United States Patent [19]

Bright

[11] **3,774,407**

[45] **Nov. 27, 1973**

[54] **VISCOUS FLUID TIMER FOR TRAY ICE MAKER**

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[73] Assignee: **General Motors Corporation**, Detroit, Mich.

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[52] **U.S. Cl.** ..... **62/157**, 62/233, 62/353, 200/33 R, 200/41, 335/280

[51] **Int. Cl.** **F25c 1/10**

[58] **Field of Search** 62/157, 233, 353

[56] **References Cited**

UNITED STATES PATENTS

2,966,567	12/1960	Ovshinsky	335/280
3,055,186	9/1962	Linstromberg et al.	62/344 X
3,714,794	2/1973	Linstromberg et al.	62/233

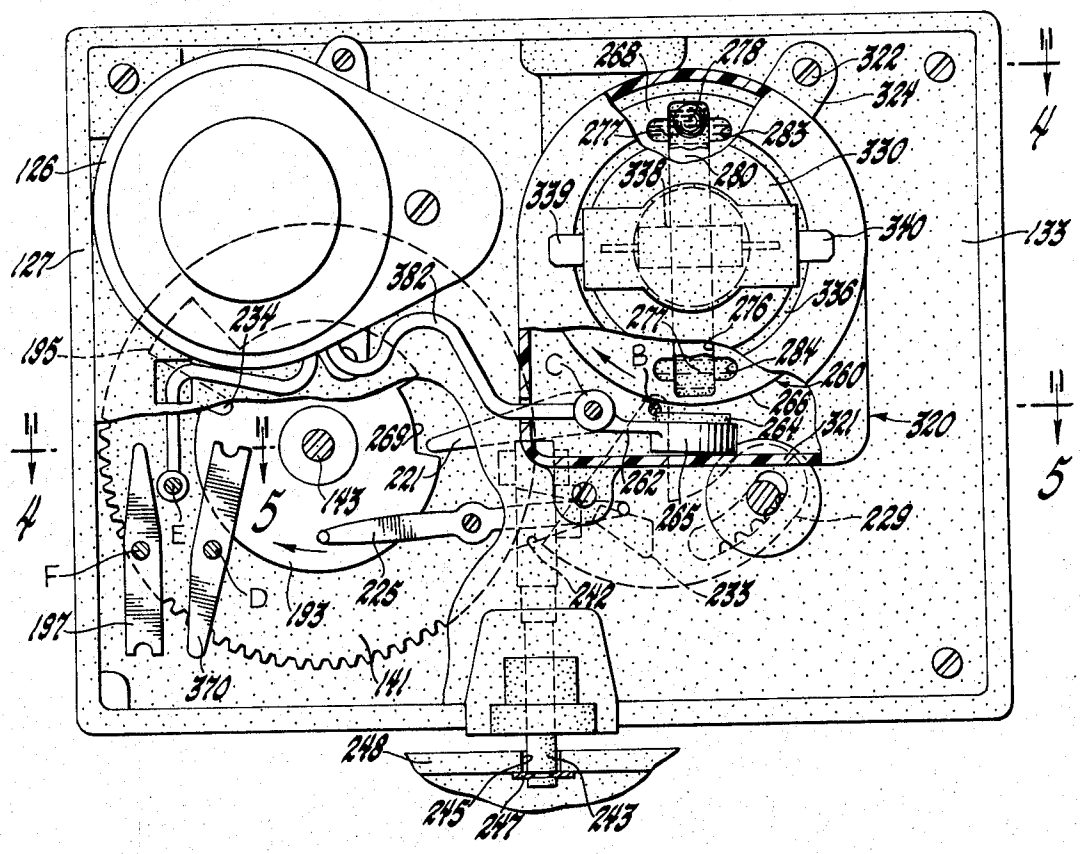
Primary Examiner—William E. Wayner

Attorney—William S. Pettigrew et al.

[57] **ABSTRACT**

A viscous fluid timer useful for a refrigerator automatic ice maker having a magnetic member movable in the fluid at a controlled rate under the influence of gravity where its presence will attract a magnetic switch to a closed condition to initiate the ice harvesting cycle of the ice maker. Thermostatic means are controlled such that upon the occurrence of a predetermined temperature the timer operates to interrupt the travel of the movable magnetic member whereby the viscous fluid timer is sensitive to the ice making temperature of the refrigerator.

5 Claims, 8 Drawing Figures



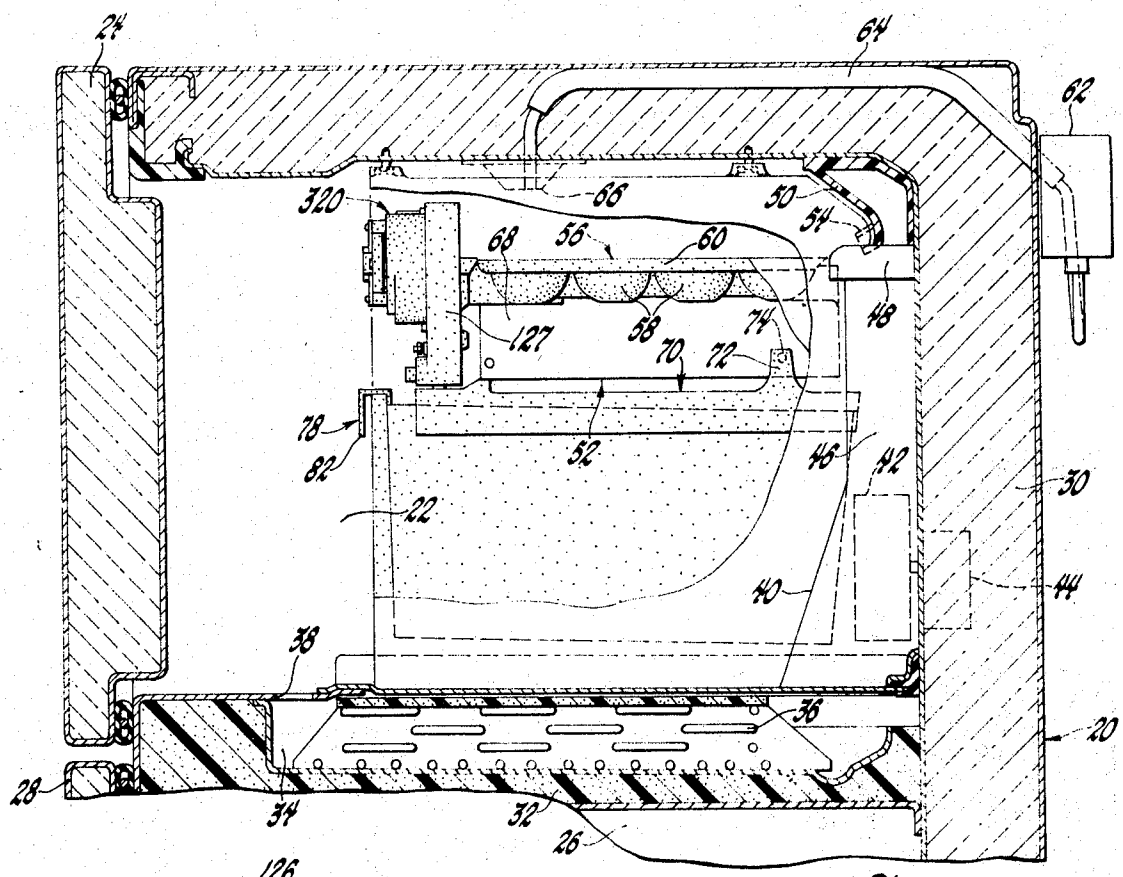

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Fig. 1

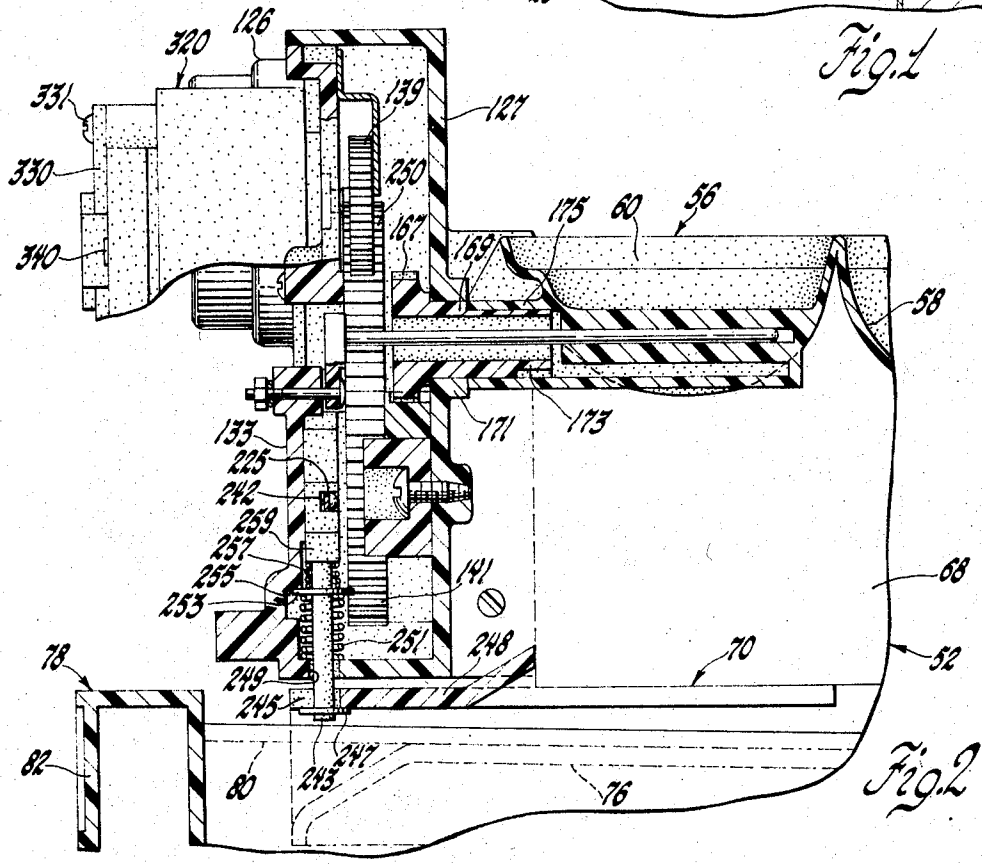

320
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Fig. 2

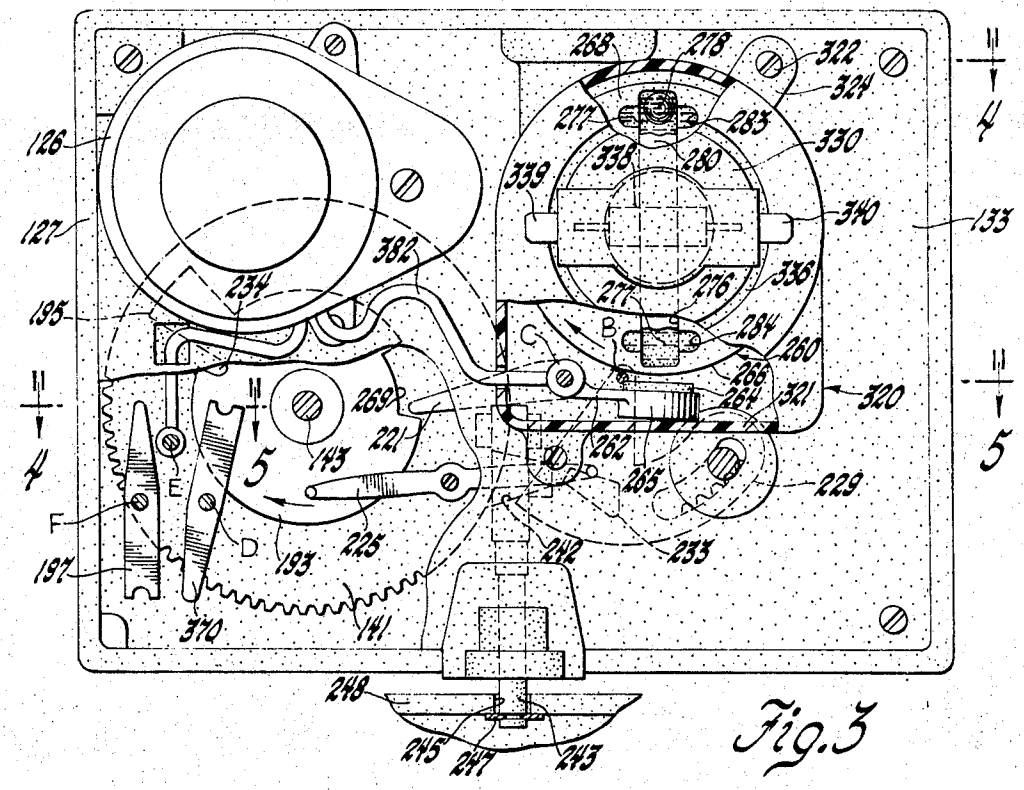


Fig. 3

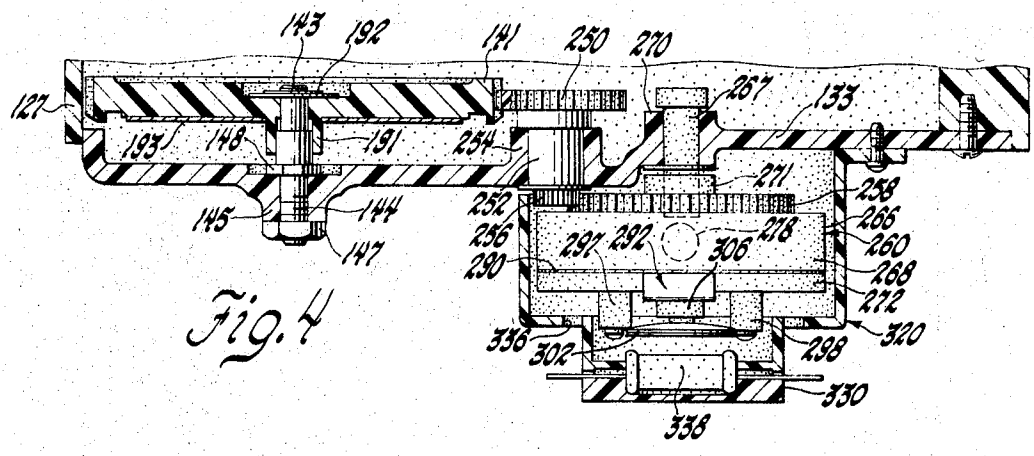


Fig. 4

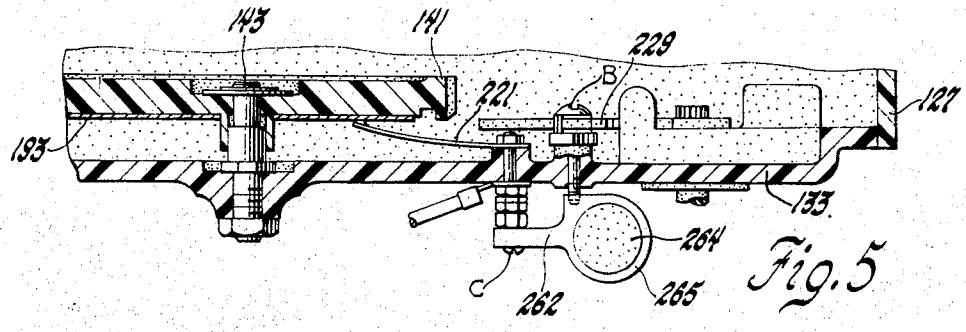


Fig. 5

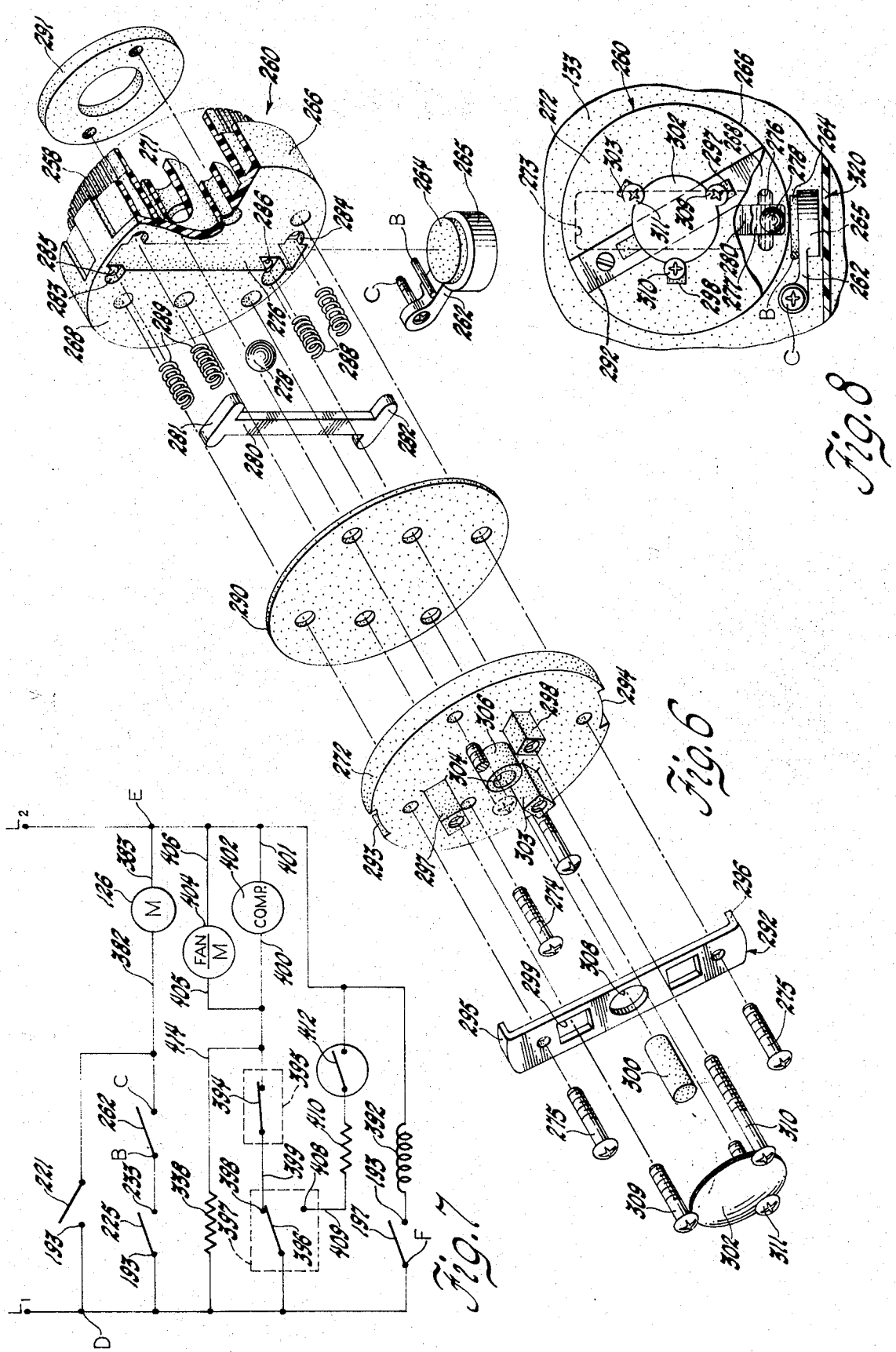


Fig. 7

Fig. 6

Fig. 8

VISCOUS FLUID TIMER FOR TRAY ICE MAKER

This invention relates to viscous fluid timer switch assemblies, and more particularly to a switch assembly having thermostatic means for operating the timer switch under ice making temperature conditions of a refrigerator.

In one form of improved automatic ice maker disclosed in the Eyman Jr., et al. U.S. Pat. No. 3,540,227, owned by the assignee of the instant invention, a hydraulic thermostat switch is disclosed having a hydraulic tube sensing bulb extending into a coaxial cavity of an ice piece mold so as to be responsive to the temperature of the unfrozen or frozen liquid in the pockets of the mold. Such an arrangement makes the removal of the molds difficult in that the sensing bulb must be withdrawn from the mold before the mold can be removed from the ice maker to allow for the replacement by a mold having different sized pockets, for example.

It is therefore an object of this invention to provide a single viscous fluid ice maker timing mechanism which is selectively variable by means of varying the viscosity of the liquid charge in a diametrically positioned rotatable chamber to control the rate at which a ball of magnetic material descends within the chamber. A pivotal switch arm, gravity biased into a normally open position, is mounted adjacent the lower end of the chamber upon its being rotated 180° to either of its two vertically oriented positions. Magnetic means in the form of a permanent magnet is positioned on the switch arm such that the presence of the ball will attract the switch arm magnetically causing the arm to pivot upwardly and close the switch contacts. Thermostatic means, in the form of a snap acting thermostatic disc, operates a stop bar to interrupt the descent of the ball to delay the cycle time of the ice maker to insure proper temperature conditions are present in the freezer compartment of a refrigerator.

It is another object of this invention to provide a viscous fluid timer for automatic ice makers which results in a minimum of testing of such devices by eliminating the need for thermostatic switches requiring temperature calibration.

It is another object of the invention to provide a viscous fluid timer for automatic ice makers which employs a minimum of moving parts to reduce cost while insuring a high degree of reliability.

It is still another object of the invention to provide a viscous fluid timer including a housing member adapted to be periodically rotated by drive means such that a diametrically positioned chamber filled with a viscous fluid includes a steel ball movable in the fluid in a controlled manner. Initial rotating of the chamber to a vertical oriented position allows the ball to descend under the influence of gravity at a controlled rate to actuate an adjacent movable switch arm, gravitationally held in normally open position, by virtue of the ball moving into the field of a magnetic member on the switch arm causing upward movement of the switch arm to a closed circuit position after which the housing is rotated 180° to place the ball in position to initiate a new cycle.

Further objects and advantages of the present invention will be apparent from the following description, reference being had to the accompanying drawings, wherein a preferred embodiment of the present invention is clearly shown.

In the drawings:

FIG. 1 is an irregular vertical sectional view through a refrigerator embodying an air cooled automatic freezer illustrating one form of the invention;

FIG. 2 is an enlarged fragmentary vertical sectional view through the automatic freezer shown in FIG. 1;

FIG. 3 is an enlarged vertical elevational view of the front control housing of the automatic freezer;

FIG. 4 is a horizontal sectional view taken along the lines 4—4 of FIG. 3;

FIG. 5 is a horizontal fragmentary sectional view taken along the lines 5—5 of FIG. 3;

FIG. 6 is an exploded view of the viscous fluid timer portion of the automatic freezer;

FIG. 7 is a wiring diagram of the circuits associated with the proposed viscous fluid timer switch and schematically shows the electrical circuit operated by said devices;

FIG. 8 is a fragmentary vertical elevational view of the timer with the cover removed.

Referring now to the drawings and more particularly to FIG. 1, there is shown a frost-free type of household refrigerator 20 with an upper below-freezing compartment 22 closed by an insulated door 24 and a lower above-freezing compartment 26 closed by a lower insulated door 28.

These compartments are surrounded by the insulated side, top, bottom and rear walls 30 and separated by a horizontal insulated wall 32 containing an evaporator compartment 34 provided with a finned evaporator 36 having vertical fins extending from the front to the rear of the compartment 34. Evaporator compartment 34 is provided with an inlet 38 at the front communicating with the front of the below-freezing compartment 22 and additional inlets, not shown, communicating with the top of the above-freezing compartment 26. At the rear, the compartment 34 connects with a shroud 40 communicating with the entrance to a centrifugal fan 42 which is driven by an electric motor 44 housed in the rear wall 30 of the cabinet. A cooling arrangement for the compartment may be similar to that shown in U.S. Pat. Nos. 3,359,750, issued Dec. 26, 1967 or 3,310,597 issued Mar. 28, 1967, and which reference may be had for further details of construction of the refrigerator.

The fan 42 is provided with an upwardly extending discharge duct 46 having a distributor 48 at the top which distributes the discharge of air through the below-freezing compartment 22. Evaporator 36 is maintained at suitable below-freezing temperatures such as −5 to −15° F. to maintain the compartment 22 at the temperature of 0° F. or below.

For providing special cooling for the automatic freezer, the distributor 48 is provided with laterally extending discharge duct 50 extending along the inner section of the rear and top walls. Behind liquid freezer or automatic ice maker 52 the laterally extending duct 50 is provided with wide discharge nozzles 54 which discharge cold air directly onto the top of the ice maker 52 and particularly onto the top of the mold 56.

The mold 56 is provided with two rows of pockets 58 containing four pockets in each row and has an upwardly flanged rim 60 extending around the short and long sides thereof. The mold 56 of the ice maker is provided with water or any other liquid to be frozen from a pressure water system or liquid under pressure to a solenoid control valve 62 which controls the flow of water through a pipe 64 extending through the insula-

tion of the top wall to a suitable discharge device **66** in the top wall of the below-freezing compartment **22** above the front pockets **58** of the mold **56.** The ice maker **52** is provided with a wide U-shaped frame **68** which surrounds the mold **56** and is fastened to the adjacent side walls or wall of the freezing compartment **22** by suitable screws. Below the frame **68** is a rectangular bin carrier **70** having adjacent the rear, upwardly extending pivoting projections **72** which are pivoted by the outwardly directed pivot pins **74** extending through aligned apertures in the side walls of the frame **68.** The bin carrier **70** is provided with supporting ledges **76** on its inner sides for supporting the laterally extending flanges **80** of the box-shaped bin **78.** The bin **78** is provided with a double flange **82** at the front to serve as a handle.

The mold **56** is suitably pivotably supported within the automatic freezer such as by integrally molded boss means at its rear portion (not shown) which is described in the above-mentioned U.S. Pat. No. 3,540,227 and reference should be had to this patent for details of the mold supporting and pivoting means the disclosure of which is incorporated by reference herein. The mold **56** is formed with a pinion **167** which is provided on the front end of the coaxial sleeve **169** which is rotatably mounted in the bearing **171** provided in the rear cover **127.** This sleeve **169** has a coaxial rearward hollow projection **173** provided with a flat upper surface which fits tightly within a boss **175** located between the front pockets **58** of the mold **56.**

A detailed description of the ejection system and the control system, except as modified, of the ice maker is unnecessary herein since such is now on the market and is preferably of the type disclosed in the Eyman, Jr. et al. U.S. Pat. No. 3,540,227.

For accessibility all the mechanism and controls are located at the front of the freezer with the tray rotating and twisting mechanism disclosed in U.S. Pat. No. 3,540,227, being located in the housing **127** while the electric driving motor **126** and the control mechanism are mounted upon an irregular plastic upright electrical mounting plate **133** which closes the front end of the housing **127.** The drive motor **126** has its final drive shaft (not shown) extending through the electrical control plate **133** and is provided with a drive pinion **139** on the opposite side which continuously meshes with a large driven gear **141.** The large gear **141** has an apertured hub **191** (FIG. 4) rotatably mounted in a removable manner by a suitable snap retainer **192** on the inner shaft end of hexagon collar bolt **143.** The outer threaded end of bolt **143** extends through opening **144** in boss **145** on plate **133** and is fixedly secured thereto by lock not **147** and its collar **148.**

The large timing gear **141** is recessed to receive and hold in position the thin brass nickel plated commutator **193** which is shown bonded to the face of the gear **141** nearest the plate **133.** As seen in FIG. **3** the commutator **193** includes a fill projection or segment **195** cooperating with a spring contact and terminal member **197** to measure the fill period by the time period required for the fill projection or segment **195** to move past the upper end of the spring contact **197.** The holding switch arm **221** is in electrical continuity with threaded terminal post C (FIG. **5**) about which a pivotal timer switch arm **262** is rotated.

The large timing gear **141** also directly drives a small gear **250** mounted on the inner end of shaft **252** extending through apertured bearing **254** in plate **133** and has a gear **256** on its outer end meshed with integral housing gear **258** for driving ball timer **260.** The ball timer has a pivotal timer switch arm **262** including a magnetic slug **264** mounted in a cup-shaped free end portion **265** disposed adjacent the normally non-analagous periphery **266** of a rotatable ball timer housing **268** molded from a suitable plastic material such as acetal resin. The housing **268** is mounted on plate **133** by shaft **267** extending through apertured boss **270** for fixed reception in concentric hub **271** of the housing.

As best seen in FIG. **6** a cover member **272** is secured in the front of housing **268** and suitably secured as by threaded tapping screws **274.** A diametrical viscous fluid chamber **276** is formed in housing **268** for receiving a magnetic member, which in the disclosed form is a steel ball **278** about one-quarter inch in diameter. The ball is movably retained in chamber **276** by stop means in the form of I-shaped stop bar **280** whose transverse foot portions **281, 282** are dimensioned for reception in transverse countersunk slots **283, 284,** each having respective pairs of bores **285, 286** for seating paired coiled compression springs **288, 289** operative to bias stop bar **280** outwardly against the inner face of gasket **290** positioned between cover **272** and the outer face of housing **268** which with seal plate **291** operates to seal a charge of viscous fluid in chamber **276.**

A switch holding plate **292,** preferably of galvanized steel, is positioned in opposed notches **293, 294** by means of its arcuate legs **295, 296** so as to be offset from the principal vertical axis of chamber **276** by an angle of about **30** degrees and is retained thereon by screws **275** and rectangular post **297** molded on cover **272** for reception in conforming aperture **299** in the switch holding plate **292.** A motion transfer rod **300,** formed from suitable insulating material, is supported in concentric alignment with bimetallic disc **302** for axial sliding movement within bore **304** of cover hub **306** and through aligned hold **308** in plate **292.** The rod **300** is resiliently biased with its inner end contacting the outer face of gasket **290** and its outer end adjacent disc **302** and is operable to move axially inwardly under the influence of the thermostatic disc **302** as it snaps from an outward curvature to an opposite inward curvature in a manner to be explained. The disc **302** is shown supported at its periphery in concentric fashion by means of three tap screws **309, 310** and **311** threadably received in radially spaced cover posts **297, 298** and **303,** respectively.

As seen in FIGS. **3** and **4** a concentric casing member **320** encloses the ball timer housing **268** and its switch arm **262** and is affixed to the plate **133** by suitable means such as screws **322,** extending through apertured securing tabs **324.** An outer closure member **330** serves as a heater and terminal retainer located on the outer face of the cover **320** by securing tabs **331, 332** having screws **333, 334** extending therethrough. The closure member **330** is positioned in concentric fashion over circular opening **336** in cover **320** in which is located a timer heater in the form of resistor **338** (FIG. **3**), having a resistance of about 6,800 ohms and a power rating of 2 watts at 70° C, so as to heat the adjacent bimetal disc **302** upon the application of power line voltage at its terminals **339, 340** which causes a flow of current through the heater **338** in a manner to be explained.

As seen in FIG. 2 the weigh rod 243 is vertically slidably mounted through the aperture 249 in the bottom of the upright dividing wall 133 and projects through the bottom thereof and through a slot 245 in the front cross member 248 of the bin carrier 70. A bottom of the weigh rod 243 is provided with a C-shaped disc retainer 247 which is keyed thereto and which retains the weigh rod on the front cross member 248 of the bin carrier 70. Suitable bin control means are provided which in the disclosed form include a relatively strong bin supporting coil spring 251 pressing against a disc 253 held against a shoulder 255 of wall 133 while a weaker coil spring 257 surrounds the weigh rod 243 between the disc 253 and a shoulder 259 of shaft 243 below V-notch 242. As explained in the U.S. Pat. No. 3,540,227, whenever the bin 78 is removed from the carrier 70, the spring 257 will raise the weigh rod 243 and the adjacent right end of pivoted contact 225 to open the circuit. When the bin 78 is placed in proper position on the carrier 70 the spring 257 will be pressed down until the spring contact 225 is in a horizontal position in engagement with the commutator 193 to close the circuit. A segment contact member 229, pivoted on terminal post B, includes a wedge shaped contact 233 adapted to be contacted by the adjacent end of pivotal switch contact member 225. The wedge shaped contact 233 is electrically connected to post B and allows for variations in loading of the bin 78 as explained in the above-mentioned U.S. Pat. No. 3,540,227.

As seen in FIG. 3 the commutator 193 is shown positioned at the end of an ice harvest cycle wherein the commutator 193 has been cycled or rotated in a clockwise direction through one complete revolution of 360° by the drive motor 126. In FIG. 3 the holding switch arm 221 has dropped-off the commutator 193 with the notch 269 positioned beneath the contact arm 221 resulting in a deenergization of the motor 126. As the housing gear 258 is geared so as to be driven by the motor 126 in unison with the driving of the commutator gear 141 but at twice the rotational speed the diagonal housing ball chamber 276 has been cycled or rotated in a clockwise direction through one-half of a revolution or through an angle of 180°. Said differently, the chamber 276 is rotated 180° from its position shown in FIG. 8 with the ball 278 located at its lowermost point adjacent the magnet 264 of switch arm 262 to a position shown in FIG. 3 wherein the ball is located in its diametrically opposite position where it is free to move downward in vertically oriented chamber 276 through the viscous fluid therein under the influence of gravity the full height of chamber 276 to start a new harvest cycle. In the disclosed embodiment the viscosity of the fluid, the length of the chamber 276 and the weight of the ball 278 are such that the time interval required for the ball to travel the full length of chamber 276 is of the order of 90 minutes which is more than sufficient to freeze the liquid in the mold into ice pieces during normal operation of the refrigerator.

In operation during the time the steel ball 278 moves in its downward travel in chamber 276 through the viscous fluid the liquid in the mold cavities is frozen into ice pieces. When the ball 278 reaches its lowermost position in chamber 276 the timer switch arm 262, shown in FIG. 3, its gravity biased downward open position in contact with stop means in the form of bottom wall 321 of casing 320, is pivoted upwardly by the force of attraction between the permanent magnet 264 and the ball 278 to close the timer switch between electrical terminal posts B and C as shown in FIG. 8. As the pivoted contact arm 225 is also closed to its wedge shaped contact 233, assuming an inserted empty or partially filled bin, a circuit is completed from power lines L_1 through the arm 225, the timer switch 262, conductor 382, the motor 126, the conductor 383 and the terminal post E to power line L_2 energizing the motor 126 which starts the ice maker harvest cycle. As the commutator 193 is fixed on the large commutator gear 141, driven directly off of the motor gear 139, whenever the motor 126 runs, the commutator 193 must also rotate in a clockwise direction as viewed in FIG. 3.

The commutator 193 continues to advance until the holding switch 221, electrically connected to post C, is closed to the commutator 193 so as to complete the motor circuit directly to L_1 as seen in the wiring diagram of FIG. 7. It is at this point that the mold begins to first twist (clockwise).

The holding switch arm 221 opens when the mold is at an angle of about 45 degrees to prevent continuation of the cycle and harvesting of the ice pieces in the event the bin 78 has been removed after the start of the harvest cycle. With the bin in place, current to the motor 126 continues to be supplied through the holding switch arm 221 which is closed by engaging the commutator 193 at all times except when notch 269 or the notch 234 are oriented with the rounded end of switch arm 221, as explained in U.S. Pat. No. 3,540,227.

As seen in FIG. 7, upon the fill projection 195 being rotated into contact with fill switch 197 a circuit is completed from L_1 to the commutator 193 to solenoid 392 of the fill valve 62 while the hold switch arm 221 is closed to terminal C to prevent interruption of the motor circuit during the fill period which is about 12 seconds in duration.

In normal operation with the freezer section 22 at a temperature of about 9° F. or below, the freezing period for the water in the mold 56 is completed during a 90 minute continuous descent of the ball 278 in the viscous fluid chamber 276 of the timer. This assumes that movable contact 394 of the refrigerator cold control switch 395 is closed and the movable contact 396 of the refrigerator defrost timer switch 397 is closed to its off position in contact with fixed contact 398 to complete the circuit through conductors 399, 400 and 401 to energize the refrigerator compressor 402 across the power lines L_1 and L_2 together with the energization of refrigerator fan motor 404 through conductors 405 and 406.

When the defrost timer switch 397 operates to place its movable contact 396 in electrical contact with fixed contact 408 a circuit is completed through conductor 409, defrost heater 410 and defrost limiter switch 412 to energize the heater 410 and deenergize the compressor 402 and fan 404 causing the refrigeration unit to cycle off. To make the ball timer 260 sensitive to the run or on-cycle time of the refrigeration unit it will be noted in FIG. 7 that the thermostatic disc heater 338 is energized during both the defrost period and off-cycle periods of the refrigerating unit, when the cold control switch 394 is open, by completing the circuit from L_1, commutator 193, spring contact 370, terminal post D, heater 338, conductor 414, conductor 400, the motor windings of compressor 402, conductor 401 and power line L_2.

As the bimetal disc **302** is designed to move or "pop-in" from an outward curvature to an inward curvature upon the occurrence of a first predetermined temperature condition, having a value in the disclosed form of 19° ± 3 F., thereby causing axial inward movement of the transfer rod **300** in hub **306** (FIG. **6**) to flex the gasket **290** inwardly against stop bar **280** which in turn is moved inwardly against the bias of springs **288** to engage ball **278** and interrupt its downward movement in chamber **276.** It will be noted that the relatively small current flow through the compressor motor windings required to energize disc heater **338** during defrost is not sufficient to energize the compressor **402.**

Upon the termination of the defrost period the movable contact **396** moves to fixed contact **298** re-establishing the circuit through compressor **402** and fan **404,** and short circuiting the disc heater **338.** Upon the refrigeration unit lowering the temperature in the freezer to a second predetermined temperature of about 9° ± 3 F. in the instant embodiment the disc flexes outwardly or "pops-out" to an opposite curvature causing the spring biased stop bar **280** to move outwardly against gasket **290** moving rod **300** axially to its initial outer position adjacent the center of disc **302.** It will be noted that if the refrigeration unit goes through a short "off cycle" period the temperature rise normally will not be sufficient to reach 19° F. and the ball **278** will not be interrupted in its descent.

When the ball **278** reaches the position shown in FIG. **8** closing the movable arm **262** between terminal posts B and C to again initiate a harvest cycle whereby the timer housing **268** is rotated 180° by drive motor **126** which in the intant embodiment requires about 2.8 minutes. As it is essential that the timer switch arm **262** remain closed to fixed terminal post C for a certain length of time during 180° timer housing rotation the holding switch plate **292** is positioned as shown in dashed lines in FIG. **8** at about a 30° angle relative to the vertical center line of chamber **276.** In this way when the housing **268** is rotated in a clockwise direction the lower flange **296** will be moved into the flux field of the permanent magnet **264** to insure that switch arm **262** remains in its closed upwardly pivoted position until the holding switch **221** is closed to complete the motor circuit therethrough directly to the commutator **193.**

A suitable high viscosity liquid charge **277** is employed in the chamber **276** having oil-like dampening characteristics and substantially constant viscosity over the temperature range of between −10° F. to +10° F. encountered in the freezer compartment of the refrigerator. Experimental work has indicated the silicone oils such as sold by Dow Corning under their stock number designation **210** are preferable for use in the viscous fluid timer herein described.

As seen in FIG. **8** the inner face of the cover member **272** has a depressed area **273** formed therein having a uniform depth of about one-sixteenth inch such that the rubber sealing gasket **290** extends thereover in its assembled portion sandwiched between the cover **272** and the housing **268.** It will be appreciated that any expansion of the liquid charge **277** will be accommodated by the outward flexing of the gasket into the depressed area **273** while alleviating leakage of the liquid charge from the chamber. In the embodiment disclosed the rubber gasket **290** has a material thickness of the order of 0.010 inches and a durometer index of about 40.

While the embodiment of the present invention as herein disclosed constitutes a preferred form, it is to be understood that other forms might be adopted.

I claim:

1. The combination with a refrigerator automatic ice maker adapted to manufacture and discharge ice pieces including a mold, means for supplying liquid to said mold, means for freezing the liquid in said mold, an electric drive motor, timer switch means, a control circuit connecting said timer switch means in series with said drive motor, said timer switch means including a rotational housing member of nonmagnetic material mounted to rotate about a horizontal axis, said rotational housing member having an enclosed diametrically extending sealed chamber for accommodating a high viscosity liquid therein, said drive motor coupled to said housing and adapted when energized to rotate the same through an angle of about 180° to invert said chamber from its one vertically oriented position to its other vertically oriented position in response to the closing of said timer switch means at the completion of each ice piece freezing period to initiate an ice piece harvest of said ice maker, a movable magnetic body in said liquid chamber, stop means positioned for movement in said liquid chamber from a first position permitting movement of said magnetic body to a second position interrupting the downward movement of said magnetic body, thermostatic means on said housing operative for moving said stop means from said first position to said second position upon a predetermined temperature increase in the refrigerator, resilient means on said housing operative to bias said stop means in said first position, said timer switch means having normally open contacts which close upon being magnetically actuated, said timer contacts located so as to be adjacent the lower end of said chamber when said chamber is oriented in either of its two vertical positions, said magnetic body movable through the high viscosity liquid under the influence of gravity from one upper end to the opposite lower end of said chamber during a predetermined ice piece forming time interval to close said timer contacts whereby said control circuit energizes said drive motor, said thermostatic means operative upon the attainment of said predetermined temperature rise in the refrigerator to move said stop means to said second position thereby interrupting the downward travel of said magnetic body until the refrigerator temperature is lowered below said predetermined temperature, whereby said resilient means operates to return said stop means to said first position such that said movable body is again free to descend in said chamber for subsequent magnetic actuation of said timer contacts.

2. A timer switch for use with a refrigerator automatic ice maker including a rotational housing member of non-magnetic material mounted to rotate about a horizontal axis, said rotational housing member having a diametrically located chamber therein, said chamber dimensioned in symmetrical fashion about said horizontal axis for accommodating a high viscosity liquid therein, drive means coupled to said housing and adapted to rotate the same in a vertical plane through an angle of about 180° so as to invert said chamber from its one vertically oriented position to its opposite vertically oriented position in response to the completion of each freezing period to initiate an ice piece harvest cycle of the ice maker, a movable body of magnetic material in said chamber, cover means on said rotatable housing enclosing said chamber in a

sealed manner having an axial bore therein, a motion transfer rod slidable in said bore, a thermostatic disc supported in concentric fashion on said cover means and movable in a snap-like manner from one outward curvature to an opposite inward curvature upon the occurrence of a predetermined temperature increase within the refrigerator, a stop bar positioned for axial movement in said passage, resilient biasing means on said housing operative to bias said stop bar to a first position out of contact with said movable body, magnetically actuated normally open switch means disposed adjacent a lower end of said housing chamber when said chamber is oriented in either of its two vertical positions, said movable body being displaceable through the high viscosity liquid under the influence of gravity from the upper end of said chamber to its lower end during a predetermined time interval sufficient to allow the formation of ice pieces in the ice maker, said movable body operative to close said magnetic switch means and energize said drive means upon reaching the lower end of said chamber, the movement of said thermostatic disc to said inward curvature upon the attainment of said predetermined temperature rise operative by imparting axial movement to said rod to a second position causing said stop means to contact said movable body interrupting the downward movement thereof, said movable body being prevented by said stop bar from further descent until the temperature in the refrigerator is lowered below said predetermined temperature, whereby the return of said thermostatic disc to said outward curvature allows said biasing means to move said stop bar and said rod to said first position such that said body is again free to descend in said chamber through the high viscosity liquid at a controlled rate for subsequent magnetic closing of said switch means.

3. A timer switch for use with a refrigerator automatic ice maker including a rotational housing member of nonmagnetic material mounted to rotate about a horizontal axis, said rotational housing member having a diametrically located chamber therein, said chamber dimensioned in symmetrical fashion about said horizontal axis for accommodating a high viscosity liquid therein, drive means coupled to said housing and adapted to rotate the same in a vertical plane through an angle of about 180° so as to invert said chamber from its one vertically oriented position to its opposite vertically oriented position in response to the completion of a harvest cycle of the ice maker, a movable ball of magnetic material in said chamber, a cover removably affixed on said rotatable housing overlying said chamber, a diaphragm flexible gasket sandwiched between said cover and said housing so as to seal the high viscosity liquid within said chamber, a recess formed in the inner face of said cover whereby expansion of the high viscosity liquid is accommodated by flexture of said gasket into said recess, an axial bore in said cover, a motion transfer rod slidable in said bore, a thermostatic disc supported in concentric fashion on said cover and movable in a snap-like manner from one outward curvature to an opposite inward curvature upon the occurrence of a predetermined temperature increase within said refrigerator, a stop bar positioned for axial movement in said passage, resilient biasing means on said housing operative to bias said stop bar to a first position out of contact with said movable ball, magnetically actuated normally open switch means disposed adjacent a lower end of said housing chamber when said chamber is oriented in either of its two vertical positions, said movable ball being displaceable through the high viscosity liquid under the influence of gravity from the upper end of said chamber to its lower end during a predetermined time interval sufficient to allow the formation of ice pieces in the ice maker, said movable ball operative to close said magnetic switch means and energize said drive means upon reaching the lower end of said chamber, the movement of said thermostatic disc to said inward curvature upon the attainment of said predetermined temperature increase operative by imparting axial movement to said rod to a second position moving said stop bar means into contact with said movable ball interrupting the downward movement thereof, said movable ball being prevented by said stop bar from further descent until the temperature in the refrigerator is lowered below said predetermined temperature, whereby the return of said thermostatic disc to said outward curvature allows said biasing means to move said stop bar and said rod to said first position such that said body is again free to descend in said chamber through the high viscosity liquid at a controlled rate for subsequent magnetic closing of said switch means.

4. The combination with a refrigerator automatic ice maker adapted to manufacture and discharge ice pieces including a mold, means for supplying liquid to said mold, means for freezing the liquid in said mold, an electric drive motor, timer switch means, a control circuit connecting said timer switch means in series with said drive motor, said timer switch means including a rotational housing member of nonmagnetic material mounted to rotate about a horizontal axis, said rotational housing member having an enclosed diametrically extending sealed chamber for accommodating a high viscosity silicone liquid therein, said drive motor coupled to said housing and adapted when energized to rotate the same through an angle of about 180° to invert said chamber from its one vertically oriented position to its other vertically oriented position in response to the closing of said timer switch means at the completion of each ice piece harvest of said ice maker, a movable steel ball in said liquid chamber, stop means positioned for movement in said liquid chamber from a first position permitting movement of said ball to a second position interrupting the downward movement thereof, thermostatic means on said housing operative for moving said stop means from said first position to said second position upon a predetermined temperature increase in the refrigerator, resilient means on said housing operative to bias said stop means in said first position, said timer switch means including a pivotal switch arm having a permanent magnet thereon, said switch arm gravity biased to a first normally open position engaging stop means, a fixed contact of said timer switch located adjacent the lower end of said chamber in either of its two vertically oriented positions, said ball movable through the silicone liquid under the influence of gravity from one upper end to the opposite lower end of said chamber during a predetermined ice piece forming time interval, said ball upon reaching the lower end of said chamber being positioned to attract said permanent magnet and pivot said switch arm into electrical contact with said fixed contact whereby said control circuit energizes said drive motor, said thermostatic means operative upon the attainment of said pre-

determined temperature rise in the refrigerator to move said stop means to said second position thereby interrupting the downward travel of said ball until the refrigerator temperature is lowered below said predetermined temperature whereby said resilient means operates to return said stop means to said first positon such that said ball is again free to descend in said chamber for subsequent magnetic actuation of said pivotal switch arm.

5. The combination with a refrigerator automatic ice maker adapted to manufacture and discharge ice pieces including a mold, means for supplying liquid to said mold, means for freezing the liquid in said mold, an electric drive motor, timer switch means, a control circuit connecting said timer switch means in series with said drive motor, said timer switch means including a rotational housing member of nonmagnetic material mounted to rotate about a horizontal axis, said rotational housing member having an enclosed diametrically extending sealed chamber for accommodating a high viscosity liquid therein, said drive motor coupled to said housing and adapted when energized to rotate the same through an angle of about 180° to invert said chamber from its one vertically oriented position to its other vertically oriented position in response to the closing of said timer switch means, a movable magnetic body in said liquid chamber, said timer switch means having normally open contacts which close upon being magnetically actuated, said timer contacts located so as to be adjacent the lower end of said chamber when said chamber is oriented in either of its two vertical positions, said magnetic body movable through the high viscosity liquid under the influence of gravity from one upper end to the opposite lower end of said chamber during a predetermined ice piece forming time interval to close said timer contacts whereby said control circuit energizes said drive motor to initiate an ice piece harvest of said ice maker.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,774,407 Dated November 27, 1973

Inventor(s) James A. Bright

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 7, line 33, "intant" should be -- instant --. Column 9, claim 3, line 49, delete "a" (first occurrence) and insert therefor -- each freezing period to initiate an ice piece --. Column 10, claim 4, line 43, after "each" insert -- freezing period to initiate an --. Column 11, claim 4, line 6, "positon" should be -- position --.

Signed and sealed this 6th day of August 1974.

(SEAL)
Attest:

McCOY M. GIBSON, JR.
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents

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