

Aug. 1, 1961

J. F. BRUBAKER ET AL
REFRIGERATING APPARATUS

2,994,205

Filed Jan. 26, 1959

3 Sheets-Sheet 2

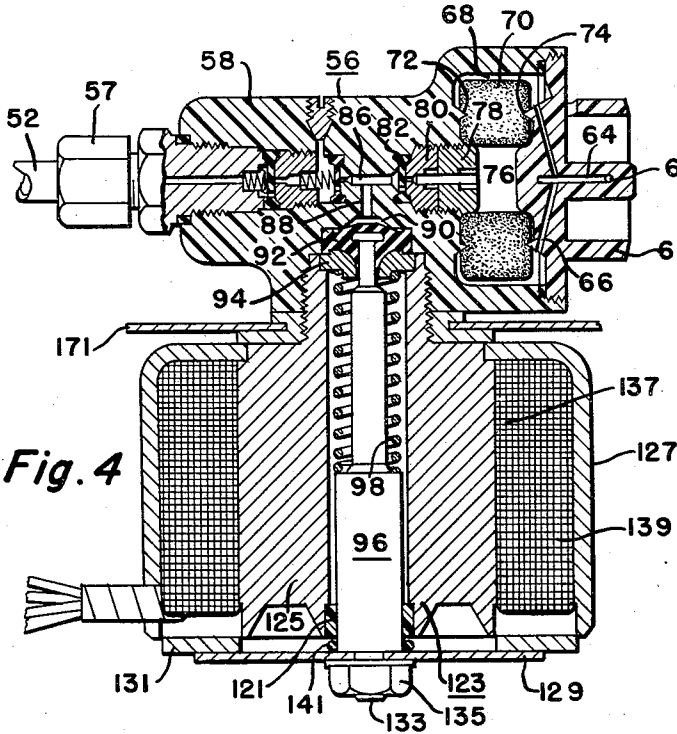


Fig. 4

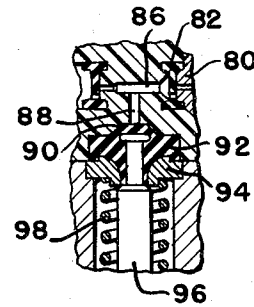


Fig. 5

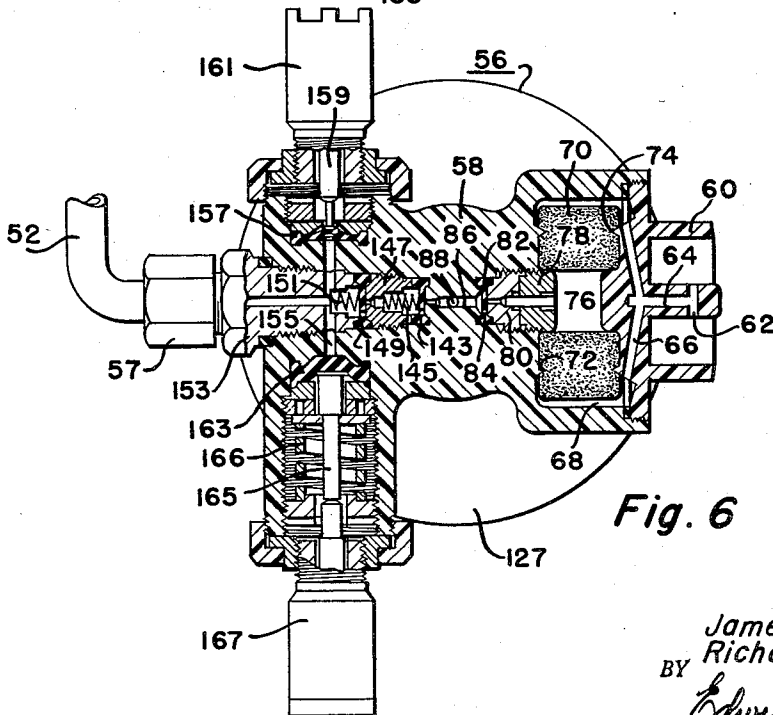


Fig. 6

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3 Sheets-Sheet 3

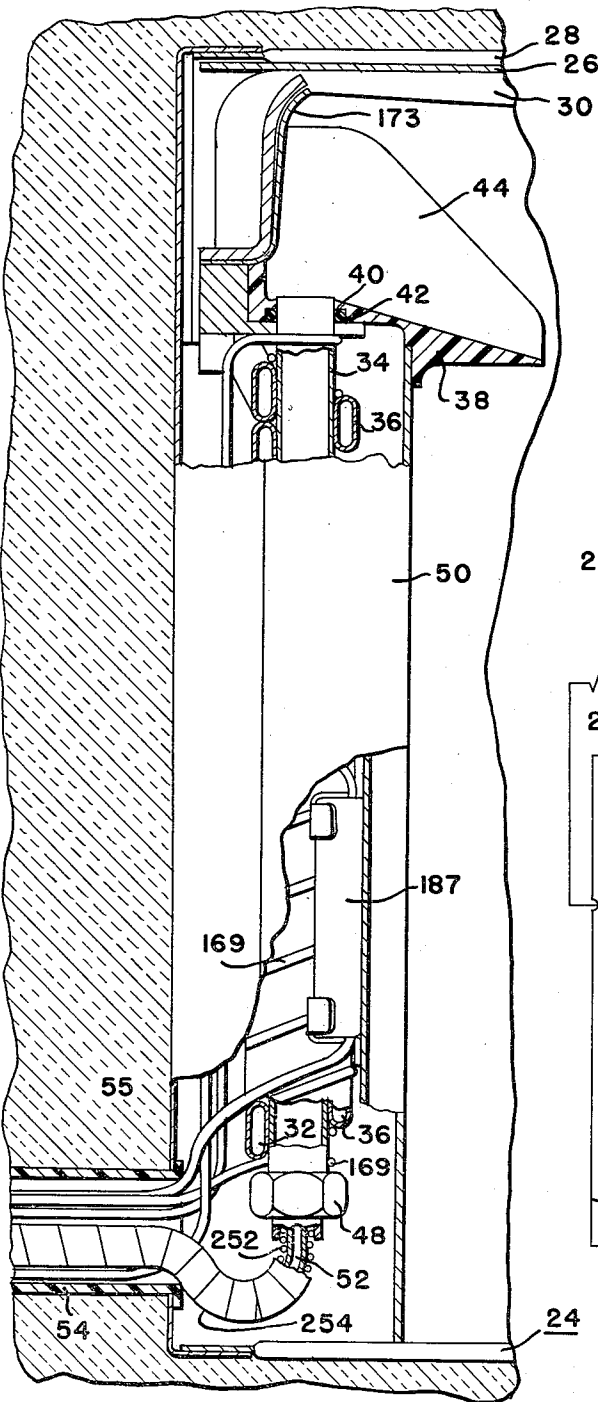


Fig. 7

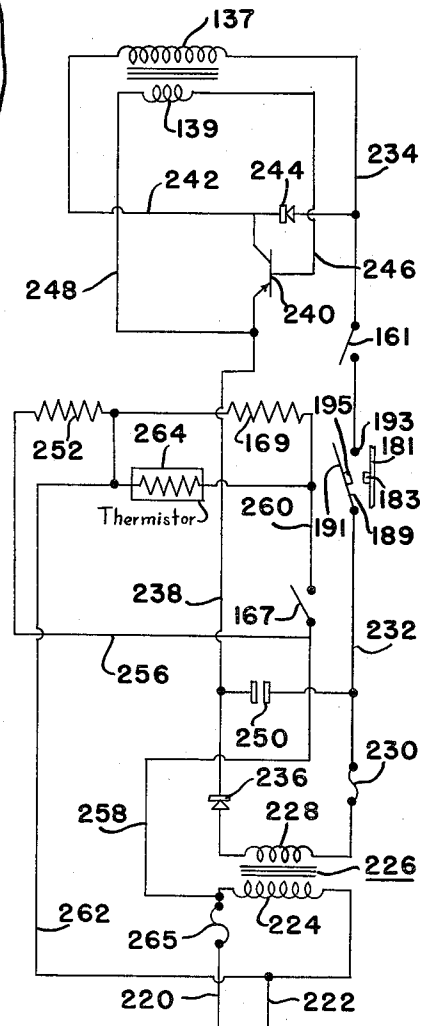


Fig. 8

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2,994,205

REFRIGERATING APPARATUS

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14 Claims. (Cl. 62-132)

This invention pertains to refrigerating apparatus and more particularly to a machine for continuously automatically making ice in small pieces.

It has been customary to freeze ice domestically in ice trays having quick removal grid devices. Considerable time normally elapses before the ice is frozen in such trays. Even though quick removal devices are provided, the removal of ice from the tray is an unwelcome chore; often an entire tray full of ice is removed in order to obtain several cubes.

It is an object of this invention to provide a simple reliable automatic machine which will deliver small quantities of ice in a very short time.

It is another object of this invention to provide a simple reliable machine which will automatically deliver small ice pieces one by one continuously and to deposit them in a suitable receptacle.

It is another object of this invention to provide a simple inexpensive arrangement to stop the production of ice pieces in such a machine whenever the ice receptacle is either filled or removed.

It is another object of this invention to provide a simple reliable pump in which the pumping pressure increases as it progresses through the stroke to force ice out of the freezing cell.

It is another object of this invention to provide a simple solenoid pump which has no radio interference.

It is another object of this invention to provide a simple effective automatic machine arranged for freeing ice in the cell whenever it cannot be moved by the pump.

It is another object of this invention to provide a simple effective arrangement for preventing pumping of water to the freezing cell whenever ice fails to seal the cell.

These and other objects are attained in the form shown in the drawings in which a simple solenoid pump has a main and an auxiliary actuating winding magnetically associated which are energized by an electronic transistor circuit in such a way that the force of the stroke increases as the stroke progresses. The normal operation of the pump does not entail opening and closing of circuits and is without radio interference. The pump draws water through a filter and inlet valve from a source under pressure and pumps it through a high pressure discharge valve arrangement into a freezing tube or cell provided with a slight taper. The freezing tube is refrigerated by a secondary circuit from a primary refrigerating system. The water freezes in the end of the tube and the ice is forced out of the tube and broken off by engaging a cam positioned a distance from the end of the tube determined by the desired length of the pieces. Should the water pressure in the tube be less than a predetermined low pressure, then the pump is stopped by a low pressure switch; should the ice stick in the tube, an electric heater associated with the tube is energized by a high pressure switch responsive to the water pressure in the tube. The arrangement is capable of supplying pieces of ice automatically at the rate of one every couple minutes and discharging them into a receptacle. An ingenious magnetic switch stops the operation of the pump when either the receptacle is filled or removed.

Further objects and advantages of the present invention will be apparent from the following description, reference being had to the accompanying drawings,

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wherein a preferred embodiment of the present invention is clearly shown.

In the drawings:

FIGURE 1 is a fragmentary vertical sectional view through the freezing compartment of a household refrigerator incorporating an ice maker embodying one form of our invention;

FIGURE 2 is a similar fragmentary vertical sectional view showing the ice receptacle filled sufficiently that the switch is opened to stop the pump;

FIGURE 3 is a fragmentary view similar to FIGURE 2 showing the opened switch for stopping the pump when the ice receptacle is removed;

FIGURE 4 is a sectional view through the pump and valves thereof;

FIGURE 5 is an enlarged fragmentary view showing the pump at the opposite end of its stroke;

FIGURE 6 is a sectional view through the pump body showing the valves and pressure operated switches;

FIGURE 7 is a fragmentary view somewhat similar to FIGURE 1 but showing the portions of the secondary refrigerant tubing and the freezing tube or cell in section; and

FIGURE 8 is a wiring diagram.

Referring now to the drawings and more particularly to FIGURES 1 to 3, the ice maker generally designated by the reference character 20 is shown installed within a household refrigerator having a freezing compartment 22 enclosed by a sheet metal evaporator 24 having refrigerant passages on the top, bottom and sides thereof. This evaporator 24, for example, may be of the type shown in the Wurtz et al. Patent 2,712,736 issued July 12, 1955.

To provide a convenient effective method of cooling the ice maker 20, a metal plate 26 is provided which is clamped to the top wall 28 of the evaporator 24. Metallically bonded to this top plate 26 is the condenser 30 in the form of a loop of refrigerant tubing connected at one end to the refrigerant duct 32 extending downwardly to the bottom of a flattened helical refrigerant tube 36 which tightly encompasses the tubular freezing cell 34 of thin stainless steel. The tube 34 is approximately $1\frac{1}{2}$ inch I.D. with approximately .001 inch taper per lineal inch. However, any tube between approximately $1\frac{1}{16}$ and $\frac{1}{2}$ inch I.D. is satisfactory with a taper as high as .003 inch taper per inch as an upper limit with the lower limit extending to a negligible taper for the smaller size tubing. The refrigerant tubing 36 may be metallically bonded to the freezing cell 34 to provide good conduction. The refrigerant tubing 32 and 36 may be made of some suitable metal such as copper, brass or aluminum. The upper portion of the refrigerant tubing 36 is connected by a conduit to the other end of the condenser 30.

If desired, other forms of cooling the freezing cell 34 may be employed such as refrigerant from the primary system either directly or through a metallic conductor or by brine or by cold air. The tube or cell 34 may be upright or inclined. The upper end of the freezing cell 34 extends through an aperture 40 in a plastic top 38 sealed by a ring 42 of elastomeric material. The plastic top 38 is provided with upwardly projecting ribs 44 to provide a spout for receiving ice from the top of the tube 34 and delivering the ice to the ice receptacle 46 also of a suitable plastic material located below the top 38.

The top plate 26 may be fastened to the top wall 28 of the evaporator 24 by screws or other forms of threaded fastenings. The freezing cell 34, the refrigerant tube 36 and the duct tubing 32 are enclosed in a vertical metal housing 50 extending downwardly from the top 38 to the bottom wall of the evaporator 24. The evaporator 24

is maintained at an average of about -10° F. which is sufficient to keep the compartment 22 at about 0° F. Due to the heat given off in the making of the ice in the freezing cell 34, the condenser 30 is maintained at the slightly higher temperature of 10° F.

The bottom of freezing cell 34 is connected by the flare connection 48 and the tubing 52 which extends through the plastic sleeve 54 in the rear wall 55 to the machinery compartment of the refrigerator. This tubing 52 within the machinery compartment connects by a similar flare connection 57 to a solenoid pump 56. The solenoid pump includes a valve body 58 of molded plastic material provided with a quick detachable water inlet connection 60 adapted to connect with a supply of drinking water under normal supply pressures which may vary from 10 to 150 pounds per square inch. The quick detachable connection 60 connects through passages 62, 64 and 66 to a filter chamber 68 containing an annular filter 70. The quick detachable connection 60 forms one wall of the filter chamber 68 and is threaded thereto and gasketed to seal the filter chamber. The filter chamber 68 is provided with annular projections 72 and 74 in the opposite walls thereof provided by the pump body 58 and the quick detachable connection 60 to seal to the opposite faces of the annular filter 70 to force the water coming in through the passages 62, 64 and 66 to flow to the outer periphery of the filter ring 70 and thence radially inwardly through the filter 70 to the central opening 76 therein.

The threaded bushings 78 and 80 in the valve body 58 provide a passage to the inlet check valve 82 of high quality rubber in the form of a diaphragm having a thick rim which is squeezed against its seat in the valve body 58 by the threaded plug or bushing 80. This inlet valve 82 has an off-center perforation 84 therein allowing fluid to flow whenever the central diaphragm portion is pushed away from the face of the bushing 80. The face of the bushing 80 forms a seat for the diaphragm. The valve body 58 is provided with clearance to allow the central diaphragm of the inlet valve 82 to move away from the bushing 80 sufficiently to allow water to flow through the off-center aperture 84 into the central passage 86 in the pump and valve body 58.

A branch passage 88 connects directly with the pumping chamber 90 (FIGURE 4). The pumping chamber 90 contains an elastomeric piston 92 of natural rubber containing a thick rim which is squeezed by the bushing 94 into the pumping chamber 90 to provide a tight seal. The central portion of this piston 92 is molded onto the head in the upper reduced end of a piston rod 96. Surrounding the reduced portion of the piston rod 96 is a compression type coil spring 98 extending from the large lower portion of the piston rod 96 to the bushing 94. This spring 98 acts to position the piston 92 in the downward stroke.

The enlarged lower portion of the piston rod 96 is slidably mounted in a plastic ring 121 of nylon or similar polyamide thermoplastic resin which is mounted in the solenoid housing assembly 123. The solenoid housing assembly 123 of soft iron is provided with a single radial slit to minimize eddy current losses. The solenoid assembly includes an inner plug 125 and external shell 127 joined to the plug 125 at its upper end as shown in FIGURE 4. Between the inner plug 125 and the exterior shell 127 are a primary winding 137 of 500 turns and a feed-back winding 139 of 100 turns which are wound together to provide a transformer relationship between the windings.

An armature plate 129 to which is fastened an armature ring 131 is fastened to the threaded lower end 133 of the piston rod 96 by a nut and washer 135. This plate 129 and ring 131 are provided with a single radial slot to minimize eddy current losses. The ring 131 is adapted to fit in between the plug 125 and the exterior shell 127. The adjacent rim of the exterior shell 127 and the plug 125 are tapered so as to improve the magnetic pull be-

tween them and the ring 131. Surrounding the piston rod 96 and resting upon the plate 129 is a small round rubber ring 141 which engages the bushing 121 on the upward stroke of the piston rod 96 to limit this upward movement of the rod 96. The solenoid pump has a stroke of about .060 inch and vibrates normally at a frequency of 120 cycles per minute.

The opposite end of the passage 86 from the inlet valve 82 is provided with an outlet check valve 143 which is similar to the inlet check valve 82 but is slightly thicker and provided with a compression type coil spring 145 for normally holding it against its seat in the valve body 58 sufficient to raise the discharge pressure from the passage 86 to about 15 pounds per square inch while the inlet pressure required to pass the inlet check valve 82 is about 2 pounds per square inch. The outlet check valve 143 is held in place by a hollow threaded bushing 147 which holds in place the compression spring 145. The opposite side of the bushing 147 supports one face of a high pressure check valve 149 larger but otherwise similar to the check valve 143. It is held against its seat upon the adjacent end of the threaded plug 147 by a more forceful compression spring 151 located in the hollow end of the nipple 153 which threads into the valve body 58 and squeezes the thickened rim of the high pressure check valve 149. The spring 151 raises the pressure required to pass the valve 149 to 150 pounds per square inch.

The nipple 153 is provided with a co-axial passage connecting the high pressure check valve 149 with the pipe 52 extending to the tubular freezing cell 34 as previously described. The valve body 58 and the nipple 153 also have a transverse passage 155 extending at one end to a low pressure diaphragm 157 somewhat similar to the piston 92 and connecting through a rod 159 to a switch mechanism 161 calibrated to close whenever the pressure upon the diaphragm 157 and the passage 155 is equal to or greater than ten pounds per square inch. The switch 161 controls the energization of the windings 137 and 139 as disclosed in the wiring diagram FIGURE 8.

The opposite end of the passage 155 connects to a diaphragm 163 somewhat similar to the piston 92 and the diaphragm 157 excepting that it is quite thick. It is held in place by a ring and threaded member in a suitable enlarged cavity in the valve body 58. The diaphragm 163 is provided with a follower 165 extending to the push pin of a switch 167 which is closed only when the pressure within the passage 155 is 500 pounds per square inch or higher. This switch is connected in series with an electric heater 169 enclosed in silicone rubber insulation and wrapped helically around the freezing cell 34 at the ends thereof and in the helical groove between adjacent turns of the helical refrigerant tubing 36. The solenoid pump is mounted upon a plate 171 in the machine compartment (not shown) located below the evaporator 24. This machine compartment also provides a housing for the electrical system shown in the wiring diagram FIGURE 8.

This electrical system controls the operation of the solenoid pump 90, 92 and the delivery of ice from the tubular freezing cell 34. Under normal circumstances water is drawn from the supply source of 15 pounds per square inch minimum pressure through the passages 62, 64 and 66, through the filter 70 and the check valve 82 by the pump piston 92 operating at about 120 strokes per minute and discharges this water through the outlet valves 143 and 149 and the tube 52 to the freezing cell 34. The refrigerant tubing 36 maintains a temperature of about 10° in the freezing cell 34 causing water to be frozen in this cell and pushed out by the force of the water coming through the supply tube 52. This ice is pushed upwardly until the upper end engages the cam surface 173 causing a piece to break off just above the freezing tube 34 and topple over and to slide down the spout 38 into the ice receptacle 46.

The ice receptacle 46 is mounted upon a cantilever sprung platform 175 anchored to the fixed support 177 at the front end thereof. A second cantilever spring 179

extends beneath the cantilever sprung platform and support 175 and engages the platform 175 adjacent its rear and is similarly anchored at the front to the fixed support 177. The rear end of the platform 175 is turned down as indicated by the reference character 181 and carries a U-shaped permanent magnet 183 held adjacent the wall 50 of the ice maker. This wall 50 may have an aperture 185 therein directly opposite the magnet 183.

Upon the inside of the wall 50 there is mounted a switch housing 187 of a plastic material within which is provided a cantilever mounted leaf spring switch 189 anchored to the switch housing 187 at its lower end provided with a movable contact 191 at its upper end cooperating with a stationary contact 193. This leaf spring switch member 189 carries a permanent magnet 195 which may also be U-shaped similar to the magnet 183 but having its poles oppositely arranged so that when the two magnets are aligned as in FIGURE 1, there will be sufficient attraction between the magnets 183 and 195 to overcome the open spring bias of the leaf spring 189 to pull the contacts to closed position. The spring force of the platform 175 and the spring 179 is sufficient that the weight of the ice receptacle 46 with or without a partial filling of ice pieces will hold the magnet 183 substantially aligned with the magnet 195 to keep the switch contacts 193 and 191 in the closed position as shown in FIGURE 1.

When the ice receptacle 46 becomes substantially filled with ice pieces, the weight will be sufficient to depress the spring platform 175 sufficiently to displace the magnet 183 downwardly so that the opposite poles of the magnets are no longer adjacent each other thereby reducing the magnet attraction sufficiently to allow the spring bias of the leaf spring 189 to separate the contacts 191 and 193. It should be noted that further depression of the spring platform 175 will place the upper pole of the magnet 183 opposite the lower pole of magnet 195 causing like poles to be opposite or aligned creating a repulsion between the magnets.

This arrangement is also used to prevent the delivery of ice when the ice receptacle 46 is removed. When the ice receptacle 46 is removed, the spring platform 175 is relieved of enough weight that it will spring upwardly to the position shown in FIGURE 3 thus displacing the poles of the magnets 183 and 195 sufficiently that their magnetic attraction is diminished to such an extent that the spring bias of the leaf spring 189 will open the contacts 191 and 193.

In the wiring diagram FIGURE 8, the 115 volt supply source, designated by the reference characters 220 and 222, is connected to the terminals of the primary winding 224 of a step-down transformer 226. The low voltage winding 228 of the transformer 226 is connected through a fuse 230, the conductor 232, the ice receptacle controlled magnet switch 191, 193 and the low water pressure switch 161 and the conductor 234 to the main pump winding 137.

The opposite terminal of the low voltage winding 228 is connected through a silicone rectifier 236 and a conductor 238 to the emitter of the transistor 240. The collector of the transistor 240 is connected by the conductor 242 to the second terminal of the 500 turn main pump solenoid winding 137. A germanium diode 244 is connected between the conductor 242 and the conductor 234. The base of the transistor 240 is connected by the conductor 246 to one terminal of the 100 turn winding 139 of the pump solenoid which is also connected by the conductor 248 to the emitter of the transistor 240. A 2000 microfarad condenser 250 is connected between the conductors 232 and 238.

When the supply conductors 220 and 222 are energized and the switches 191 and 161 are closed, there will be a current flow through the transistor 240 and through the main winding 137 of the solenoid pump. This will energize the solenoid and cause it to attract the

armature 129, 131 to move the piston 92 through its power stroke. This flow of current through the winding 137 will have a transformer action upon the small secondary winding 139 causing an increase in the negative bias upon the base of the transistor. Further movement of the pump will increase the transformer action to increase the negative bias on the transistor 240 to provide increased current and increased power to the pump solenoid so that the pumping force will increase as the stroke of the pump progresses until the end of the stroke is reached in which the plate 129 engages the ring 141 which sets on the bearing 121 to stop further upward movement of the pump piston 96. At the end of the upward movement, the flux in the pump solenoid reaches its maximum and the rate of change of flux is reduced to zero. Consequently there will be no induced voltage in the feed back winding 139 and the negative bias on base of the transistor 240 will drop to zero, with the result that the transistor will no longer carry the peak current. This causes the decreasing of the magnetic field in the solenoid which reverses the bias on the base of transistor 240 from negative to positive and acts to completely shut off the flow of current, thereby completely deenergizing the solenoid and allowing the return spring 98 to move the armatures 129 and 131 back to the starting position or opposite end of the stroke. The break-down current will flow through the germanium diode 244.

The diode 244 prevents reverse current flow on the power stroke. There are no moving parts excepting the armature, the piston and piston rod. There is no radio interference in this circuit. The circuit operates the pump at a frequency of about 120 cycles per minute through an amplitude of .060 inch. This so controls the pump that no more water will be pumped through the tube 52 into the freezing cell 34 than can be properly frozen thereby under normal conditions. This is sufficient to provide a piece of ice about every two minutes. The normal capacity of the machine is about thirty-five pieces per hour or .6 pound of ice per hour.

Should the refrigerating system, due to lack of refrigerating requirements for the household refrigerator, not provide for adequate refrigeration of the freezing cell 34, sufficient ice may not be formed at the top of the freezing cell to seal the outlet of the cell. The flow of water under such circumstances is then prevented by loss in pressure in the transverse passage 155 in the pump body which allows the diaphragm 157 and the plunger 159 of the switch 161 to move to open position to deenergize the solenoid circuit of the pump 56. This will stop the supply of water to the freezing cell 34 whenever there is insufficient refrigeration or whenever the outlet of the cell 34 becomes unsealed for any reason whatsoever to prevent leakage of water from the cell.

In the event that the ice making is interrupted for an extended period such as when the ice receptacle is filled with ice or is removed for a considerable period, the freezing cell 34 may be frozen solidly throughout the greater portion of its length. Upon return of the ice receptacle 46 or the emptying thereof, the circuit will be closed through the solenoid pump to start the operation thereof. The pump is capable of producing pressures as high as 1000 pounds per square inch. However, if the pump 56 raises the pressure and is unable to dislodge or push out the ice in the freezing cell 34, the pressure within the tube 52 will arise. When the pressure within the transverse passage 155 reaches 500 pounds per square inch, the diaphragm 163 and the pin 165 will be deflected overcoming the force of the return spring 166 to close the switch 167 to energize the heater 169 wrapped around the refrigerant tubing 36 and the freezing cell 34. This will heat the freezing tube 34 and ice within the freezing cell 34 sufficiently to release the ice and to permit its ejection from the freezing cell 34 by the high water pressure supplied through the tube 52. As

soon as the ice is released in the cell 34, the water pressure will drop below 500 pounds per square inch allowing the switch 167 to open.

The tube 52 is kept from freezing by a small five-watt auxiliary heater 252 which is wrapped around the tube 52 near the cell 34. Wrapped around the heater 252 is some suitable form of plastic tape 254. The heater 252 is supplied with current through the conductor 256 from a conductor 258 connecting the supply conductor 220 to the switch 167. The switch 167 controls the supply of current through the conductor 260 to the heater 169. A conductor 262 supplies current from the supply conductor 262 to the common connection of the heaters 169 and 252. In addition a thermistor 264 is connected in shunt with the main heater 169. The main heater 169 under normal operating conditions should be on only a very short time. If it should be on more than four or five minutes, it might transmit too much heat through the secondary circuit to the evaporator 24 so that excessive pressures might develop in the primary refrigerating system. The thermistor 264 has a high resistance when initially energized but under prolonged energization such as four or five minutes this thermistor 264 will heat up reducing its resistance permitting a sufficiently large volt of current to blow the fuse 265 between the conductor 258 and the supply conductor 220 to prevent further energization of the main heater and continued operation of the ice maker. This protects the primary refrigerating system from overloading by the ice maker.

When the refrigerator is installed, the service man making the installation clears the water passages of air and fills the freezing cell 34 with water. Thereafter the system will operate automatically to provide the cylindrical pieces of ice approximately $1\frac{1}{2}$ inches long and $\frac{19}{32}$ inch in diameter as required. The double outlet check valve arrangement providing low and high pressure outlet check valves 143 and 149 prevents the pump from becoming air-bound. The check valve 143 will open to permit the air in the pumping chamber 90 to dissolve in the water between the two valves and to be carried away through the check valve 149.

While the form of embodiment of the invention as herein disclosed constitutes a preferred form, it is to be understood that other forms might be adopted, as may come within the scope of the claims which follow.

What is claimed is as follows:

1. An ice maker including a freezing cell, means for cooling said cell below water freezing temperatures, a source of water under pressure, a pump having an inlet connecting to said source and a discharge outlet, said discharge outlet being provided with a high pressure relief valve having a higher escape pressure than the pressure of said source, fluid conduit means extending from said relief valve to said freezing cell, and pressure responsive means responsive to a low pressure in said fluid conduit means for preventing the forcing of water through said relief valve when the pressure within said conduit means is below a predetermined minimum.

2. An ice maker including a freezing cell, means for cooling said cell below water freezing temperatures, a source of water under pressure, a pump having an inlet connecting to said source and a discharge outlet, said discharge outlet being provided with a high pressure relief valve having a higher escape pressure than the pressure of said source, fluid conduit means extending from said relief valve to said freezing cell, an electrical heater associated in heat transfer relation with said freezing cell, and pressure responsive switch means connected in series circuit with said heater and closing responsive to a predetermined abnormally high pressure within said conduit means for energizing said heater for heating said freezing cell.

3. An ice maker including a freezing cell, means for cooling said cell below water freezing temperatures, a source of water under pressure, a pump having an inlet

connecting to said source and a discharge outlet, said discharge outlet being provided with a high pressure relief valve having a higher escape pressure than the pressure of said source, fluid conduit means extending from said relief valve to said freezing cell, and pressure responsive means responsive to a minimum pressure within said fluid conduit means for operating said pump when the pressure within said conduit means is above a predetermined minimum.

4. An ice maker including a freezing cell, means for cooling said cell below water freezing temperatures, a source of water under pressure, a pump having an inlet connecting to said source and a discharge outlet, said discharge outlet being provided with a high pressure relief valve having a higher escape pressure than the pressure of said source, fluid conduit means extending from said relief valve to said freezing cell, a removable ice receptacle normally located adjacent said freezing cell for receiving ice discharged from said freezing cell, and control means responsive to the absence of said ice receptacle adjacent said freezing cell for preventing the forcing of water through said relief valve when the ice receptacle is not in place adjacent said freezing cell.

5. An ice maker including a freezing cell, means for cooling said cell below water freezing temperatures, a source of water under pressure, a pump having an inlet connecting to said source and a discharge outlet, said discharge outlet being provided with a high pressure relief valve having a higher escape pressure than the pressure of said source, fluid conduit means extending from said relief valve to said freezing cell, a removable ice receptacle normally located adjacent said freezing cell for receiving ice discharged from said freezing cell, means for operating said pump when the pressure within said conduit means is above a predetermined minimum, and control means responsive to the absence of said ice receptacle adjacent said freezing cell for preventing the operation of said pump when the ice receptacle is not in place adjacent said freezing cell.

6. An ice maker including a freezing cell having a water inlet and an ice outlet, means for cooling said cell below water freezing temperatures, a source of water, and a reciprocating pump having a power stroke which increases in power as the stroke progresses for drawing water from said source and for pumping the water into said cell at increasing pressures throughout the stroke to force ice out of said freezing cell.

7. An ice maker including a freezing cell having a water inlet and an ice outlet, means for cooling said cell below water freezing temperatures, a source of water, a solenoid reciprocating pump having long and short solenoid windings in electromagnetic relationship to each other for pumping water from said source into said cell with pressures which increase as the stroke progresses, said pump having an armature electromagnetically associated with said solenoid windings to induce a current in said short winding as it is attracted and moved by said long winding, and means for increasing the current flow in the long winding in accordance with the induced current in the short winding.

8. An ice maker including a tubular freezing cell having an inlet and an outlet, the inner walls of said cell adjacent said outlet having a slight taper not greater than .003 inch per lineal inch, means for cooling said cell below water freezing temperatures, a source of water, and means for pumping water from said source to said inlet at a rate substantially equal to the rate of freezing of the water in said cell so that the water freezes into a progressively moving piston to seal the cell and so that the water pumped will hydraulically move the ice piston progressively through the slightly tapered cell without sticking.

9. An ice maker including a freezing cell, means for cooling said cell below water freezing temperatures, a source of water under pressure, a pump having an inlet connecting to said source and a discharge outlet, said dis-

charge outlet being provided with a high pressure relief valve having a higher escape pressure than the pressure of said source, fluid conduit means extending from said relief valve to said freezing cell, a removable ice receptacle normally located adjacent said freezing cell for receiving ice discharged from said freezing cell, and control means conjointly responsive to a minimum pressure within said fluid conduit means and to the presence of said ice receptacle in its normal location for operating said pump.

10. An ice maker including a freezing cell, means for cooling said cell below water freezing temperatures, a source of water under pressure, a pump having an inlet connecting to said source and a discharge outlet, said discharge outlet being provided with a high pressure relief valve having a higher escape pressure than the pressure of said source, fluid conduit means extending from said relief valve to said freezing cell, a removable ice receptacle normally located adjacent said freezing cell for receiving ice discharged from said freezing cell, and control means conjointly responsive to the absence of said ice receptacle from its normal location adjacent said freezing cell and to a maximum weight of said receptacle and the ice collected therein for preventing the forcing of water through said high pressure relief valve whenever the receptacle is absent or substantially filled with ice.

11. An ice maker including an ice receiving container, first means for freezing liquid in pieces and delivering the frozen pieces into said container, control means for said first means having an operating position and a non-operating position for operating and preventing the operation respectively of said first means, said container and control means having associated therewith cooperating magnetic means for moving said control means to the non-operating position in response to the filled condition of said container and to the operating position in response to the presence of the unfilled container.

12. An ice maker including an ice receiving container, first means for freezing liquid in pieces and delivering the frozen pieces into said container, control means for said first means having an operating position and a non-operating position for operating and preventing the operation respectively of said first means, said container and control means having associated therewith cooperating magnetic means for moving said control means to the non-operating position in response to the absence of said container and to the operating position in response to the presence of the unfilled container.

13. An ice maker including an ice receiving container, first means for freezing liquid in pieces and delivering the frozen pieces into said container, control means for said first means having an operating position and a non-operating position for operating and preventing the operation respectively of said first means, a mounting for said container, said control means being biased to the non-operating position, cooperating relatively movable magnetic means associated with said control means and said container, said mounting having means for moving said magnetic means into a strong attractive relationship upon the presence of the unfilled container to move said control means to operating position and for moving said magnetic means into a weak attractive position upon the presence of a filled container to cause movement of said control means to the non-operating position under the bias.

14. An ice maker including an ice receiving container, first means for freezing liquid in pieces and delivering the frozen pieces into said container, control means for said first means having an operating position and a non-operating position for operating and preventing the operation respectively of said first means, a mounting for said container, said control means being biased to the non-operating position, cooperating relatively movable magnetic means associated with said control means and said container, said mounting having means for moving said magnetic means into a strong attractive relationship upon the presence of the unfilled container to move said control means to operating position and for moving said magnetic means into a weak attractive position upon the absence of said container to cause movement of said control means to the non-operating position under the bias.

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