, with

the crusher section 46 being attached to the extension portion 60. An agitator portion 62 of shaft 58 or wire immediately in front yoke 54 is bent into a planar serpentine shape. That is, there are a number of segments 64 that deviate in some manner from the general axis 65 of shaft 58 so that when shaft 58 is rotated, segments 64 of agitator portion 62 agitate the ice. It is noted that segments 64 do not define a helically coiled wire auger because shaft 58 must help convey ice pieces to lift wheel 66 regardless of the direction of rotation. Accordingly, agitator portion 62 merely functions to agitate, rather than auger drive, the ice pieces so that they gravity feed down the sloped bottom wall 32 towards lift wheel 66.

Also referring to FIG. 3, feed section 44 further includes a plastic molded lift wheel 66 or feed wheel that has an open ended collar 68 or sleeve having an inlet end 70 that receives ice pieces and an outlet end 72 that discharges or dispenses the ice pieces through discharge opening 38 in a metered fashion that is substantially independent of the ice piece fill level in receptacle 26. In fabrication and as shown in FIG. 2, a stainless steel ice breaker plate 74 having a keyed aperture 76 such as a double-D slot is first slid onto a corresponding shaped section of shaft 58 within receptacle 26. Lift wheel 66 has an axle 78 with a circular aperture 80, and it is next slid onto shaft 58 and is also positioned within receptacle 26 behind front plate 36. Ice breaker plate 74 has radial sectors 82 with peripheral fingers 84 that engage notches 86 in lift wheel 66 so as to impart the rotational torque of ice breaker plate 74 as driven by shaft 50 to lift wheel 66. Lift wheel 66 has a vane 88 that forms a narrow rib 90 extending from the axle across the internal diameter of the collar at the outlet end 72, and fans outwardly towards the inlet end 70 so as to substantially conform to the radial sectors 82 of the ice breaker plate 74. Thus, ice breaker plate 74 protects the scoop portion of the plastic vane 88 of the lift wheel 66 so that it doesn't chip or break when subjected to high torque forces that may be required to break up ice pieces as they enter the inlet 70 of lift wheel 66. The cut-out portions 92 of ice breaker plate 74 generally correspond or conform to the inlet or opening of vane 88 into collar 68, and vane 88 tapers downwardly forming a concave surface in the direction of outlet end 72. As a result, a rotationally symmetrical vane is provided that drives ice pieces from the inlet end 70 to the outlet end 72 regardless of the direction of rotation of lift wheel 66. Ice pieces that enter the openings of the vanes 88 at the inlet end 70 of lift wheel 66 are lifted upwardly as lift wheel 66 rotates, and then the ice pieces tumble or slide rearwardly down the vane 88, or are pushed rearwardly by the entry of new ice pieces into the lift wheel 66. At the outlet end, the ice pieces are dispensed or discharged through discharge opening 38 into crusher section 46. It has been known found that 3, 4, or 5 ice pieces may be simultaneously present in each side or conduit 93 of the lift wheel 66, and that sometimes an ice piece may make more than one revolution in the lift wheel 66 before being discharged. Because lift wheel 66 is angularly symmetrical in either direction so that it is operative when rotated either clockwise or counter clockwise, lift wheel 66 is not as efficient in driving ice pieces as some prior art lift wheels that could, for example, utilize a double bladed auger. However, lift wheel particularly relies on the force of incoming ice pieces to aid in the forward feeding, and the discharge opening 38 has been appropriately sized and shaped so that ice pieces feed on both the left and right side of shaft 58 regardless of the direction of rotation. As a result, lift wheel 66 has been found to meter an optimum feeding of ice pieces through discharge opening 38. For example, lift wheel 66 may typically rotate at 21 revolutions per minute, and dispense from 2–4 ice pieces per revolution. Typically, lift wheel 66 may have an internal diameter of 4.5 inches and an axial length of 1.75 inches.

Still referring to FIG. 2, crusher section 46 includes a set, here three, of spaced crusher arms 94 or blades rotatably secured to shaft 58, and a set, here two, of interspaced stationary crusher arms 96 or blades inserted onto shaft 58 but having circular apertures 98 such that stationary crusher arms 96 do not rotate with a shaft 58.

Referring also to FIGS. 4A–C, rotatable crusher arms 94 are suitably keyed to rotate with shaft 58 such as, for example, using a double-D shaft 58 with corresponding key holes 100 in rotatable crusher arms 94. As shown in FIG. 3, rotatable crusher arms 94 are spaced along shaft 58 such as, for example, $\frac{3}{8}$" apart. In order to angularly stagger the rotatable crusher arms 94 by a few degrees, the double-D of extension portion 60 of shaft 58 is twisted along its length. More specifically, prior art crusher arms have been staggered so as to concentrate the crushing force and thereby reduce the required torque, but prior art apparatus used different angular orientations for the key holes on the respective crusher arms. Such apparatus required different crusher arms for the respective crusher arm mounting locations along the shaft, and also required due care in assembling the crusher section so that they were inserted on the shaft in the proper sequence. Here, however, the same rotatable crusher arm 94 is used for all three crusher arm locations, and the precise relative angular displacement is provided by twisting shaft 58. For example, FIG. 4A is a view showing the first rotatable crusher arm 94 nearest front plate 36 inserted on sectioned shaft 58. As noted, the double-D shaft is vertically oriented. After inserting intermediate parts to be described subsequently on shaft 58, FIG. 4B shows a view of a second identical rotatable crusher arm 94 inserted on shaft 58, and the shaft 58 is sectioned approximately $\frac{3}{8}$" to the front of FIG. 4A. As can be seen, the shaft 58 has twisted by a small number of degrees, such as, for example, 10°, and the second rotatable crusher arm 94 is therefore oriented approximately 10° counterclockwise from the first rotatable crusher arm 94. Likewise, FIG. 4C shows the third identical rotatable crusher arm 94 inserted on shaft 58, and it has an angular displacement of approximately 20° from the first rotatable crusher arm 94 because the double-D shaft 58 is further twisted approximately $1\frac{1}{4}$" to the front of the first rotatable crusher arm 94. Accordingly, the same rotatable crusher arm 94 can be stocked for all three locations in the crusher section 46, and the assembly is simplified because there is no special order or sequence for inserting the rotatable crusher arms 94. The staggering is precisely and accurately accounted for by the stamping of the shaft 58.

Referring again to FIGS. 2 and 3, a stepped washer 102 having a larger collar 104 and a smaller collar 106 facing away from the first rotatable crusher blade 94 is inserted onto the extension portion 60 of shaft 58 after the first rotatable crusher arm 94. Then, the circular aperture 98 of a stationary crusher arm 96 is inserted over the larger collar 104. Next, a waved friction washer 108 followed by barrier arm 110 and another

waved friction washer 112 are inserted over smaller collar 106 Then, the same sequence of rotatable crusher arm 94, stepped washer 102, stationary crusher arm 96, friction washer 108, barrier arm 110, and friction washer 112 followed by another rotatable crusher arm 94 are inserted on the extension portion 60 of shaft 58. Finally, a bearing washer 114 and a holding bolt 116 are applied. The bearing washer 114 inserts through a bearing aperture 118 in a plastic molded housing 120 or cover that attaches by screws 122 to the front wall 34 of receptacle 26, and defines the ice crusher chamber 124.

As shown best in FIG. 5A, the distal ends 126 of stationary crusher arms 96 have holes 128 through which a bar 130 is inserted securing them to anchor 132 that seats into recess 134 or boot of housing 120 so a to prevent stationary crusher arm 96 from rotating with shaft 58.

The operation of dispenser 14 is described with reference to FIGS. 5A and 5B. As described heretofore, and also with reference to FIGS. 1 and 2, agitator portion 62 agitates ice pieces in receptacle 26 so as to cause them to convey or gravity feed down declined bottom wall 32 toward lift wheel 66 regardless of the direction of rotation of shaft 58 by reversible motor 50. Also, regardless of the direction of rotation of lift wheel 66, ice pieces are dispensed in a somewhat metered flow through discharge opening 38 into crusher section 46. Therefore, whether shaft 58 is rotated clockwise or counterclockwise as identified for convention only with respect to FIGS. 5A and 5B, ice pieces are fed through discharge opening 38 into crusher chamber 124, and they are fed through discharge opening 38 on both the left and right sides of shaft 58 regardless of the direction of rotation. When the user has selected crushed ice, reversible motor 50 drives shaft 58 in the clockwise direction as depicted in FIG. 5A which, for simplicity of illustration, is sectioned so as to show only the first rotatable crusher arm 94 and one stationary crusher arm 96 closest to discharge opening 38. In this ice crushing mode of operation, ice pieces that are fed through the right side of discharge opening 38 fall down onto the horizontal portion 136 of the stationary crusher arm 96 and ice pieces fed through the left side of discharge opening 38 are carried up and over shaft 58 by the next set of rotatable crusher arms 94, such that, in either case, the ice pieces end up on the right side where they are caught and crushed between the respective sets of rotatable crusher arms 94 and stationary crusher arms 96. As is conventional, the respective teeth 138 of crusher arms 94 and 96 break up the ice pieces, and the crushed ice is forced downwardly through the stationary crusher arms 96 where it is guided down the side 140 of housing 120 to the chute 16 that conveys it to the user's glass. It may also be preferable that each rotatable crusher arm 94 have two or more teeth 138, and that the teeth 138 be arranged to fall between the teeth 138 of the stationary crusher arms 96.

When the user has selected whole ice cubes or ice pieces, reversible motor 50 drive shaft 58 in the counterclockwise direction as shown in FIG. 5B. In this whole ice piece or ice cube mode of operation, ice pieces fed from the left side of discharge opening 38 fall directly down the whole ice piece passageway 142 of housing 120, and ice pieces fed from the right side of discharge opening 38 are carried over the top of shaft 58 by the smooth side 143 of the next rotating set of rotatable crusher arms 94 to the left side such that, in either case, the ice pieces fall down the whole ice piece passageway 142 so that they escape being caught and crushed between the respective rotatable crusher arms 94 and stationary crusher arms 96. In other words they fall unaltered from the inlet 144 of chamber 124 which is the discharge opening 38 to the outlet 146 of the crusher chamber 124. From the crusher section 46, the whole ice pieces slide intact down chute 16 to the user's glass.

Referring again to FIG. 5A, it was found that in the ice crushing mode of operation when the rotatable crusher arms 94 are moving clockwise, an ice piece would occasionally be fed through the left side of discharge opening 38 and the lower portion of rotatable crusher arm 94 would not be rotated far enough past 6 o'clock to catch the ice piece, and it would fall down through the whole ice piece passageway 142 and be dispensed along with the crushed ice. This was an undesirable occurrence, and barrier arm 110 or baffle provides a rotatable partition to insure that it doesn't happen. More specifically, barrier arm 110 includes an axial flap 148, an axial hood 150 and a perpendicular side plate 152 having a circular hole 153 that is inserted over smaller collar 106. As shown in FIG. 3, the flap 148 and hood 150 overlay a stationary crusher arm 96, and are interleaved between rotatable crusher arms 94. Friction washers 108 and 112 are positioned on both sides of side plate 152, and the axial mounting space for all three parts on the smaller collar 106 is precisely selected so as to provide a friction clutch responsive to the rotation of a rotatable crusher arm 94. More specifically, washers 108 and 112 may be made of polymer composities using either stamping or injection molding, and preferably are peripherally waved so as to be axially resilient. Accordingly, friction washers 108 and 112 function as spring clutch disks so as to cause barrier arm 110 to be frictionally rotatable with rotatable crusher arms 94 When rotatable crusher arms 94 ar rotated clockwise as they would be in the ice crushing mode as shown in FIG. 5A, the rotation of crusher arm 94 against friction washer 112 causes it to rotate and also to rotate barrier arm 110 in the clockwise direction until the right edge 154 of hood 150 contacts a stop 156 on stationary crusher arm 96. Such stopping action may occur when the barrier arm 110 is at approximately 45° up from vertical, or between 7 o'clock and 8 o'clock, and the friction by waved friction washers 108 and 112 is large enough so that barrier arm 110 can hold one or more pieces of ice that may fall thereon, but not so large as to prevent or impede slippage of further rotation of rotatable crusher arms 94 with barrier arm 110 in that position. Accordingly, any ice pieces that would otherwise fall through escape passageway 142 during the crushing mode of operation are held on axial flaps 148 of adjacent parallel barrier arms 110 until the next set of rotatable crusher arms 94 rotate up interleaved therebetween and carry the ice piece or pieces over the top of shaft 58 for crushing.

Referring to FIG. 5B, rotatable crusher arms 94 rotate in the counterclockwise direction in the whole ice piece mode as described heretofore, and this causes barrier arms 110 to rotate in the counterclockwise direction until axial flap 148 contacts the vertical edge 158 of stationary crusher arm 96. Accordingly, in the whole ice piece mode of operation, barrier arms 110 are rotated counterclockwise out of the whole ice piece passageway 142 on the left side of shaft 58 so that the whole ice pieces can drop unaltered to the user's glass as described heretofore.

Still referring to FIGS. 5A and 5B, and also to FIG. 2, the size and shape of ice discharge opening **38** was determined by trial and error experiment so as to optimize the feeding of ice pieces to crusher section **124**. It was desirable that ice pieces feed at approximately the same rate whether shaft **58** is rotated clockwise or counterclockwise, and that ice pieces feed from both the left and right sides. Further, ice discharge opening **38** is raised on the left side as shown best in FIG. **5A** so that when barrier arm **110** is in the raised position, ice pieces are not fed through ice discharge opening **38** against the side of barrier arm **110**. In other words, the shape of ice discharge opening **38** protects barrier arm **38** so that ice pieces are not forced axially against it. Before barrier arm **110** was included in the design of crusher section **124**, the left side of ice discharge opening **38** was also raised so that a larger percentage of ice pieces would feed on the right side thereby reducing the incidence of whole ice pieces feeding through in the ice crushing mode of operation. In one embodiment, the maximum horizontal dimension of ice discharge opening **38** is 4.5" and the maximum vertical dimension is 3.5".

Also, as shown in FIGS. **5A** and **5B**, shaft **58** is twisted or keyhole **100** is oriented so that the rotatable crusher arm **94** closest front plate **36** aligns with and rotates with the rib **90** of vane **88**. That is, rib **90** aligns with the center line of the first rotatable crusher arm **94** so as to optimize the opening through which ice pieces can feed through ice discharge opening **38** past rotatable crusher arm **94** into crusher section **124**. As shown by the phantom portion of rotatable crusher arm **94** on the left side of FIG. **5A**, the teeth **138** of rotatable crusher arm **94** extend up above rib **90** and therefore may slightly interfere with the feed of ice pieces into crusher section **124**. However, to time the points of teeth **138** with rib **90** would mean that the smooth side **143** would extend further into the opening when the shaft **58** is rotated in the counterclockwise direction in the whole ice cube mode of operation. In other words, the angular orientation of the first rotatable crusher arm **94** with respect to rib **90** splits the difference so as not to unduly interfere with ice feeding in either direction of rotation.

This concludes the description of the preferred embodiment. It is understood that the reading of it by one skilled in the art will bring to mind many alterations and modifications without departing from the spirit and scope of the invention. Accordingly, it is intended that the invention be limited only by the appended claims.

What is claimed is:

1. An ice dispenser, comprising:

a receptacle for storing ice pieces, said receptacle including a front plate having a discharge opening;

means for discharging ice pieces from said receptacle through said discharge opening;

means for selectively crushing said ice pieces discharged from said receptacle through said discharge opening, said selective ice crushing means comprising at least one ice crusher arm mounted to a rotatable shaft and at least one stationary crusher arm; and

said selective ice crushing means further comprising means for rotating said shaft and said at least one shaft mounted crusher arm in a first direction to catch and crush discharged ice pieces between said rotating arm and said stationary arm and for rotating said shaft and said at least one shaft mounted crusher arm in a second direction opposite said first direction to permit discharged ice pieces to escape being crushed.

2. The ice dispenser recited in claim **1** wherein said discharging means comprises a lift wheel connected to and rotated by said shaft, said lift wheel having a collar and vanes for driving ice pieces toward said discharge opening regardless of the direction of rotation of said lift wheel.

3. The ice dispenser recited in claim **1** wherein said rotating means comprises a reversible motor.

4. The ice dispenser recited in claim **1** further comprising means connected to said shaft and positioned in said receptacle for agitating ice pieces in said receptacle to gravity feed toward said lift wheel.

5. An ice dispenser, comprising:

a receptacle for storing ice pieces said receptacle having a front plate with a discharge opening;

a rotatable shaft passing through said receptacle and extending forwardly through said discharge opening;

means for selectively rotating said shaft in either direction;

means positioned in said receptacle and rotatably connected to said shaft for dispensing ice pieces through said discharge opening when said shaft is rotated in one direction and also when said shaft is rotated in the opposite direction; and

means positioned in front of said front plate and rotatably coupled to said shaft for selectively crushing ice pieces dispensed through said discharge opening when said shaft is rotated in one direction, said selective crushing means being inoperative for crushing ice pieces when said shaft is rotated in the opposite direction.

6. The ice dispenser recited in claim **5** wherein said selective rotating means comprises a reversible motor.

7. The ice dispenser recited in claim **5** wherein said dispensing means comprises a lift wheel having a cylindrical collar with an outlet end facing the discharge opening and an inlet end, said lift wheel further having a central axle and at least one vane comprising means for driving ice pieces from said inlet end to said outlet end regardless of the direction in which said lift wheel is rotated.

8. The ice dispenser recited in claim **5** wherein said receptacle has a bottom slope downwardly towards the front, and said shaft has a portion comprising means for agitating ice pieces in said receptacle to gravity feed them down the sloped bottom to the inlet end of the lift wheel regardless of the direction of rotation of the shaft.

9. The ice dispenser recited in claim **5** wherein said selective crushing means comprises a set of crusher arms mounted for rotation to said shaft.

10. The ice dispenser recited in claim **9** wherein said selective crushing means further comprises at least one stationary arm on one side of said shaft wherein, when said shaft is rotated in one direction, ice pieces are caught and crushed between said rotating crusher arms and said at least one stationary crusher arm and, when said shaft is rotated in the opposite direction, ice pieces fall down the opposite side of said shaft where they escape being caught and crushed.

11. An ice dispenser, comprising:

a receptacle for storing ice pieces, said receptacle including a front plate having a discharge opening and a bottom sloped downwardly toward the front;

a shaft extending through said receptacle and passing forwardly through said discharge opening;

means for rotating said shaft in a clockwise direction and a counterclockwise direction;

a feed section positioned in said receptacle and mounted for axial rotation to said shaft for feeding ice pieces through said discharge opening regardless of whether said feed wheel is rotated in the clockwise or counterclockwise direction;

said shaft having a portion with a plurality of planar bends providing a serpentine shape for agitating ice pieces to gravity feed down said sloped bottom to said feed wheel; and

means positioned in front of said front plate for selectively crushing ice pieces fed through said discharge opening depending on whether said shaft is rotated clockwise or counterclockwise, said crushing means comprising at least one crusher arm mounted for axial rotation to said shaft and a stationary crusher arm wherein, when said shaft is rotated in one direction, ice pieces are caught and crushed between said crusher arm and said stationary crusher arm and, when said shaft is rotated in the opposite direction, said ice pieces escape from being caught and crushed.

12. The method of dispensing ice from an ice dispenser having a feed section for delivering ice pieces to a chamber having an inlet and a lower outlet including at least one crusher arm rotatably mounted to a horizontal rotatable shaft and at least one stationary crusher arm on one side of said shaft, comprising the steps of:

selectively crushing said ice pieces by rotating said shaft and said shaft mounted crusher arm in one direction to catch and crush ice pieces between said respective rotating and stationary crusher arms, and rotating said shaft and said shaft mounted crusher arm in the opposite direction to permit said ice pieces to fall down the side of said shaft opposite said stationary crusher arm so as to avoid being crushed.

* * * * *

EXHIBIT 2

US006120685A

United States Patent [19]

Carlson et al.

[11] Patent Number: 6,120,685

[45] Date of Patent: Sep. 19, 2000

[54] **WATER FILTERING SYSTEM WITH REPLACEABLE CARTRIDGE FOR A REFRIGERATOR**

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[73] Assignee: **Maytag Corporation**, Newton, Iowa

[21] Appl. No.: **09/258,356**

[22] Filed: **Feb. 26, 1999**

[51] **Int. Cl.**[7] **B01D 27/00**

[52] **U.S. Cl.** **210/232**; 210/236; 210/444; 210/DIG. 17; 62/339; 222/189.06

[58] **Field of Search** ..... 210/232, 443, 210/444, DIG. 17, 236; 62/338, 339, 389; 222/189 06, 189.11

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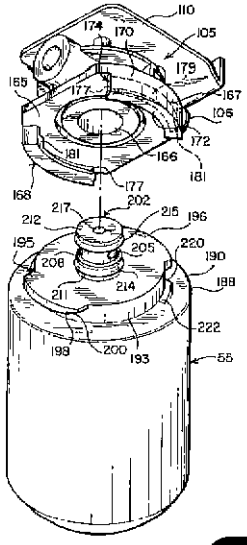
Primary Examiner—David A. Simmons
Assistant Examiner—Fred Prince
Attorney, Agent, or Firm—Everett G. Diederiks, Jr.

[57] **ABSTRACT**

A water filtering system for a refrigerator includes a mounting head preferably arranged under a temperature control housing in a fresh food compartment. A replaceable filter cartridge is adapted to be selectively attached to the mounting head in order to complete a fluid circuit from a water supply source to at least one of a water dispenser and an ice maker. The filter cartridge and the mounting head have cooperating camming structure which axially draws a stem portion of the cartridge into a port of the mounting head upon rotation of the cartridge relative to the mounting head during installation of the cartridge. Furthermore, camming structure is also provided to at least partially, axially withdraw the stem portion from the port upon rotation of the cartridge a predetermined amount in an opposing direction. Also provided as part of the water filtering system is a plug which can be used to complete the fluid circuit in the absence of a filter cartridge.

20 Claims, 4 Drawing Sheets



EXHIBIT

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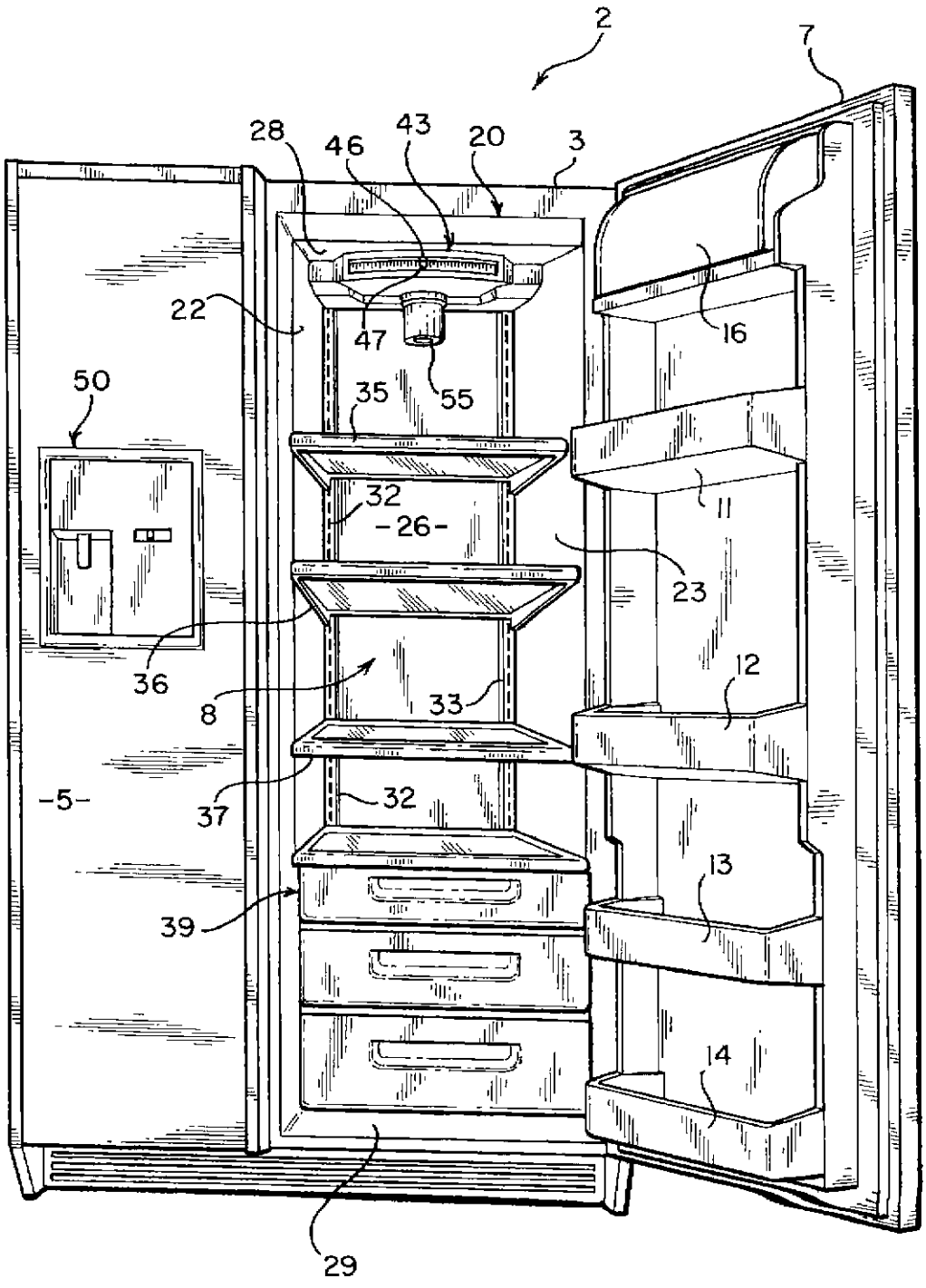
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FIG. 1

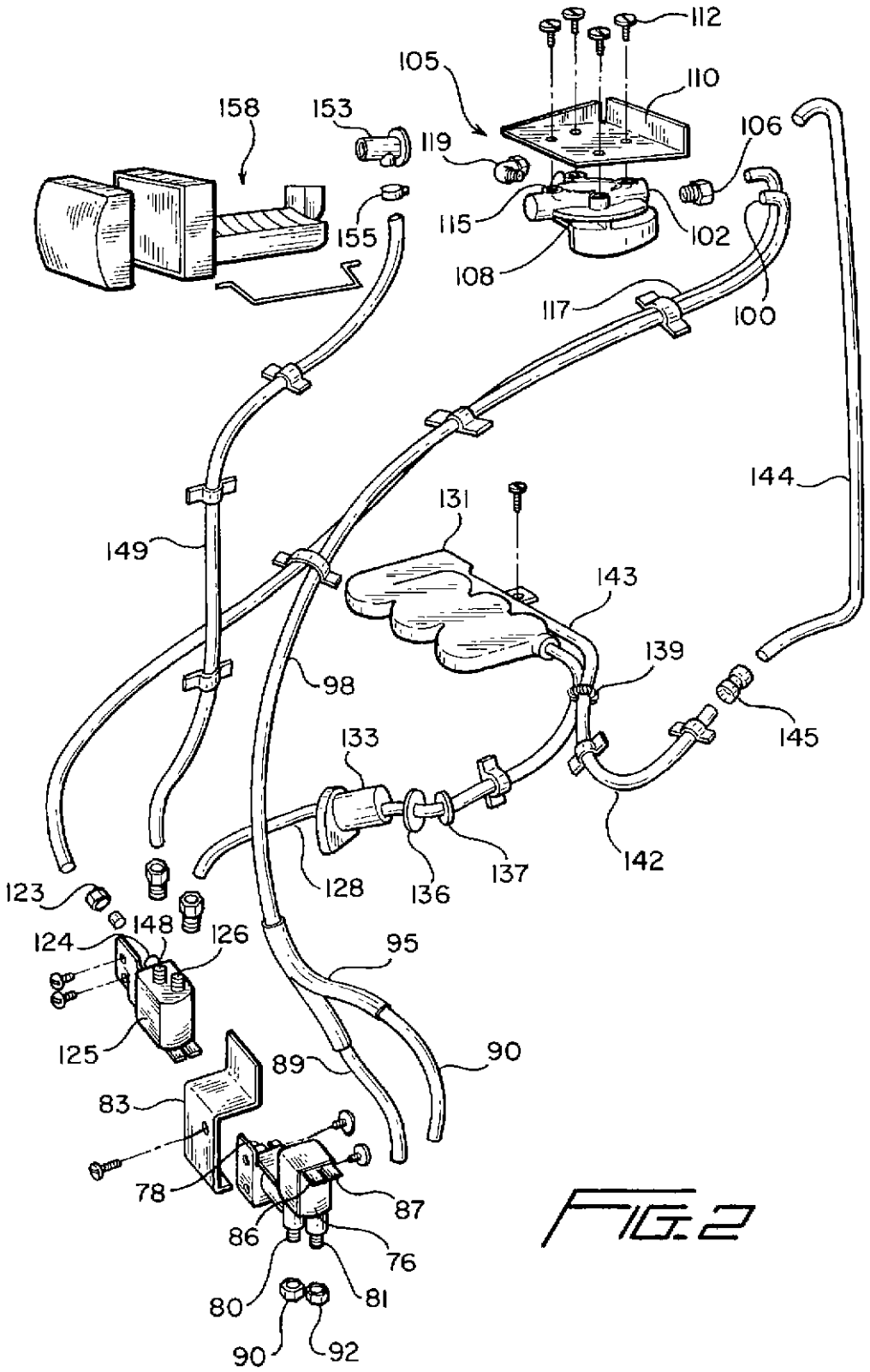
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FIG. 2

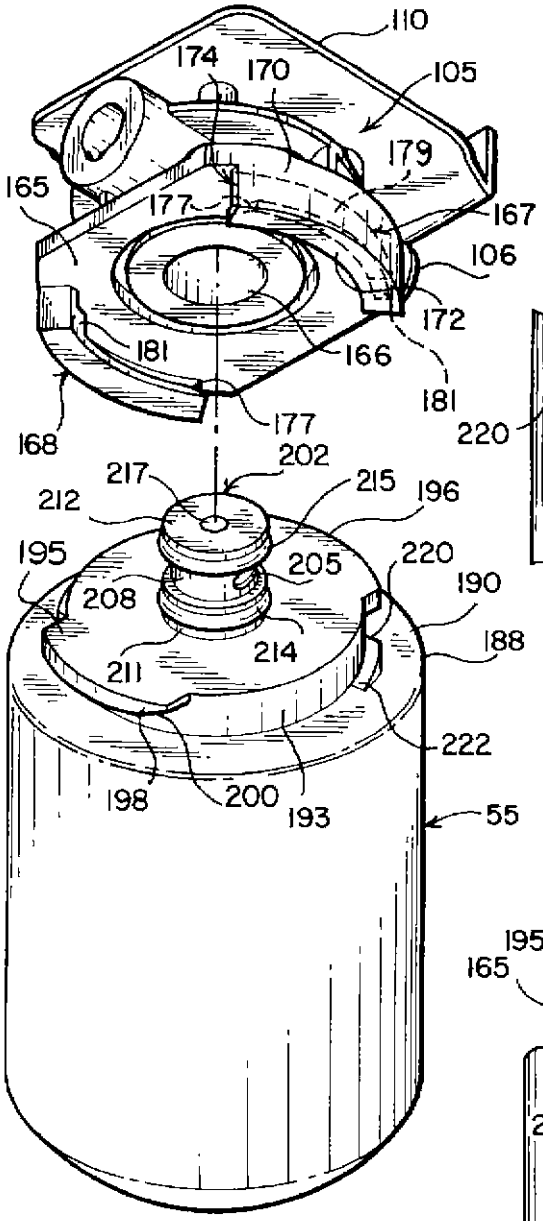

FIG. 3

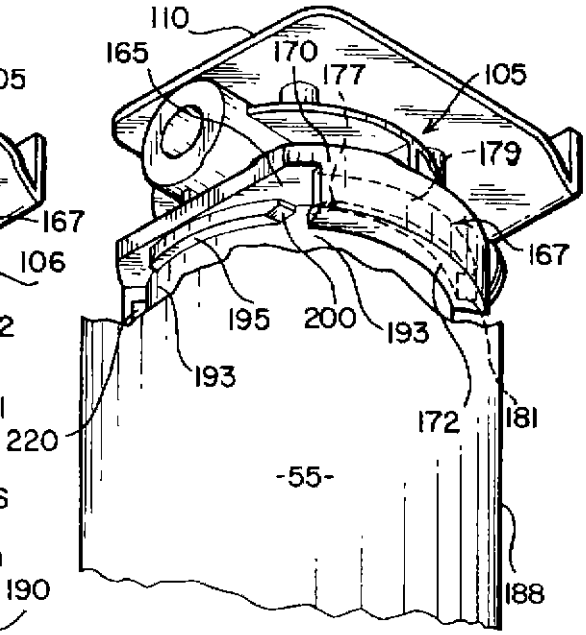

FIG. 4

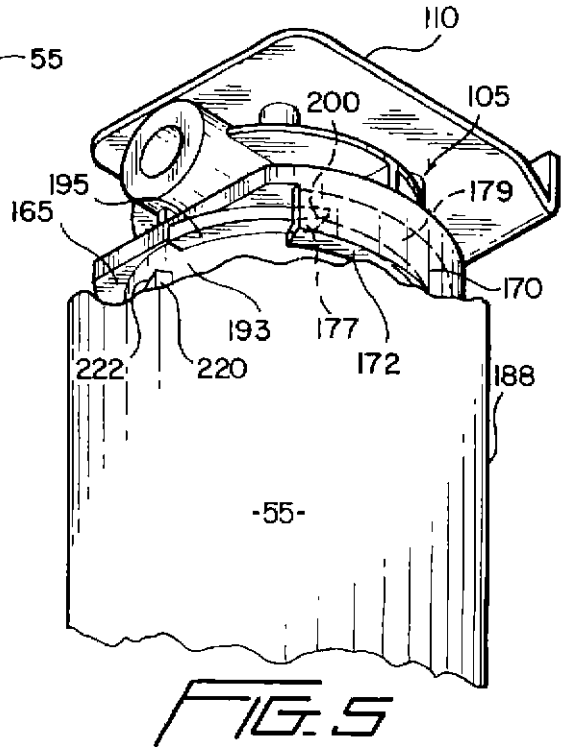

FIG. 5

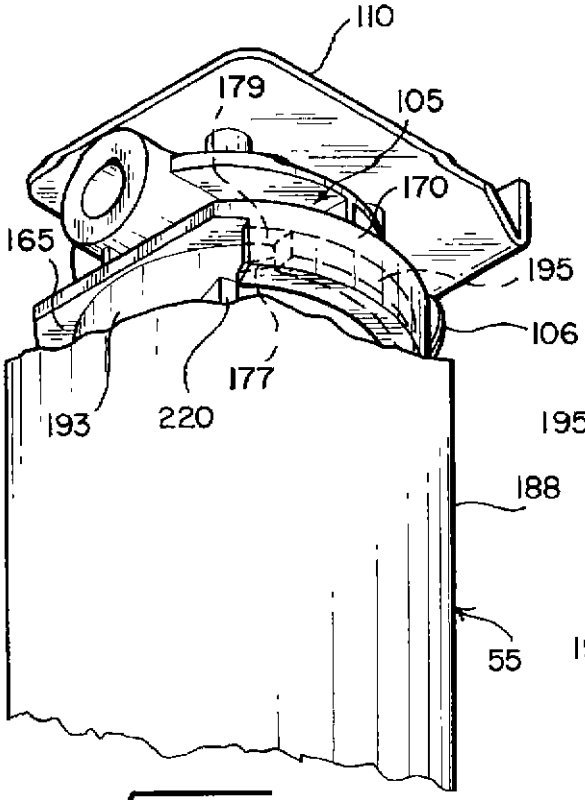

FIG. 6

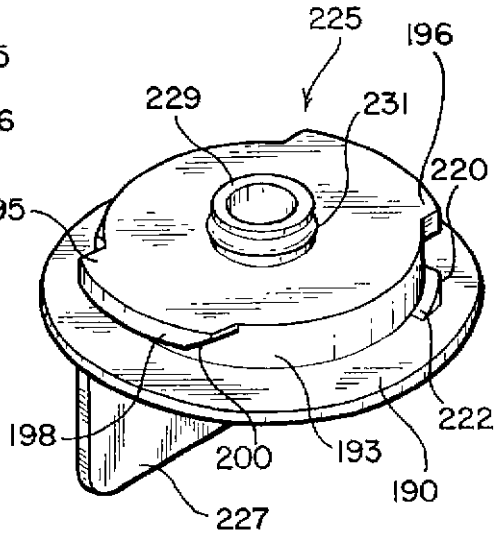

FIG. 8

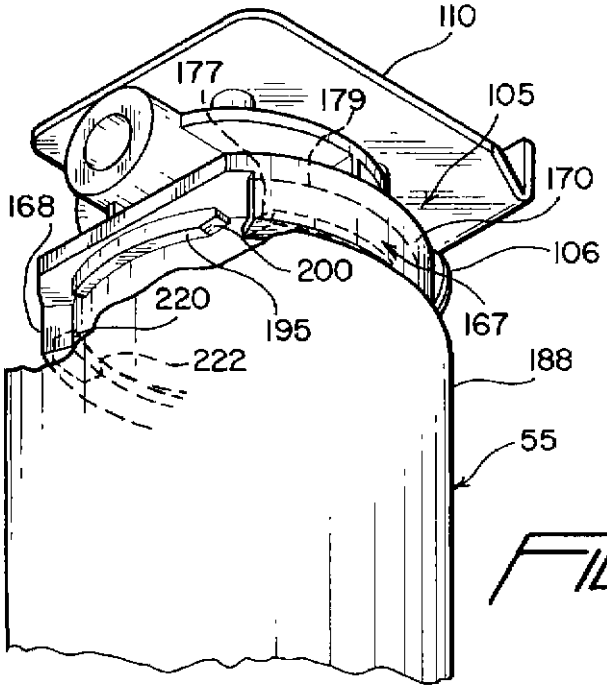

FIG. 7

WATER FILTERING SYSTEM WITH REPLACEABLE CARTRIDGE FOR A REFRIGERATOR

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention pertains to the art of water filtering systems and, more particularly, to a water filtering system incorporating a replaceable filter cartridge assembly particularly adapted for use in a refrigerator.

2. Discussion of the Invention

Providing water dispensers and automatic ice makers in household refrigerators has become extremely commonplace. In addition, there is a growing trend towards increasing the purity of all consumed water. For at least these reasons, it has heretofore been proposed in the art to incorporate a water purifying system in a refrigerator in order to filter the water supplied to a water dispenser and/or ice maker. Early proposed purifying systems of this type centered around providing a filtering unit between the water supply and the conduit entering the refrigerator. These systems were typically installed by service personnel as aftermarket add-on units. More recently, it has been proposed to incorporate filter assemblies during the overall manufacturing of refrigerators, while utilizing filters which can be fairly, readily accessed for replacement directly by consumers.

In developing an improved water filtering system, many factors need to be considered, including associated manufacturing costs, ease of use, manner of operation and reliability. Although various refrigerator water filtering assemblies are known in the art, many improvements are left to be made to simplify known filtering assemblies while increasing reliability, particularly with respect to the manner and ease in which the filter cartridges can be replaced. Based on the above, there exists a need in the art for an enhanced water filtering system, particularly a water filtering system for a refrigerator including an improved filter cartridge mounting arrangement.

SUMMARY OF THE INVENTION

The present invention is directed to a water filtering system for a refrigerator, as well as a filter cartridge useable therewith. The system is arranged to present the filter cartridge in a clearly visible and accessible location for ease of replacement by the consumer. In the preferred embodiment, the refrigerator is provided with a temperature control housing mounted in an upper rear portion of the fresh food compartment. The control housing covers a portion of a filter mounting head to which the filter cartridge is selectively secured to complete a water circuit for the system.

In accordance with a preferred embodiment of the invention, the filter cartridge includes a housing enclosing a filtering medium and a stem which projects axially from the housing for insertion into a port of the mounting head. At least one mounting lug projects radially outwardly beyond the stem, with the lug being adapted to interengage with a support element of the mounting head upon insertion of the stem into the port and at least partial rotation of the cartridge. Preferably, the lug and support element include cooperating camming surfaces which cause the stem to be drawn into the port upon initial rotation of the cartridge in a first direction. In addition, further camming surfaces are provided between the cartridge and the mounting head which causes the stem to at least partially withdraw from the port upon rotation of the cartridge in an opposite direction. In the most preferred form, the additional camming surfaces do not become interengaged until the lug is disengaged from the support element.

In accordance with another aspect of the invention, the filtering system further includes a plug which can be used in place of the filter cartridge to complete the fluid circuit through the mounting head. Preferably, the plug also incorporates multiple camming surfaces adapted to cooperate with the mounting head structure to enhance the seating and withdrawal of the plug respectively. Additional objects, features and advantages of the water filtering system of the invention will become more readily apparent from the following detailed description of a preferred embodiment, when taken in conjunction with the drawings wherein like reference numerals refer to corresponding parts in the several views.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a perspective view of a side-by-side refrigerator incorporating a filtering assembly constructed in accordance with the present invention;

FIG. **2** is an exploded view of the filtering assembly of the invention;

FIG. **3** shows a water filter cartridge incorporated in the filtering assembly of the invention in a disengaged position;

FIG. **4** shows the water filter cartridge of FIG. **3** initially attached to a filter mounting head;

FIG. **5** illustrates the water filter cartridge attached to the mounting head following partial rotation of the cartridge;

FIG. **6** illustrates the water filter cartridge in a fully attached position with the mounting head;

FIG. **7** illustrates the manner in which the water filter cartridge is disengaged from the mounting head upon rotation of the cartridge; and

FIG. **8** is a perspective view of a plug which can be attached to the mounting head in place of the water filter cartridge of the invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

With initial reference to FIG. **1**, a side-by-side refrigerator is generally indicated at **2**. In a manner widely known in the art, a side-by-side refrigerator **2** is formed from a cabinet shell **3** to which is pivotably attached a freezer compartment side door **5** and a fresh food compartment side door **7**. Side door **7** is shown open to expose a fresh food compartment **8** defined within cabinet shell **3**. Fresh food compartment side door **7** supports a plurality of vertically spaced shelves **11–14** and is also preferably provided with a dairy compartment **16**. In a preferred embodiment, fresh food compartment **8** is formed from an integral liner **20** having opposed side walls **22** and **23**, a rear wall **26** and top and bottom walls **28** and **29**. Secured to rear walls **26** by means of mechanical fasteners (not shown) are a pair of laterally spaced and vertically extending rails **32** and **33** that adjustably support various vertically spaced shelves **35–37**, as well as a shelf supporting bin assembly generally indicated at **39**.

Also shown mounted within fresh food compartment **8** at top wall **28** is a temperature control unit **43**. Temperature control unit **43** is preferably molded of plastic and includes upper and lower slidable temperature control members **46** and **47** which can be used by a consumer to adjust the temperatures within side-by-side refrigerator **2** to preferable levels. As also shown in this figure, freezer compartment

side door **5** is preferably provided with a dispensing unit **50** which can be used to selectively dispense either water or ice In general, the above-described structure of side-by-side refrigerator **2** is known in the art and does not form part of the present invention Instead, this description is provided for the sake of completeness. The present invention is particularly directed to the incorporation of a water filtering system for use in purifying water supplied, either directly to dispensing unit **50** or to an automatic ice maker. The present invention is also directed to a replaceable filter, generally indicated at **55** in FIG. **1**, which forms part of the water filtering system of the present invention. As shown, filter cartridge **55** preferably projects downward from within the housing of temperature control unit **43** at a central rear portion of fresh food compartment **8**. This location is utilized in accordance with the preferred embodiment to provide a readily visible and easily accessible filter cartridge **55** that can be replaced by a consumer as needed.

Reference will now be made to FIG. **2** in detailing the overall components and their interconnections for the water filtering system of the present invention. In accordance with the preferred form of the invention, a water supply (not shown) is attached to refrigerator **2** at dual valve **76** More specifically, dual valve **76** includes an inlet **78** for attachment of the supply line, as well as first and second outlets **80** and **81**. Dual valve **76** is attached to refrigerator **2** by means of bracket **83** and preferably constitutes a solenoid-type valve having electrical connectors **86** and **87** which can be utilized to fluidly interconnect inlet **78** to one or more of the first and second outlets **80** and **81** in the manner which will be described more fully below Outlets **80** and **81** are respectively connected to first and second water delivery tubes **89** and **90**, preferably through the use of compression nuts **90** and **92**. First and second water delivery tubes **89** and **90** converge by means of a Y-connector **95** into a common water delivery tube **98** Tube **98** has a terminal end **100** that is connected to a water inlet **102** of a filter cartridge mounting head **105** through a connector **106**

Filter cartridge mounting head **105** is used to support filter cartridge **55** and therefore it is preferably mounted such that at least a portion of the housing of temperature control unit **43** encloses filter cartridge mounting head **105**. In any event, mounting head **105** includes a main body **108** which is preferably injection molded of plastic and attached to a bracket **110** by means of various screws **112**. In addition to water inlet **102**, mounting head **105** has associated therewith a water outlet **115** to which is attached a tube **117** by means of an elbow connector **119**. The manner in which water flows through mounting head **105** from tube **98** to tube **117** will be detailed more fully below. An opposing end of tube **117** is connected through a fitting **123** to an inlet port **124** of a dispenser valve **125**. Dispenser valve **125** includes a first outlet **126** which is connected through a conduit **128** that leads to a water tank **131**. In a manner known in the art, water tank **131** is preferably mounted within fresh food compartment **8**, such as at lower rear portion thereof.

Since both valves **76** and **125** are preferably located outside of fresh food compartment **8**, conduit **128** has positioned therealong a spacer **133** that extends through liner **20** to permit sealing around conduit **128** during the injection molding of foamed insulation within cabinet **3** in a manner widely known in the art. For additional sealing purposes, seals **136**, **137** and **139** are also provided. Seal **139** is actually associated with a tube **142** that leads from water tank **131**. More specifically, tube **142** includes a first section **143** that is interconnected to a second section **144** through a connector **145**. Second section **144** of tube **142** directly leads to the fountain of water dispensing unit **50**. Dispenser valve **125** also includes a second outlet **148** to which is attached a tube **149** that leads to a nozzle **153**. More specifically, tube **149** is attached to nozzle **153** by means of a clamp **155** and nozzle **153** is utilized to provide a flow of water to an ice maker generally indicated at **158**.

With this arrangement, water supplied to refrigerator **2** is first delivered to valve **76**. Whether ice maker **158** or the fountain associated with dispensing unit **50** requires water will determine which side of dual valve **76** is actuated, thereby controlling the connection between the first and second water delivery tubes **89** and **90** with the flow into inlet **78**. As will be discussed more fully below, mounting head **105** would normally have filter cartridge **55** attached thereto, such that water would flow into inlet **102** through common tube **98**, would be forced to flow through filter cartridge **55** and would be delivered to a water outlet **115** The filtered water would then be delivered through tube **117** to dispenser valve **125** which would regulate whether the water would flow to water tank **131** and then dispenser unit **50** or to ice maker **158**.

At this point, it should be realized that two valves **76** and **125** are utilized to control the flow of water in the overall water circuit. These multiple valves are utilized in order to separate the electrical nodes and allow the water to flow to its desired source. However, there are various other types of water circuit arrangements which could be devised to perform this function, such as utilizing a valve in place of dual valve **76** which has a single input and output in combination with dispenser valve **125**. The disclosed embodiment is preferred since a single signal received from either the dispenser unit **50** or ice maker **158** can be used to control both valves **76** and **125** such that the water is routed in the desired path. In any case, all of the water for either the dispensing unit **50** or ice maker **158** is directed through mounting head **105** and, so long as the consumer has attached a suitable filter cartridge **55**, the purity of the water delivered either to dispensing unit **50** or ice maker **158** will be enhanced

A particular aspect of the present invention is the construction of filter cartridge **55** and the manner in which it is assembled and disassembled from mounting head **105**. Reference will now be made to FIG. **3** in detailing the preferred construction of both filter cartridge **55** and mounting head **105**. As shown, mounting head **105** includes a base plate **165** which is formed with a central, filter stem receiving port **166**. Projecting downwardly at spaced circumferential positions from base plate **165** is a pair of arcuate support elements **167** and **168**. Since the preferred construction of each of the support elements **167** and **168** is identical, the preferred construction for support element **167** will now be described in detail and it is to be understood that a corresponding structure is preferably utilized for support element **168**. Support element **167** is actually defined by a substantially vertical, arcuate side wall **170** which projects downward from base plate **165**, as well as a radially, inwardly projecting flange **172**. With this construction, flange **172** is located in a plane below base plate **165** such that a mounting channel **174** is defined therebetween. At the entrance to mounting channel **174**, flange **172** is formed with a ramp portion **177** that leads to a central portion **179** and an upstanding abutment stop **181**.

On the other hand, filter cartridge **55** includes a housing **188** having an upper surface portion **190**. Above surface portion **190** is provided a mounting projection **193** that includes a pair of opposed, radially outwardly extending lugs **195** and **196**. In a manner analogous to support ele-

ments **167** and **168**, each of lugs **195** and **196** are correspondingly constructed such that the preferred construction for a lug **195** will now be described in detail and it is to be understood that lug **196** has a corresponding construction. Lug **195** includes a leading edge **198** that is preferably chamfered or tapered at **200**. Filter cartridge **55** also includes a stem **202** which projects axially above mounting projection **193**. Stem **202** is provided with a pair of opposed fluid entry ports, one of which is shown at **205**, formed in a reduced diametric central portion **208**. Axially spaced in opposing directions from central portion **208**, stem **202** includes enlarged diametric portions **211** and **212**, each of which is formed with an annular groove within which is seated a respective O-ring **214**, **215**. As clearly shown in this figure, stem **202** is also formed with a terminal, upper port **217**. Filter cartridge **55** is further preferably provided with a projection **220** that extends upward from upper surface portion **190** and radially from mounting projection **193**. As clearly shown in this figure, projection **220** is provided with a sloping surface **222** which tapers in a direction substantially corresponding to that of leading edge **198**. In the most preferred form of the invention, two such projections **220** are provided at circumferentially spaced positions from both each other and lugs **195** and **196**.

With this construction, a consumer can manually grasp filter cartridge **55** and insert stem **202** into receiving port **166** of mounting head **105** with lugs **195** and **196** being circumferentially positioned between support elements **167** and **168**. In other words, upon initial attachment of filter cartridge **55** to mounting head **105**, filter cartridge **55** will be arranged relative to mounting head **105** in the manner generally illustrated in FIG. **4**. In achieving this position, it should be realized that O-rings **214** and **215** create some resistance to full insertion of stem **202** within receiving port **166**. Therefore, unless filter cartridge **55** is axially forced to cause mounting projection **193** to abut base plate **165**, there will likely be a certain axial gap between mounting projection **193** and base plate **165**. However, upon initial rotation of filter cartridge **55** relative to mounting head **105**, the leading edge **198** of each lug **195**, **196** will cam with a ramp **177** of a respective support element **167**, **168** which will automatically cause filter cartridge **55** to be axially drawn towards base plate **165** (see FIG. **5**). In other words, upon initial rotation of filter cartridge **55** in a first direction, stem **102** will be fully drawn into receiving port **166**. Thereafter, filter cartridge **55** can be continually rotated in the same direction as lugs **195** and **196** are farther received within respective mounting channels **174** until abutment stops **181** are engaged (see FIG. **6**). This represents the fully seated and locked position for filter cartridge **55**. In this position, water flowing into water inlet **102** of mounting head **105** will be at a location corresponding to reduced diametric central portion **208** such that the water will be caused to flow into opposed entry ports **205** of filter cartridge **55**. The water will then flow into housing **188** for purification as it flows through a filtering medium and then out upper port **217**. Since upper port **217** is in fluid communication with water outlet **115**, the filtered water can then flow through tube **117** to dispenser valve **125**.

As indicated above, O-rings **214** and **215** provide some resistance to the full insertion of stem **202** within receiving port **166**. When it is desired to remove or replace filter cartridge **55**, a similar resistance is also encountered. Actually, given pressures acting on at least central portion **208** within mounting head **105**, even greater forces resisting removal of filter cartridge **55** can be encountered. Although these forces can be overcome by a greater axial downward force being exerted on the filter cartridge **55**, such an exerted force could damage the mounting of bracket **110**. However, in accordance with the present invention, the interaction between filter cartridge **55** and mounting head **105** during relative rotation advantageously assists in the removal of filter cartridge **55** More specifically, as filter cartridge **55** is moved from the fully locked position of FIG. **6**, through the partially locked position of FIG. **5** and then to the position of FIG. **7**, the sloping surface **222** of each projection **220** will cam with a respective support element **167**, **168** to cause filter cartridge **55** to be axially shifted away from base plate **165** such that stem **202** of filter cartridge **55** automatically becomes partially withdrawn from receiving port **166** upon the simple rotation of filter cartridge **55**

Although a preferred embodiment for the structure and mounting of filter cartridge **55** has been described, it should be recognized that there are various other types of camming arrangements which could be readily utilized to enhance the axial shifting of filter cartridge **55** relative to mounting head **105** upon rotating of filter cartridge **55**. For instance, although lugs **195** and **196**, as well as projections **220**, are preferably provided on filter cartridge **55** and support elements **167** and **168** are formed as part of mounting head **105**, the position of these elements are interchangeable and could be readily reversed. At this point, it is simply important to note the ability of the mounting arrangement to provide for the axial shifting of filter cartridge **55** relative to mounting head **105** upon rotation of filter cartridge **55** in either direction. This axial shifting is particularly advantageous during the removal of filter cartridge **55** and is considered to represent a significant advantage over the known prior art.

Based on the above description, it should also be realized that mounting head **105** does not incorporate any complicated internal valving structure that would need to be activated upon positioning of stem **202** within receiving port **166** Therefore, with this system, it would be possible for water to flow out of receiving port **166** of mounting head **105** if doors **5** and **7** of refrigerator **2** were closed and dispenser unit **50** and/or ice maker **158** signal the need for water in the absence of filter cartridge **55**. In case another filter cartridge **55** is not readily available for replacement purposes, the overall filtering system of the present invention also contemplates the utilization of a plug such as that shown at **225** in FIG. **8**. In general, plug **225** is adapted to be mounted to head **105** in a manner directly analogous to that described above with respect to filter cartridge **55** and therefore includes corresponding mounting structure. For at least these reasons, common reference numerals have been utilized in FIG. **8** and the reiteration of this structure will not be presented here. However, it should be noted that plug **225** is provided with an elongated tab **227** which can be grasped by a user for mounting of plug **225** to mounting head **105**. In addition, since plug **225** is only intended to close off receiving port **166** and not to divide any flow path between water inlet **102** and water outlet **115**, plug **225** includes a stem **229** which is actually shorter than stem **202** and which incorporates a single O-ring **231**. More importantly, plug **225** includes corresponding lug and projection structure such that the axial shifting of stem **229** into and out of receiving port **166** upon rotation of plug **225** is performed in a manner directly corresponding to that described above with respect to filter cartridge **55**.

Based on the above, it should be readily apparent that various changes and/or modifications can be made to the present invention without departing from the spirit thereof For instance, although described with reference to use in a side-by-side refrigerator, the filtering system and cartridge

of the invention could be used in various environments, as well as different style refrigerators. In any event, the invention is only intended to be limited by the scope of the following claims.

We claim:

1. In a refrigerator incorporating a system for filtering water delivered to at least one of a water dispenser and an ice maker, a water filter assembly comprising:

a mounting head having a water inlet adapted to be connected to a fresh water supply, a water outlet connected to at least one of a water dispenser and an ice maker, a filter stem receiving port fluidly interposed between the water inlet and the water outlet, and at least one support element; and

a water filter cartridge adapted to be replaceably attached to the mounting head to fluidly interconnect the water inlet and water outlet, said water filter cartridge including: a housing for enclosing a filtering medium with said housing having an upper surface portion; a stem projecting axially away from the upper surface portion, said stem being adapted to be inserted into the port of the mounting head and being provided with at least one O-ring, at a position spaced from the upper surface portion of the housing, for creating a seal between the stem and the port; at least one mounting lug projecting radially outwardly beyond the stem, with the mounting lug being interengaged with the support element of the mounting head upon insertion of the stem in the port and at least partially rotating the housing relative to the mounting head; a first cam element adapted to interengage with the mounting head to draw the stem within the port upon rotation of the housing relative to the mounting head in a first direction, and a second cam element adapted to interengage with the mounting head to withdraw the stem from within the port upon rotation of the housing relative to the mounting head in a second direction.

2. The water filter assembly according to claim 1, wherein the second cam element is located physically closer to the upper surface of the housing than the first cam element.

3. The water filter assembly according to claim 2, wherein the second cam element projects directly from the upper surface portion.

4. The water filter assembly according to claim 1, wherein the first cam element is circumferentially offset relative to the second cam element.

5. The water filter assembly according to claim 4, wherein each of the first and second cam elements includes a sloping surface portion, with the sloping surface portions of the first and second cam elements tapering in a common direction.

6. The water filter assembly according to claim 1, wherein the second cam element is positioned relative to the at least one mounting lug such that the second cam element is adapted to engage the mounting head following disengagement of the mounting lug with the support element.

7. The water filter assembly according to claim 1, wherein the first cam element is formed at an end section of the at least one mounting lug.

8. The water filter assembly according to claim 1, further comprising:

a plug, having an associated stem and mounting lug, adapted to be selectively attached to the mounting head in place of the filter cartridge.

9. The water filter assembly according to claim 1, wherein the refrigerator includes a fresh food compartment within which is mounted a temperature control housing, said temperature control housing covering at least a portion of the mounting head while the filter cartridge is visually exposed below the temperature control housing.

10. A water filter cartridge for replaceable attachment to a mounting head of a water filtering system comprising:

a housing for enclosing a filtering medium, said housing including an upper surface portion;

a stem projecting axially away from the upper surface portion, said stem being adapted to be inserted into a port of the mounting head through which water flows to be purified, said stem being provided with at least one O-ring, at a position spaced from the upper surface portion, for creating a seal between the stem and mounting head;

at least one mounting lug projecting radially outwardly beyond the stem, said at least one mounting lug being adapted to interengage with a support element of the mounting head upon insertion of the stem in the port and at least partial rotation of the housing relative to the mounting head;

a first cam element adapted to interengage with the mounting head to draw the stem within the port upon rotation of the housing relative to the mounting head in a first direction, and

a second cam element adapted to interengage with the mounting head to withdraw the stem from within the port upon rotation of the housing relative to the mounting head in a second direction

11. The water filter cartridge according to claim 10, wherein the second cam element is located physically closer to the upper surface of the housing than the first cam element.

12. The water filter cartridge according to claim 11, wherein the second cam element projects directly from the upper surface portion.

13. The water filter cartridge according to claim 10, wherein the first cam element is circumferentially offset relative to the second cam element.

14. The water filter cartridge according to claim 13, wherein each of the first and second cam elements includes a sloping surface portion, with the sloping surface portions of the first and second cam elements tapering in a common direction.

15. The water filter cartridge according to claim 10, wherein the second cam element is positioned relative to the at least one mounting lug such that the second cam element is adapted to engage the mounting head following disengagement of the mounting lug with the support element.

16. The water filter cartridge according to claim 10, wherein the first cam element is formed at an end section of the at least one mounting lug.

17. A method of replacing a filter cartridge of a refrigerator water filtering system comprising:

manually rotating the filter cartridge relative to a mounting head of the water filtering system to cause a mounting lug of the filter cartridge to become disengaged from a support element on the mounting head;

continuing to rotate the filter cartridge while a camming action between the filter cartridge and the mounting head causes the filter cartridge to be axially shifted relative to the mounting head and a stem portion of the filter cartridge to become at least partially withdrawn from within a filter port formed in the mounting head;

axially removing the filter cartridge from the mounting head,

positioning a new filter cartridge with an axial stem portion projecting into the filter port of the mounting head, and

rotating the new filter cartridge to interengage a mounting lug thereof with the support element of the mounting head.

18. The method according to claim 17, further comprising: axially drawing the stem portion of the new filter cartridge into the filter port during rotation of the new filter cartridge through a camming action between the filter cartridge and the mounting head

19. The method according to claim 17, further comprising: causing the filter cartridge to axially shift relative to the mounting head through the camming action only following complete disengagement between the mounting lug and the support element.

20. The method according to claim 17, further comprising: selectively connecting a plug to the mounting head in place of a filter cartridge.

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