

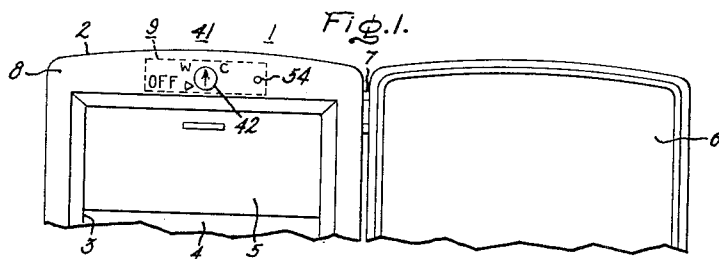
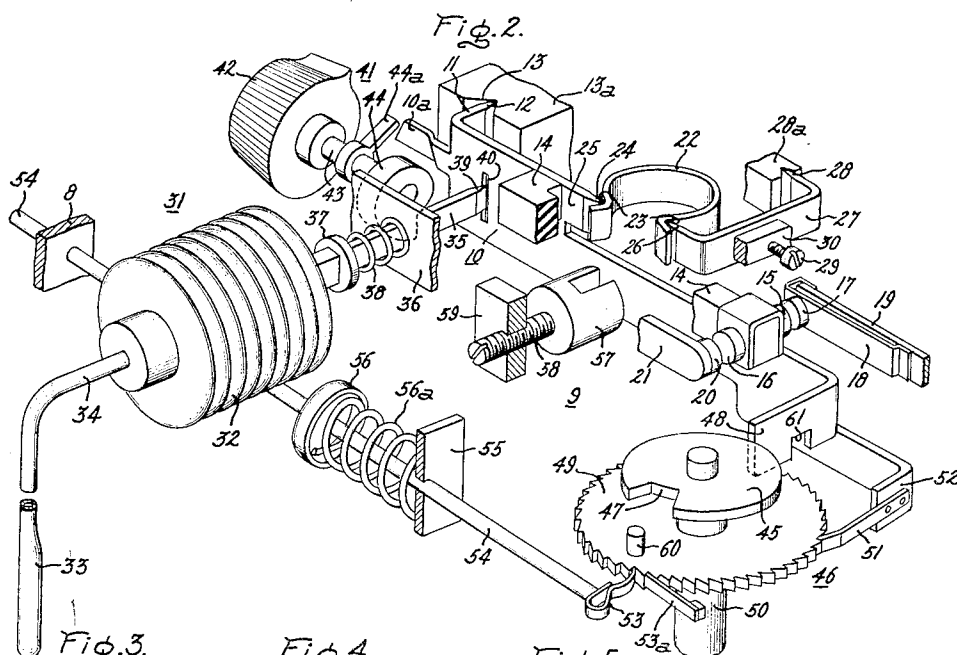
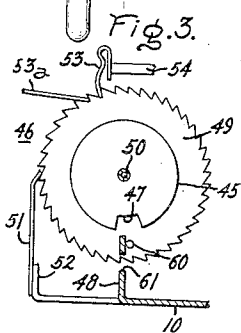
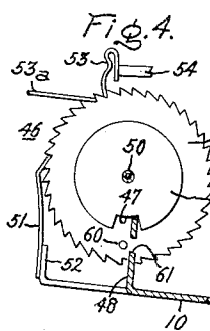
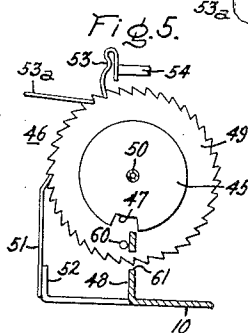
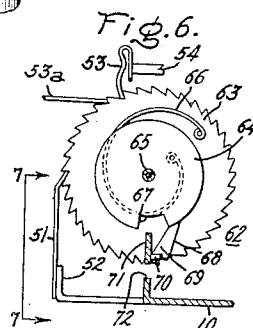
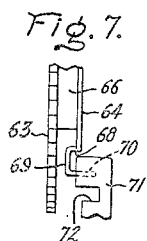
June 21, 1955

C. S. GRIMSHAW

2,711,079

AUTOMATIC REFRIGERATOR CONTROL

Filed Nov. 18, 1952



Inventor:
Charles S. Grimshaw,
by *David A. B. B. B.*
His Attorney.

2,711,079

AUTOMATIC REFRIGERATOR CONTROL

Charles S. Grimshaw, Harborcreek Township, Erie County, Pa., assignor to General Electric Company, a corporation of New York

Application November 18, 1952, Serial No. 321,153

16 Claims. (Cl. 62—4)

My invention relates to refrigeration apparatus and pertains more particularly to automatic controlling means therefor.

The primary object of my invention is to provide a new and improved automatic refrigerator controlling means for maintaining a substantially constant refrigerator temperature and for initiating defrosting operations.

Another object of my invention is to provide an improved automatic refrigerator controlling means whereby unit cycles and door openings during unit cycles are accumulated to provide an improved defrost initiating function.

Still another object of my invention is to provide in an automatic refrigerator control including a single pole double throw switch for controlling both unit operation and defrosting, means for independently adjusting the normal operating and defrosting temperatures.

Further objects and advantages of my invention will become apparent as the following description proceeds and the features of novelty which characterize my invention will be pointed out with particularity in the claims annexed to and forming part of this specification.

In carrying out the objects of my invention, I provide an arm movable between a refrigerating unit operating position and a defrosting position. A spring biases the arm toward the defrosting position and temperature responsive means is effective above a predetermined temperature for maintaining the arm in the unit operating position against the bias of the spring. When the temperature decreases and the temperature responsive means is no longer effective for maintaining the arm in the unit operating position, the arm is actuated by the spring toward the defrosting position. A rotatable cam normally stops the arm in an "off" position intermediate the unit operating and defrosting positions. Following each complete rotation of the cam, the cam is ineffective for stopping the arm and permits the arm to move to the defrost position. A counter actuated in response to unit cycles and door openings determines the rotation of the cam. When the unit is idle, door openings are ineffective for actuating the counter. In the defrosting position, a magnet attracts the arm and determines the temperature at which the temperature responsive means is effective for returning the arm to the unit operating position.

For a better understanding of my invention, reference may be had to the accompanying drawing in which:

Fig. 1 is fragmentary view of a portion of a refrigerator incorporating my invention;

Fig. 2 is an enlarged perspective detail view of the preferred form of my invention;

Fig. 3 is a detail view illustrating the counter in one operational position thereof;

Fig. 4 is a detail view illustrating the counter in another operational position;

Fig. 5 is a detail view illustrating the counter in still another operational position;

Fig. 6 is a detail view of a modification of the counter; and

Fig. 7 is a sectional view taken along the lines 7—7 in Fig. 6 and looking in the direction of the arrows.

In Fig. 1 is partially shown a refrigerator cabinet 1 including an outer case 2 and a spaced apart liner 3. The liner 3 defines a food storage compartment 4 wherein is located an evaporator 5 provided for cooling the contents of the food storage compartment. Provided for closing an access opening to the food storage compartment is a door 6 supported by a pair of hinges 7 (only one of which is shown) secured to the outer case 2.

Formed on the outer case 2 of the refrigerator cabinet 1 and surrounding the access opening to the food storage compartment 4 is a face portion 8. Suitably mounted behind the upper central portion of the face portion 8 is a preferred embodiment of my automatic refrigerator control generally designated 9 and shown in detail in Fig. 2.

Included in the control 9 is a main arm 10. The main arm 10 is formed at the forward end thereof with a laterally extending portion 11, the extremity of which is formed as a knife-edge 12. The knife-edge 12 is disposed in a V-groove 13 formed in a stationary block 13a whereby pivotal movement of the main arm 10 is permitted about the knife-edge.

Secured to the main arm 10 is a rearwardly extending insulative arm 14. Carried on the extremity of the arm 14 are first and second contacts 15 and 16, respectively. The contacts 15 and 16 are disposed on opposite sides of the insulative arm 14 and are suitably electrically connected. The first contact 15 cooperates with a motor control contact 17. When the first contact 15 and the motor control contact 17 are in engagement, the main arm is in a first or refrigerating unit operating position and a refrigerating unit (not shown) is energized for lowering the temperature of the evaporator 5 and thereby cooling the food storage compartment. The motor control contact 17 is carried on a resilient strip 18. The resilient strip 18 is spaced for the greater part of its length from a contact arm 19 and is secured at its extremity to the contact arm 19. This arrangement allows contact 17 to follow contact 15 a short distance when the contacts are disengaged, for reducing arcing and thereby increasing contact life. The second contact 16 cooperates with a defrost heater contact 20 carried on a contact arm 21. When the second contact 16 and the defrost heater contact 20 are engaged, the main arm is in a second or defrost position and a heater (not shown) is energized whereby frost formed on the evaporator 5 is melted.

Provided for biasing the main arm 10 clockwise in Fig. 2 toward the defrost position wherein the first contact 15 and the motor control contact 17 are disengaged and the second contact 16 and the heater contact 20 are engaged is a U-shaped spring 22. The two legs of the spring 22 each include a depression 23. Pivotaly seated in one of the depressions 23 is a knife-edge 24 formed on a portion 25 of the main arm 10 intermediate the extremities of the main arm. Pivoted in the other depression 23 is a knife-edge 26 formed on one end of an adjustment yoke 27. The opposite end of the yoke 27 is formed with a knife-edge 28 which pivots in a V-groove formed in another stationary block 28a. Adjustment to the tension of the spring 22 is accomplished by turning an adjustment screw 29 which is threaded in a stationary bar 30 and extends therethrough for engaging the yoke 27. Turning the adjustment screw 29 inwardly increases the tension of the spring 22 and therefore the force with which the main arm 10 is biased clockwise. Turning the adjustment screw outwardly relieves the tension in the spring 22 and reduces the biasing effect thereof on the main arm 10. By adjusting the tension of the spring 22 in the just described manner the normal operating tem-

perature to be maintained in the refrigerator may be independently determined.

Provided for effecting engagement and disengagement of the first contact 15 and the motor control contact 17 in accordance with the temperature of the evaporator 5, thereby to maintain a substantially constant temperature in the fresh food compartment 4, is a temperature responsive arrangement generally designated 31. The temperature responsive arrangement 31 includes a metal bellows 32, and a volatile fluid containing bulb 33 adapted to be disposed in heat exchange relationship with the evaporator 5 and connected to the bellows by a tube 34. In accordance with temperature changes at the evaporator 5 the saturation pressure of the fluid in the bulb 33 results in corresponding longitudinal expansion and contraction movements of the bellows 32. A pin 35 passes slidingly through a plate 36. On the bellows side of the pin 35 is formed a shoulder 37 and carried on the pin 35 intermediate the shoulder 37 and the plate 36 is a coil spring 38. One end of the coil spring 38 engages the plate 36 and the other end engages the shoulder 37 whereby the pin 35 is caused to follow the contraction movements of the bellows 32. In turn expansion movements of the bellows 32 effects compression of the spring 38 and actuates the pin 35. The extremity of the pin 35 is formed with a knife-edge 39 which seats pivotally in a V-groove 40 in the left-hand side of the main arm 10 intermediate the bent portion 11 and the rear extremity of the main arm. The compression of the spring 38 and therefore the expansion movements of the bellows 32 are determined by a manually settable control indicated generally by 41 in Figs. 1 and 2. The control 41 includes a knob 42 fitted securely on a shaft 43 which extends pivotally through the face portion 8 of the outer case 2. Carried fixedly on the rear extremity of the shaft 43 is a cam 44 adapted for cooperating with the plate 36. It will be seen that in accordance with the setting of the knob 42 the cam 44 will actuate the plate 36 and determine the compression of the spring 38.

In the operation of the arrangement described to this point, an increase in temperature at the evaporator 5 results in an increase in pressure of the volatile fluid contained in the bulb 33 and corresponding expansion of the bellows 32. Upon a temperature increase above a predetermined level determined by the setting of the knob 42, the bellows expansion is such that the pin 35 overcomes the spring 38 and exerts a force on the main arm 10 sufficient for overcoming the bias of the spring 22 and rotating the main arm 10 counterclockwise about the knife-edge 12. Movement of the main arm 10 in this manner effects engagement of the first contact 15 and the motor control contact 17. This results in operation of the refrigeration unit whereby the temperature of the evaporator 5 is reduced. Reduction of the evaporator temperature effects reduction in pressure of the fluid in the bulb 33 and corresponding contraction of the bellows 32. Upon reduction of the evaporator temperature below a predetermined minimum the bellows contraction is such that the spring 22 is able to overcome the effect of the pin 35. As a result the first contact 15 and the motor control contact 17 are disengaged and the refrigerating unit becomes idle.

Thereafter the spring 22 actuates the main arm 10 toward the position wherein the second contact 16 would engage the defrost heater contact 20 and thereby energize the heater. Since it is not desirable to energize the defrost heater after each cycle of unit operation, I have provided means for preventing engagement of the second contact 16 and the heater contact 20 until that time when it is desired that a defrosting operation be initiated.

In the preferred form of my invention defrosting is initiated as a function of refrigerating unit cycles plus refrigerator door openings during the time the refrigerating unit is operating. In order both to prevent energization of the defrost heater after each unit cycle and to

avoid counting door openings when the unit is idle, I have provided a cam 45 included in a counting arrangement generally designated 46. The cam 45 is circular and includes an enlarged radial recess 47. Provided for cooperating with the cam 45 is a stop 48 formed laterally off the rear extremity of the main arm 10. Following each unit cycle the main arm 10 is moved clockwise under the influence of the spring 22 for disengaging the first contact 15 and the motor control contact 17 in the manner described above. If the cam 45 is so positioned at that time that the periphery thereof is in the path of the stop 48, the cam periphery is engaged by the stop and movement of the main arm 10 clockwise is limited. Thus the main arm 10 assumes a unit "off" position intermediate the unit operating and defrosting positions and engagement of the second contact 16 and the heater contact 20 is prevented. Additionally, the force exerted on the main arm 10 by the spring 22 is sufficient to effect considerable friction between the stop 48 and the cam periphery, and the stop 48 in effect serves as a brake on the cam during the time the unit is idle. The purpose for this will be seen hereinafter.

If the cam recess 47 is in alignment with the stop 48 when the unit becomes idle, the stop 48 will move into the recess and the main arm 10 will be permitted to move past the intermediate unit "off" position for bringing the second contact 16 into engagement with the heater contact 20 for thereby energizing the heater. The position of the recess 47 with respect to the stop 48 when the spring 22 returns the main arm 10 depends upon operation of the counting arrangement 46.

In the counting arrangement 46 the cam 45 and a ratchet wheel 49 are carried fixedly and spaced apart on a rotatable shaft 50. Provided for cooperating with the ratchet wheel 49 to effect an angular displacement thereof after each unit cycle is a pawl 51. The pawl 51 is suitably secured to a laterally extending portion 52 bent off the rear extremity of the main arm 10. By this arrangement the ratchet wheel 49 is displaced one tooth space after each unit cycle and as a result of the return or clockwise movement of the main arm 10 effected by the spring 22 following disengagement of the first contact 15 and the motor control contact 17. Also provided for cooperating with the ratchet wheel 49 to effect angular displacements thereof by means of refrigerator door openings is a resilient pawl 53. The resilient pawl 53 is carried on the rear extremity of a push rod 54 mounted slidably in suitable apertures in both the face portion 8 of the cabinet outer case 2 and a fixed bracket 55. Carried securely on the push rod 54 intermediate the face portion 8 and the bracket 55 is a spring seat 56. Carried on the push rod is a coil spring 56a. One end of the spring 56a is disposed in the spring seat 56 and the other end engages the forward side of the bracket 55. In this arrangement the spring 56a biases the push rod 54 forwardly. As seen in Figs. 1 and 2, the forward end of the push rod 54 extends through the face portion 8 for cooperating with the refrigerator door 6. When the refrigerator door is closed, it engages the push rod 54 and urges it rearwardly against the bias of the coil spring 56a. Opening of the door 6 permits the push rod 54 to move forwardly under the influence of the spring 56a. Each such forward movement resulting from a door opening brings the resilient pawl 53 into engagement with a tooth on the ratchet wheel 49 for angularly displacing the ratchet wheel. Provided for preventing backward rotation of the ratchet wheel by the pawl 53 when the door 6 is closed and by the pawl 51 when the main arm 10 moves to the unit operating position is another pawl 53a. In addition to preventing backward rotation of the ratchet wheel, the pawl 53a insures the displacement of only one tooth space of the ratchet wheel each time the door 6 opens. This is accomplished by arranging the pawl 53a so that it is always engaged with the tooth that is next to be

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engaged by the door operated pawl 53. Therefore, when the door 6 is closed the pawl 53 rides up on the pawl 53a and when the door opens the pawl 53 rides down the pawl 53a and into engagement with the next tooth to be engaged for displacing the ratchet one tooth space.

As pointed out above, when the refrigerating unit is idle and the spring 22 moves the stop 48 into engagement with the periphery of the cam 45, there is considerable friction between the stop 48 and the cam periphery. Thus the cam 45 and, therefore, the ratchet wheel 49 are restrained. Also, the resilient pawl 53 is of the "freedom" type and is incapable of overcoming the friction between the stop 48 and the cam periphery. That is, due to the configuration and weakness of the pawl 53 as compared with the spring 22, the pawl 53 is capable of engaging and moving the ratchet wheel after a door opening only when the refrigerating unit is operating and the stop 48 is not engaged with the cam periphery. If the refrigerator door is opened while the unit is idle and the stop 48 is in engagement with the cam periphery, the pawl 53 will be incapable of overcoming the friction between the stop and the cam and as a result the pawl will yield and that door opening will not effect a displacement of the ratchet wheel.

In the arrangement described to this point the ratchet wheel 49 is displaced one tooth after each refrigerating unit cycle by the pawl 51 and is displaced one tooth after each refrigerator door opening during the time the refrigerating unit is operating. Thus, the unit cycles and door openings during unit operation are counted and accumulated to provide a function for determining the initiation of defrosting of the evaporator 5.

The movement of the main arm 10 to the position wherein it brings the second contact 16 into engagement with the heater contact 20 for thereby energizing the heater and initiating a defrosting operation is determined by the position of the recess in the cam 45 with respect to the stop 48. As pointed out above the ratchet wheel 49 and the cam 45 are both secured to the rotatable shaft 50. Therefore, the recess 47 in the cam is disposed in alignment with the stop 48 after each complete revolution of the ratchet wheel 49 as effected by unit cycles and door openings during unit operation. When the slot 47 is so aligned with the stop 48 and the unit becomes idle, the arm 10 moves clockwise under the influence of the spring 22 and the stop 48 formed thereof moves into the recess 47. This brings the second contact 16 into engagement with the heater contact 20 whereby the heater is energized and defrosting is initiated. This movement of the arm also brings the arm 10 which is formed of a magnetic material into the field of attraction of a horseshoe magnet 57. The horseshoe magnet 57 holds the main arm 10 in the defrosting position. In the defrosting position of the main arm 10 the contact 20 serves as a stop for limiting the movement of the stop 48 into the recess 47 whereby the stop 48 is prevented from bottoming in the recess. Also, the contact 20 serves to prevent engagement of main arm 10 with the magnet 57, to which it is attracted. A set screw 58 fitted rotatably in the magnet 57 and threaded into a stationary bracket 59 both supports the magnet 57 and provides for adjustment of the space between the magnet and the main arm. By adjusting the space, and therefore, the attraction between the magnet and the arm, independent adjustment of the defrost temperature, or the temperature at which defrosting will terminate, may be obtained.

Upon attainment of a temperature at the evaporator 5 sufficient for melting all the frost formed thereon, the pressure in the bulb 33 and the bellows 32 is sufficient for overcoming the influence of the magnet 57 and the spring 22. Thereafter by means of the pin 35 the bellows 32 moves the main arm 10 counterclockwise in Fig. 2 out of the field of attraction of magnet 57 and the second

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contact 16 is disengaged from the heating contact 20 thereby to de-energize the heater and terminate the defrosting operation. It will be seen that this movement of the main arm 10 also brings the first contact 15 into engagement with the motor control contact 17 whereby a normal refrigerating operation is initiated.

In order to insure a defrosting operation after each complete revolution of the ratchet wheel 49 and the cam 45, I have provided means effective when the recess 47 in the cam 45 is aligned with the stop 48 whereby further rotation of the ratchet wheel 49, as effected by door openings, is prevented until the unit becomes idle and the stop 48 is able to move into the recess 47. This provision includes an upstanding stud or lug 60 carried on the ratchet wheel 49 in a substantially central radial position relative to the recess 47 in the cam 45 and intermediate the cam periphery and the ratchet wheel teeth. The lug 60 is adapted to cooperate with the stop 48 and a slot 61 formed in the lower edge thereof. The operation of this arrangement is shown sequentially in the Figs. 3, 4 and 5. If when the refrigerating unit is operating and the stop 48 is not in engagement with the cam periphery in the manner shown in Fig. 3, the recess 47 should, as a result of a door opening, become aligned with the stop 48, the lug 60 will engage the lateral portion of the stop 48 intermediate the end thereof and the slot 61. This prevents further rotational movement of the cam 45 and any subsequent door openings before a defrosting operation is initiated result simply in yielding of the resilient pawl 53. At the end of the current unit cycle and in the manner shown in Fig. 4 the stop 48 moves into the cam recess 47 and the pawl 51 displaces the ratchet wheel 49 one tooth space whereby the lug 60 is moved through the slot 61 in the stop 48. With the stop 48 positioned in the recess 47 the above described defrosting operation is initiated. Upon termination of the defrosting operation in the manner described above the main arm 10 moves to the unit operating position thereof and the stop 48 is moved out of the recess 47 and out of engagement with the cam periphery in the manner shown in Fig. 5. Thereafter the ratchet 49 may be rotated through unit cycles and door openings during unit operation until the recess 47 in the cam 45 is again aligned with the stop 48 at which time further rotation of the ratchet wheel and cam is prevented until the unit becomes idle and another defrosting operation is initiated in the manner described above.

As pointed out above my control provides for independent adjustment of both the normal operating and defrosting temperatures of the refrigerator. That is, through adjustments made to the tension of the spring 22 by turning the screw 29 the temperature ranges of each of the settings of the knob 42 may be adjusted. Also, adjustments to the position of the magnet 57 with respect to the main arm 10, as effected by turning the screw 58, determines the duration of, and therefore the temperature attained, during each defrosting operation.

As seen in Fig. 2 my control 9 also includes means whereby the user may shut off the refrigerator manually. The knob 42 has an "off" setting, as seen in Fig. 1, and when turned to this setting an arm 44a carried fixedly on the shaft 43 engages a projection 10a formed off the forward end of the main arm 10. This engagement positions and holds the main arm 10 in its intermediate or unit "off" position, in which the motor contacts are opened.

A modification of the counter, which includes an extra bearing and spring, but allows greater manufacturing tolerances, is illustrated in Fig. 6 and is generally designated 62. This form includes a ratchet wheel 63 and a cam 64 carried rotatably and spaced apart on a pin 65. Resiliently connecting the ratchet wheel 63 and the cam 64 and disposed therebetween is a torsion spring 66 which is stronger than the resilient pawl 53. The cam 64 is

formed to include a radial recess 67 and a U-shaped arm 68 formed off the cam periphery to one side of the recess 67. The U-shaped arm 68 includes a leg which extends downwardly, a base portion 69 and an upright stop or lug 70 which is offset laterally and disposed in a central radial position with respect to the recess 67. In this modification a stop 71 formed laterally off the main arm 10 and including a slot 72 cooperates with the cam recess 67 and the lug 70.

In operation the ratchet wheel 63 is angularly displaced in the same manner as the ratchet wheel in the first described embodiment. The termination of each unit cycle results in a movement of the main arm 10 inwardly toward the cam 64. This movement causes the pawl 51 to engage a tooth on the ratchet wheel 63 and displace it one tooth space. Due to the connection between the ratchet wheel 63 and the cam 64 by the torsion spring 66, this movement of the ratchet wheel results in a corresponding movement of the cam. If this movement of the cam does not position the recess 67 in alignment with the stop 71, the inward movement of the main arm 10 by the spring 22 results in the stop 71 engaging the cam periphery with considerable force in the manner and for the purpose described above. The resilient pawl 53 guided by the pawl 53a engages a single ratchet tooth each time the refrigerator door is opened for rotating the ratchet wheel 63 one tooth space. If the refrigerating unit is operating, actuations of the pawl 53 due to door openings will result in displacements thereby of the ratchet wheel 63 and the transfer of corresponding displacements to the cam 64 by means of the torsion spring 66. If, however, the refrigerating unit is idle and the stop 71 is biased against the cam periphery when the door is opened, the pawl 53 which is weaker than the torsion spring 66 will yield and no rotative effect will be had on the ratchet wheel and cam. In this manner door openings when the refrigerating unit is idle are prevented from being counted and being a determining factor in controlling the defrosting operation.

Following a complete rotation of the cam 64 as effected by refrigerator unit cycles and door openings during the operating period of the refrigerating unit, the lug 70 is brought into engagement with the stop 71 and the recess 67 formed in the cam 64 is aligned with the stop 71. This prevents further rotation of the cam 64 until a defrosting operation is initiated. Any door openings while the cam 64 is so prevented from rotating will simply result in the resilient pawl 53 yielding without displacing the ratchet wheel. The defrosting operation is thereafter initiated as soon as the unit becomes idle and the stop 71 moves into the recess 67. This results further in the pawl 51 engaging and displacing the ratchet wheel one tooth space. This movement of the ratchet wheel is transferred to the cam 64 by the spring 66 whereby the lug 70 is moved through the slot 72 in the manner shown in Fig. 7. Subsequently termination of the defrosting operation results in the stop 71 being withdrawn from the recess 67 on the opposite side of the lug 70.

While I have shown and described specific embodiments of my invention, I do not desire my invention to be limited to the particular forms shown and described and I intend by the appended claims to cover all modifications within the spirit and scope of my invention.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. In a refrigerator including a door, a refrigerating unit and defrosting means, automatic refrigerator controlling means comprising; an arm movable between a first and a second position, said arm effecting operation of said refrigerating unit when in said first position and energization of said defrosting means when in said second position, means biasing said arm toward said second position, temperature responsive means effective above a predetermined temperature for maintaining said arm in

said first position, said temperature responsive means being effective below said predetermined temperature for permitting movement of said arm toward said second position, said arm including a stop, a rotatable cam including a recess, means responsive to refrigerator door openings for rotating said cam, and means responsive to refrigerating unit cycles for rotating said cam, said cam permitting movement of said arm to said second position when said recess is aligned with said stop, the periphery of said cam being otherwise engaged by said stop whereby said arm is positioned intermediate said first and second positions.

2. In a refrigerator including a door, a refrigerating unit and defrosting means, automatic refrigerator controlling means comprising; an arm movable between a first and a second position, said arm effecting operation of said refrigerating unit when in said first position and energization of said defrosting means when in said second position, means biasing said arm toward said second position, temperature responsive means effective above a predetermined temperature for maintaining said arm in said first position, said temperature responsive means being effective below said predetermined temperature for permitting movement of said arm toward said second position, said arm including a stop, a rotatable cam including a recess, means responsive to refrigerator door openings for rotating said cam, and means responsive to refrigerating unit cycles for rotating said cam, said cam permitting movement of said arm to said second position when said recess is aligned with said stop, the periphery of said cam being otherwise engaged by said stop, engagement of said stop with said cam periphery being effective for positioning said arm intermediate said first and second positions and rendering said door responsive means ineffective for rotating said cam.

3. In a refrigerator including a door, a refrigerating unit and a defrosting means, automatic refrigerator controlling means comprising; an arm movable between a first and a second position, said arm effecting operation of said refrigerating unit when in said first position and energization of said defrosting means when in said second position, means biasing said arm toward said second position, temperature responsive means effective above a predetermined temperature for maintaining said arm in said first position, said temperature responsive means being effective below said predetermined temperature for permitting movement of said arm toward said second position, said arm including a stop, a rotatable cam including a recess, means responsive to refrigerator door openings for rotating said cam, means responsive to refrigerating unit cycles for rotating said cam, said cam permitting movement of said arm to said second position when said recess is aligned with said stop, and means effective when said recess is moved into alignment with said stop and said arm is in said first position for retaining said recess in said alignment until said arm moves toward said second position.

4. In a refrigerator including a door, a refrigerating unit and defrosting means, automatic refrigerator controlling means comprising; an arm movable between a first and a second position, said arm effecting operation of said refrigerating unit when in said first position and energization of said defrosting means when in said second position, means biasing said arm toward said second position, temperature responsive means effective above a predetermined temperature for maintaining said arm in said first position, said temperature responsive means being effective below said predetermined temperature for permitting movement of said arm toward said second position, adjusting means for varying the effect of said means biasing said arm thereby to determine said predetermined temperature, said arm including a stop, a rotatable cam including a recess, means responsive to refrigerator door openings for rotating said cam, and means responsive to refrigerating unit cycles for rotating said cam, said cam permitting movement of said arm to said second position

when said recess is aligned with said stop, the periphery of said cam being otherwise engaged by said stop whereby said arm is positioned intermediate said first and second positions.

5. In a refrigerator including a door, a refrigerating unit and defrosting means, automatic refrigerator controlling means comprising; an arm movable between a first and a second position, said arm effecting operation of said refrigerating unit when in said first position and energization of said defrosting means when in said second position, means biasing said arm toward said second position, temperature responsive means effective above a predetermined temperature for maintaining said arm in said first position, said temperature responsive means being effective below said predetermined temperature for permitting movement of said arm toward said second position, said arm including a stop, a rotatable cam including a recess, means responsive to refrigerator door openings for rotating said cam, means responsive to refrigerator unit cycles for rotating said cam, said cam permitting movement of said arm to said second position when said recess is in alignment with said stop, and a magnet attracting said arm when said arm is in said second position, the attraction of said magnet being overcome and said arm being actuated to said first position by said temperature responsive means at a predetermined temperature for terminating a defrosting operation.

6. In a refrigerator including a door, a refrigerating unit and defrosting means, automatic refrigerator controlling means comprising; an arm movable between a first and a second position, said arm effecting operation of said refrigerating unit when in said first position and energization of said defrosting means when in said second position, means biasing said arm toward said second position, temperature responsive means effective above a predetermined temperature for maintaining said arm in said first position, said temperature responsive means being effective below said predetermined temperature for permitting movement of said arm toward said second position, said arm including a stop, a rotatable cam including a recess, means responsive to refrigerator door openings for rotating said cam, means responsive to refrigerating unit cycles for rotating said cam, said cam permitting movement of said arm to said second position when said recess is in alignment with said stop, a magnet attracting said arm when said arm is in said second position, the attraction of said magnet being overcome and said arm being actuated to said first position by said temperature responsive means at a predetermined temperature for terminating a defrosting operation, and adjusting means for varying the position of said magnet relative to said arm thereby to determine said predetermined temperature at which said defrosting operation is terminated.

7. In a refrigerator including a door, a refrigerating unit and defrosting means, automatic refrigerator controlling means comprising; an arm movable between a first and a second position, said arm effecting operation of said refrigerating unit when in said first position and energization of said defrosting means when in said second position, means biasing said arm toward said second position, temperature responsive means effective above a predetermined temperature for permitting movement of said arm toward said second position, said arm including a stop, a rotatable cam including a recess, a rotatable ratchet wheel, a first pawl carried by said arm and effecting an angular displacement of said ratchet wheel in response to each cycle of operation of said refrigerating unit, a second pawl for effecting angular displacements of said ratchet wheel in response to openings of said refrigerator door, and means transferring displacements of said ratchet wheel to said cam, said cam permitting movement of said arm to said second position when said recess is aligned with said stop, the periphery of said cam being otherwise engaged by said stop whereby

said arm is positioned intermediate said first and second positions.

8. In a refrigerator including a door, a refrigerating unit and defrosting means, automatic refrigerator controlling means comprising; an arm movable between a first and a second position; said arm effecting operation of said refrigerating unit when in said first position and energization of said defrosting means when in said second position, means biasing said arm toward said second position, temperature responsive means effective above a predetermined temperature for maintaining said arm in said first position, said temperature responsive means being effective below said predetermined temperature for permitting movement of said arm toward said second position, said arm including a stop, a rotatable cam including a recess, a rotatable ratchet wheel, a pawl carried by said arm and effecting an angular displacement of said ratchet wheel in response to each cycle of operation of said refrigerating unit, a resilient pawl for effecting angular displacements of said ratchet wheel in response to openings of said refrigerator door, and means transferring the displacements of said ratchet wheel to said cam, said cam permitting movement of said arm to said second position when said recess is aligned with said stop, the periphery of said cam being otherwise engaged by said stop whereby said arm is positioned intermediate said first and second positions and said cam is restrained, said resilient pawl yielding and being ineffective for displacing said ratchet wheel when said cam is restrained.

9. In a refrigerator including a door, a refrigerating unit and defrosting means, automatic refrigerator controlling means comprising; an arm movable between a first and a second position, said arm effecting operation of said refrigerating unit when in said first position and energization of said defrosting means when in said second position, means biasing said arm toward said second position, temperature responsive means effective above a predetermined temperature for maintaining said arm in said first position, said temperature responsive means being effective below said predetermined temperature for permitting movement of said arm toward said second position, said arm including a stop, a rotatable cam including a recess, a rotatable ratchet wheel, a first pawl carried by said arm and effecting an angular displacement of said ratchet wheel in response to each cycle of operation of said refrigerating unit, a second pawl for effecting angular displacements of said ratchet wheel in response to openings of said refrigerator door, means transferring displacements of said ratchet wheel to said cam, said cam permitting movement of said arm to said second position when said recess is aligned with said stop, and a member engaging said stop when said recess is moved into alignment with said stop and said arm is in said first position for preventing further displacement of said cam until said arm moves toward said second position.

10. In a refrigerator including a door, a refrigerating unit and defrosting means, automatic refrigerator controlling means comprising; an arm movable between a first and a second position, said arm effecting operation of said refrigerating unit when in said first position and energization of said defrosting means when in said second position, means biasing said arm toward said second position, temperature responsive means effective above a predetermined temperature for maintaining said arm in said first position, said temperature responsive means being effective below said predetermined temperature for permitting movement of said arm toward said second position, said arm including a stop, a rotatable cam including a recess, a rotatable ratchet wheel, a first pawl carried by said arm and effecting an angular displacement of said ratchet wheel in response to each cycle of operation of said refrigerating unit, a second pawl for effecting angular displacements of said ratchet wheel in response to openings of said refrigerator door, means transferring displacements of said ratchet wheel to said

cam, said cam permitting movement of said arm to said second position when said recess is in alignment with said stop, and a magnet attracting said arm when said arm is in said second position, the attraction of said magnet being overcome and said arm being actuated to said first position by said temperature responsive means at a predetermined temperature for terminating a defrosting operation.

11. In a refrigerator including a door, a refrigerating unit and defrosting means, automatic refrigerator controlling means comprising; an arm movable between a first and a second position, said arm effecting operation of said refrigerating unit when in said first position and energization of said defrosting means when in said second position, means biasing said arm toward said second position, temperature responsive means effective above a predetermined temperature for maintaining said arm in said first position, said temperature responsive means being effective below said predetermined temperature for permitting movement of said arm toward second position, said arm including a stop, a rotatable shaft, a cam carried fixedly on said shaft, said cam including a recess, a ratchet wheel carried fixedly on said shaft, a first pawl carried by said arm and effecting an angular displacement of said ratchet wheel and cam in response to each cycle of operation of said refrigerating unit, and a second pawl for effecting angular displacements of said ratchet wheel and cam in response to refrigerator door openings, said cam permitting movement of said arm to said second position when said recess is aligned with said stop, the periphery of said cam being otherwise engaged by said stop whereby said arm is positioned intermediate said first and second positions.

12. In a refrigerator including a door, a refrigerating unit and defrosting means, automatic refrigerator controlling means comprising; an arm movable between a first and a second position, said arm effecting operation of said refrigerating unit when in said first position and energization of said defrosting means when in said second position, means biasing said arm toward said second position, temperature responsive means effective above a predetermined temperature for maintaining said arm in said first position, said temperature responsive means being effective below said predetermined temperature for permitting movement of said arm toward said second position, said arm including a stop, a rotatable shaft, a cam carried fixedly on said shaft, said cam including a recess, a ratchet wheel carried fixedly on said shaft, a pawl carried by said arm and effecting an angular displacement of said ratchet wheel and cam in response to each cycle of operation of said refrigerating unit, and a resilient pawl for effecting angular displacements of said ratchet wheel and cam in response to refrigerator door openings, said cam permitting movement of said arm to said second position when said recess is aligned with said stop, the periphery of said cam being otherwise engaged by said stop whereby said arm is positioned intermediate said first and second positions and said ratchet wheel and cam are restrained, said resilient pawl yielding and being ineffective for displacing said ratchet wheel and cam when said ratchet wheel and cam are restrained.

13. In a refrigerator including a door, a refrigerating unit and defrosting means, automatic refrigerator controlling means comprising; an arm movable between a first and a second position, said arm effecting operation of said refrigerating unit when in said first position and energization of said defrosting means when in said second position, means biasing said arm toward said second position, temperature responsive means effective above a predetermined temperature for maintaining said arm in said first position, said temperature responsive means being effective below said predetermined temperature for permitting movement of said arm toward said second position, said arm including a stop, said stop including a slot, a rotatable shaft, a cam carried fixedly on said shaft,

said cam including a recess, a ratchet wheel carried fixedly on said shaft, a first pawl carried by said arm and effecting an angular displacement of said ratchet wheel and cam in response to each cycle of operation of said refrigerating unit, a second pawl for effecting angular displacements of said ratchet wheel and cam in response to refrigerator door openings, said cam permitting movement of said arm to said second position when said recess is aligned with said stop, and a lug carried by said ratchet wheel and engaging said stop when said recess is moved into alignment with said stop and said arm is in said first position for retaining said recess in said alignment until said arm moves toward said second position, said lug passing through said slot in said top when said stop moves into said recess.

14. In a refrigerator including a door, a refrigerating unit and defrosting means, automatic refrigerator controlling means comprising; an arm movable between a first and a second position, said arm effecting operation of said refrigerating unit when in said first position and energization of said defrosting means when in said second position, means biasing said arm toward said second position, temperature responsive means effective above a predetermined temperature for maintaining said arm in said first position, said temperature responsive means being effective below said predetermined temperature for permitting movement of said arm toward said second position, said arm including a stop, a rotatable shaft, a cam carried fixedly on said shaft, said cam including a recess, a ratchet wheel carried fixedly on said shaft, a first pawl carried by said arm and effecting an angular displacement of said ratchet wheel and cam in response to each cycle of operation of said refrigerating unit, a second pawl for effecting angular displacements of said ratchet wheel and cam in response to refrigerator door openings, said cam permitting movement of said arm to said second position when said recess is in alignment with stop, and a magnet attracting said arm when said arm is in said second position, the attraction of said magnet being overcome and said arm being actuated to said first position by said temperature responsive means at a predetermined temperature for terminating a defrosting operation.

15. In a refrigerator including a door, a refrigerating unit and defrosting means, automatic refrigerator controlling means comprising; an arm movable between a first and a second position, said arm effecting operation of said refrigerating unit when in said first position and energization of said defrosting means when in said second position, means biasing said arm toward said second position, temperature responsive means effective above a predetermined temperature for maintaining said arm in said first position, said temperature responsive means being effective below said predetermined temperature for permitting movement of said arm toward said second position, said arm including a stop, a rotatable cam including a recess, a rotatable ratchet wheel, a pawl carried by said arm and effecting an angular displacement of said ratchet wheel in response to each cycle of operation of said refrigerating unit, a resilient pawl for effecting angular displacements of said ratchet wheel in response to openings of said refrigerator door, and a resilient connection between said ratchet wheel and said cam transferring displacements of said ratchet wheel to said cam, said cam permitting movement of said arm to said second position when said recess is aligned with said stop, the periphery of said cam being otherwise engaged by said stop whereby said arm is positioned intermediate said first and second positions and said cam is restrained, said resilient pawl yielding to the tension of said resilient connection and being ineffective for displacing said ratchet wheel when said cam is restrained.

16. In a refrigerator including a door, a refrigerating unit and defrosting means, automatic refrigerator controlling means comprising; an arm movable between a first and a second position, said arm effecting operation

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of said refrigerating unit when in said first position and energization of said defrosting means when in said second position, means biasing said arm toward said second position, temperature responsive means effective above a predetermined temperature for maintaining said arm in said first position, said temperature responsive means being effective below said predetermined temperature for permitting movement of said arm toward said second position, said arm including a stop, said stop including a slot, a rotatable cam including a recess, a lug carried by said cam, a rotatable ratchet wheel, a first pawl carried by said arm and effecting an angular displacement of said ratchet wheel in response to each cycle of operation of said refrigerating unit, a second pawl for effecting angular displacements of said ratchet wheel in response to openings of said refrigerator door, and a resilient connection between said ratchet wheel and said cam transferring displacements of said ratchet wheel to said cam, said cam permitting movement of said arm to said second position

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tion when said recess is aligned with said stop, said lug engaging said stop when said recess is moved into alignment with said stop and said arm is in said first position whereby said recess is retained in said alignment until said arm moves toward said second position, said lug passing through said slot in said stop when said stop moves into said recess.

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