Oct. 23, 1956 R. W. WOOD, JR 2,767,555

FROST BANK AUTOMATIC DEFROST ACTUATOR

Filed July 16, 1953

2 Sheets-Sheet 1

FIG. 1.

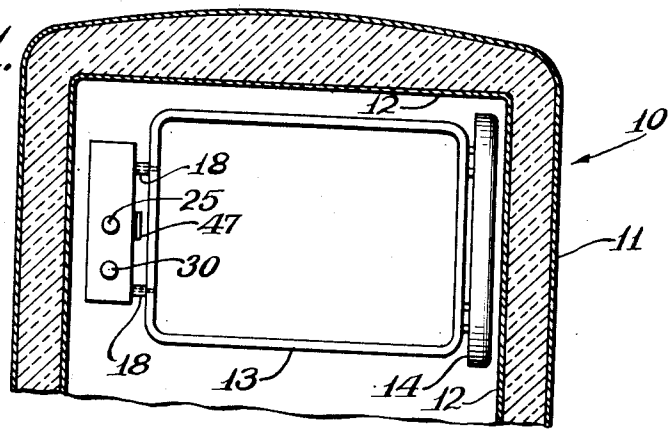


FIG. 2.

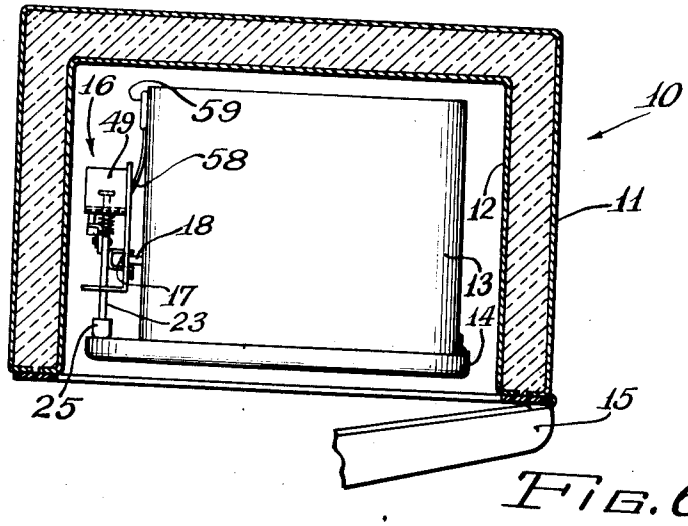
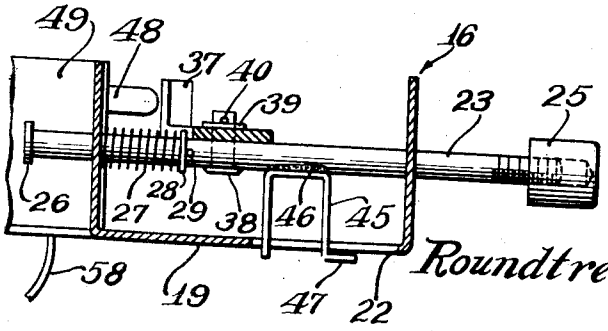
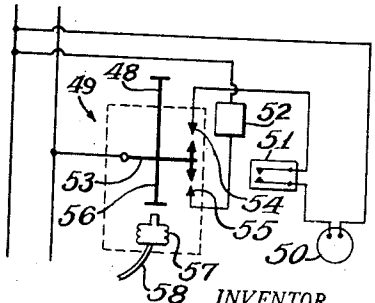


FIG. 6.

FIG. 5.





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2 Sheets-Sheet 2

FIG. 3.

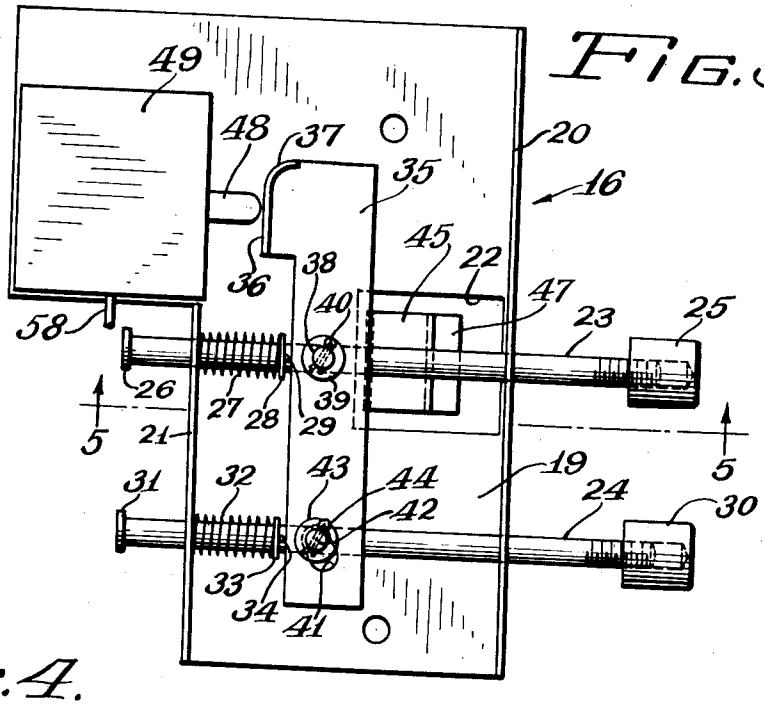
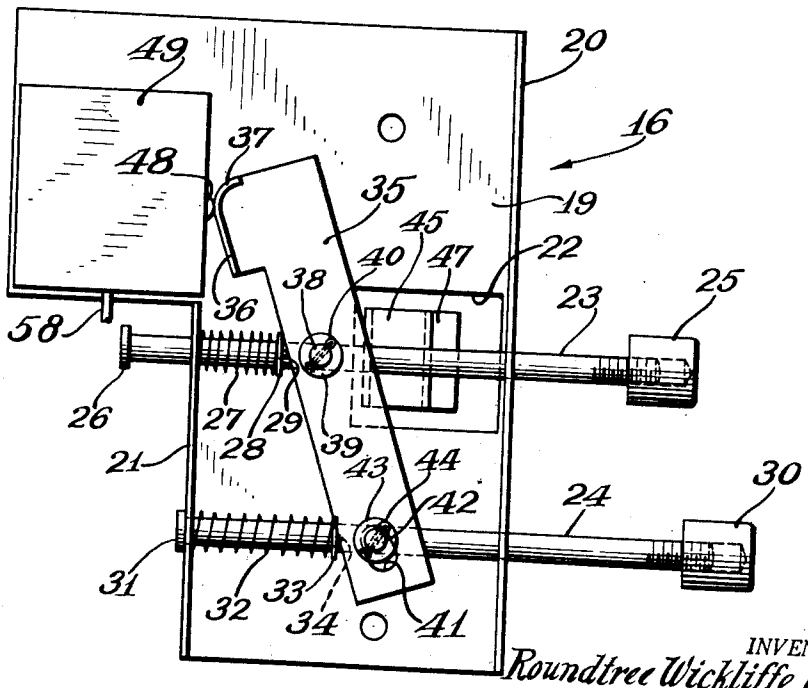


FIG. 4.



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United States Patent Office 2,767,555 Patented Oct. 23, 1956

2,767,555

FROST BANK AUTOMATIC DEFROST ACTUATOR

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Application July 16, 1953, Serial No. 368,274

7 Claims. (Cl. 62—2)

This invention relates to refrigerating apparatus, but more specifically it pertains to the automatic defrosting of a refrigerator evaporators and to the means for controlling such operation.

It is a principal object of this invention to provide an improved mechanism for initiating the defrost cycle when the accumulation of frost on a refrigerator evaporator is such as to make the removal thereof desirable.

Another object is to provide an improved defrosting control means wherein the defrost cycle is initiated as a result of the opening of the evaporator door.

A further object is to provide an improved defrost control means wherein a portion thereof must be in frictional engagement with the frost bank accumulated on the refrigerator evaporator before the defrost cycle is initiated automatically upon the opening of a door.

A still further object is to provide an improved defrost control wherein the operation of the defrost cycle may either be initiated automatically upon the opening of the evaporator door, or it may be commenced by manual manipulation of the control device.

A yet still further object is to provide an improved defrost control mechanism which is adapted for removable affixment to a refrigerant evaporator and is operable to initiate the defrost cycle upon the opening of a door associated with the refrigerator and which, additionally, is responsive to the temperature of the evaporator for stopping the defrost cycle.

Further objects and advantages of the invention will become apparent as the following description proceeds, and the features of novelty which characterize the invention will be pointed out with particularity in the claims annexed to and forming a part of this specification. For a better understanding of the invention, reference may be had to the accompanying drawings, in which:

Fig. 1 is a front elevational view of a portion of a refrigerator cabinet, with the cabinet walls in section, showing particularly the device of the present invention affixed to the evaporator thereof;

Fig. 2 is a sectional view of a refrigerator cabinet embodying the present invention;

Fig. 3 is a plan view of a control device constructed in accordance with the present invention, and shown in an inoperative position;

Fig. 4 is a plan view of the proposed device illustrated in Fig. 3 but shown in an operative position;

Fig. 5 is a sectional view of the proposed device taken on line 5—5 of Fig. 3;

Fig. 6 is a wiring diagram of the circuits associated with the proposed control device and schematically shows the electrical circuit switch operated by said device.

Referring now to the drawings for an illustrative embodiment of the present invention it will be noted there is depicted a generally conventional refrigerator cabinet 10 fashioned with an outer shell or wall 11, an inner shell or line 12, an evaporator 13, a door 14 hingedly mounted on one side of said evaporator, and a cabinet

closure or door 15 suitably hinged on one side wall of the cabinet.

The control device or defrost actuating mechanism of the present invention, indicated by the reference character 16, may be attached to one side of the evaporator 13, by any suitable means such as the screws 17, and spacer blocks or shims 18 may be used to space the device slightly away from the exterior surface of said evaporator. As illustrated, said device is affixed to the left side because the evaporator door 14 is hinged on the right side and, in the preferred embodiment shown herein, the device is actuated by the opening of this door. It is contemplated, however, that the device could, if preferred, be operated by the action of the cabinet door 15 instead of the evaporator door, in which case it would only be necessary to redimension the evaporator door and certain components of the device without in any way altering or modifying the mode of operation or the function of any of the parts thereof.

The proposed control device 16 is fashioned with a base or bracket-like support member 19 having upturned flanges 20 and 21, respectively, along opposite marginal edges thereof, and with an opening 22 in the base thereof. A pair of parallel rods or plungers 23 and 24 are spaced from one another and slidably mounted in the flanges 20 and 21. The rod 23 has a bumper of suitable resilient material, such as the rubber 25, threadably mounted on one end thereof while the opposite end may be upset or collared to provide a head or stop 26. A spring 27 coiled around a portion of said rod is disposed so that one end thereof stops against the flange 21 while the opposite end abuts a collar or ring member 28, fixed against axial movement along the rod and away from said spring by a pin 29, so that normally the spring is held in compression between said flange and collar. The rod 24 is similarly fashioned with a resilient bumper 30 threadably mounted on one end thereof while the opposite end is provided with a head or stop 31. A coil spring 32 encircles a portion of the rod 24 and a collar 33, positioned by the pin 34, serves to maintain said spring normally compressed and disposed in abutting relation with the flange 21.

A generally L-shaped operating or actuating lever 35 has one edge thereof upturned to provide a flange 36 which, preferably, is curved or rounded at one end as shown at 37 for reasons which will subsequently appear. The elver 35 is pivotally or rotatably affixed intermediate its ends to the rod 23, by suitable means such as the headed pin or stud 38, retaining washer 39 and cotter pin 40, which leaves said lever free to rotate in an axial plane about a radial axis through said rod. Proximate one end of the lever 35 there is provided a slotted opening 41 which receives in a loose fitting relationship one end of a headed pin or stud 42 the opposite end of which is anchored in the rod 24, while a retaining washer 43 and cotter pin 44 function to secure said lever to said rod in a combined sliding and rotatable relationship.

As best seen in Figure 5 there is generally U-shaped frost-engaging channel member 45 that is affixed, by some suitable means such as the welding indicated at 46, to the rod 23 and is adapted to slide therewith. One leg of said channel has a flange 47 normally projecting therefrom along the marginal edge thereof. Said channel member is positioned on the rod 23 so that the ends of the legs thereof project through the opening 22, in the base 19, and into the space adjoining the surface of the evaporator but actual contact therewith is precluded because of the shims or spacer blocks 18 which space the device from the surface thereof. The spacing provided between the ends of this channel and the evaporator depends upon the amount of frost it is desired be accumulated before the

device becomes operative to initiate the defrost cycle and hence the dimension or thickness of the shims **18** may be selected accordingly. The opening **22** in said base should be of such dimension as to preclude binding or frictional engagement between said channel member and the walls of the opening as said member slides along through the opening with each operation of the rod or plunger **23**, as well as to provide a space in which the frost may accumulate or build-up around said frost-engaging member. The flanged edge **36** of the operating lever **35** is adapted to contact a plunger **48**, which forms part of the operating mechanism of a defrost heat control electrical circuit switch **49** likewise mounted by suitable means on the base **19**, and as said actuating lever rotates about its pivotal stud **38** said flange will slide along the contacting surface of said plunger until the curved extension **37** thereof eventually picks up the contact and maintains it throughout the remainder of the movement of said lever.

As shown in the schematic representation depicted in Fig. 6 the refrigeration system includes a motor-compressor unit **50** which is connected to a suitable source of electrical power through a conventional temperature control device **51** and through the defrost heat control switch **49**. The defrost heating means, indicated generally by the reference character **52**, may include any well known electrical resistance coils or units which are attached by suitable means to the refrigerant evaporator **13** and arranged so that when the coils or units are energized the heat therefrom will effectively melt the frost from said evaporator.

The defrost heat control electrical circuit switch **49** may be any suitable switch adapted for opening one electrical circuit and then closing a second circuit, and further having means associated therewith for restoring initial conditions by reversing the operation at a subsequent time as a result of a temperature variation in a portion of the referigeration system. This device is fashioned generally as a single pole double throw switch in which a switch arm **53** may be snapped into one of two positions by means of the plunger **48**. In one such position the arm **53** engages the contact **54** and completes the electrical circuit through the motor-compressor unit **50**, and in the other position it engages the contact **55** and energizes the electrical circuit through the defrost heating device **52**. The arm **53** is provided with well known snap-spring means (not shown) which enables it to be snapped from one position to the other and retained in such position until otherwise released. This switch is further provided with a temperature control mechanism which actuates said switch to interrupt the electrical circuit through the defrost heating means in response to a preselected temperature in the evaporator. This is accomplished by an actuating lever **56** that is arranged to operate the arm **53** and break the circuit through contact **55** as a result of a motivating force supplied by the operation of a sylphon bellows **57**, in turn, connected by a capillary tube **58** to a feeler bulb **59** suitably mounted, preferably, proximate the coldest spot on the evaporator **13**. The feeler bulb, capillary and bellows are, of course, provided with a volatile fluid that expands and contracts in response to temperature changes as is well understood in the art. While any pre-selected temperature setting desired may be used it has been found that a temperature setting of the order of 47 degrees (plus or minus 2 degrees) Fahrenheit is highly effective in restoring the switch to normal at the best time.

To explain the operation of the proposed invention it is assumed that the evaporator door **14** is closed, as shown in Fig. 2, whereupon the relative position of the various components of the control mechanism will be substantially as indicated in Fig. 3. In this instance the evaporator door will abut or engage both bumpers **25** and **30** while their respective rods **23** and **24** will be slidably positioned rearwardly, both rods being moved

an equal distance, and the corresponding springs **27** and **32** will be somewhat compressed. The operating or actuating lever **35** at this time will be positioned substantially normal to the rods **23** and **24** and the channel member **45** will be disposed proximate one end of the opening **22** in the base member **19**. When the evaporator door is opened, as indicated in Fig. 1, the bumpers **25** and **30** are free to move and, aided by the actions of their respective springs **27** and **32**, will be propelled forwardly an equal distance carrying with them the operating lever **35** and the channel member **45**. The parts of the mechanism may be so dimensioned that when the channel member **45** reaches the front of the opening **22** the springs **27** and **32** will be extended to their unloaded positions, but, if not, the stops **26** and **31** on the rods will abut the flange **21** and prohibit or restrict further forward movement thereof.

As is well known in the art with each opening of the cabinet door **15** there is a build-up of a limited amount of frost upon the exterior surfaces of the evaporator until finally the deposit thereon is sufficiently thick as to require removal in any suitable manner. In the proposed device when the frost builds up to a predetermined thickness on the evaporator it contacts the flange **47**, of the frost-engaging channel member **45**, and eventually surrounds this flange and a portion of the opposite leg of said channel member. At this time the opening **22** will also be so filled with frost that said channel member becomes locked or frozen in place, thereby prohibiting any sliding motion of said member, or of the rod **23** to which it is affixed, and when such conditions prevail the evaporator is ready for defrosting.

Under such conditions when the evaporator door **14** is next opened the bumper **30** being free to move will be propelled forwardly by the action of spring **32** but bumper **25** must remain in position because of the ice-locked condition of the channel member **45** with which it is associated. The relative position of the various parts of the mechanism under this condition is best shown in Fig. 4. As the rod **24** slides forwardly, upon opening of the evaporator door, it carries with it one end of the operating lever **35** and, while another portion of said lever rotates about the pivotal stud **38** in the rod **23**, the pin or stud **42** freely slides in the slotted opening **41** in said lever and thus does not interfere with the sliding motion of the rod **24**. The actuating lever **35** after being thus rotated will be positioned so that the flange **36** on the opposite end thereof depresses the plunger **48**, of the defrost heat control switch **49**, and thereby initiates the operation of the defrost cycle. When the temperature of the evaporator **13** is such that it requires defrosting the bellows **57**, of the thermostatic device associated with said switch, will be contracted sufficiently to permit the plunger **48** when depressed to snap the switch arm **53** out of engagement with contact **54** and into engagement with contact **55**. When the circuit through contact **54** is broken the motor-compressor unit **50** will cease to operate, and when the circuit through contact **55** is energized the defrost heater unit **52** will begin to heat and melt the frost from the evaporator. The thermostatic device, of which the bellows **57** forms a part, being adjusted for a particular temperature when the evaporator reaches this predetermined value the bellows **57** expands and actuates the lever **56** thereby interrupting the flow of electrical current through the defrost heater unit **52**, and reenergizing the circuit through the motor-compressor unit **50** to return the refrigeration system to normal cycling with the temperature control unit **51** controlling future cycling thereof. As soon as the temperature of the evaporator is again reduced, through normal cycling of the system, the bellows **57** will have contracted and moved away from the lever **56** a distance sufficient to permit the plunger **48** to freely snap the switch arm **53** again when the defrost cycle is subsequently initiated. If the plunger **48** should be manually depressed before the temperature of the

evaporator is such as to require defrosting the bellows 57 together with the lever 56 would be so positioned as to prevent the switch arm 53 from being snapped over to contact 55 and hence as soon as the manual pressure was removed from said plunger the arm 53 would return to its normal position in engagement with contact 54. In this way initiation of the defrost cycle is precluded when the temperature of the evaporator is below the particular value selected for responsive operation of the bellows 57.

Although only a preferred form of the invention has been illustrated, and that form described in detail, it will be apparent to those skilled in the art that various modifications may be made therein without departing from the spirit of the invention or from the scope of the appended claims.

What is claimed is:

1. In a refrigerator including an evaporator, evaporator defrosting means and means for controlling said evaporator defrosting means comprising: a bracket mounted upon said evaporator; a switch carried by said bracket; first and second members slidably mounted on said bracket; an actuating arm pivotally affixed to the said first member and slidably affixed to the said second member, and having an end portion of said arm disposed adjacent said switch; resilient means reactive on said first and second members for urging said actuating arm out of engagement with said switch; said arm being manually rotatable into position such that the end portion thereof engages said switch and initiates operation of said defrosting means.

2. In a refrigerator including an evaporator, evaporator defrosting means and means for controlling said evaporator defrosting means comprising: a bracket mounted on said evaporator; a switch carried by said bracket; first and second members disposed parallel to one another with each being slidably mounted in said bracket; an actuating arm pivotally affixed intermediate the ends thereof to said first member, and slidably secured proximate one end thereof to said second member, and having the opposite end thereof adapted for engaging said switch; resilient means reactive on said first and second members for urging said actuating arm normally out of engagement with said switch; said actuating arm being arranged to rotate into engagement with said switch and initiate operation of said defrosting means upon application of force to one end of said first member.

3. In a refrigerator having an evaporator, evaporator defrosting means and a door, means for controlling said evaporator defrosting means comprising: a bracket mounted on said evaporator; a switch carried by said bracket; first and second member slidably mounted in said bracket and having one end of each member disposed adjacent the door in its closed position; an actuating arm pivotally secured to each of said members and having one end thereof disposed adjacent said switch; a frost-engaging member affixed to said first member and disposed so that said first member is constrained against movement when a predetermined thickness of frost accumulates on the evaporator adjacent said frost-engaging member; resilient means urging said first and second members into engagement with said door when closed so that upon opening said door when the frost is of a predetermined thickness the said second member will slide axially to rotate said actuating arm into engagement with said switch to initiate operation of said defrosting means.

4. In a refrigerator having an evaporator, evaporator defrosting means and a door, means for actuating said evaporator defrosting means comprising: a support bracket having an opening therein and mounted on said evaporator; a switch carried by said support bracket; first and second members slidably mounted in said support bracket, and having one end of each member disposed adjacent the door in its closed position; an actuating arm pivotally secured to each of said members, and having one end thereof disposed adjacent said switch; a frost-engaging

member affixed to said first member and projecting through said support bracket opening into the vicinity of the exterior surface of said evaporator so that the said first member is constrained against movement when a predetermined thickness of frost accumulates on the evaporator adjacent said frost-engaging member; and resilient means urging said first and second members into engagement with said door when closed so that upon opening of said door when the frost is of a predetermined thickness the said second member will slide axially to rotate said actuating arm into engagement with said switch to initiate operation of said defrosting means.

5. In a refrigerator, having an evaporator, evaporator door and evaporator defrosting means, means for controlling said evaporator defrosting means comprising: a bracket having an opening therein and mounted on said evaporator in spaced relation therefrom; a switch carried by said bracket; first and second members slidably mounted in said bracket, and having one end of each member disposed adjacent said evaporator door in its closed position; an actuating arm pivotally secured to each of said members, and having one end of said arm disposed adjacent said switch; a frost-engaging member depending from said first member and projecting through said bracket opening into the space between said evaporator and said bracket whereby when a predetermined thickness of frost accumulates on said frost-engaging member the said first member is constrained against movement; and resilient means urging said first and second members into engagement with said evaporator door when closed whereby upon opening the door when the frost is of a predetermined thickness on said frost-engaging member the said second member will slide axially to rotate said actuating arm into engagement with said switch to initiate operation of said defrosting means.

6. In a refrigerator having an evaporator, evaporator door and evaporator defrosting means, means for controlling said evaporator defrosting means comprising: a bracket having a base portion with an opening therein, and upturned flanges along opposite marginal edges of the base; said bracket being mounted on said evaporator in closely spaced relation therefrom; a switch carried by said bracket; first and second members slidably mounted in the flanges of said bracket, and having one end of each member disposed adjacent said evaporator door in its closed position; an actuating arm pivotally secured to each of said members, and having one end thereof disposed adjacent said switch; a frost-engaging member depending from said first member and projecting through said bracket opening into the space between said evaporator and said bracket so that when a quantity of frost accumulates on said frost-engaging member and fixedly positions said member the said first member is constrained against movement; and resilient means urging said first and second members into engagement with said evaporator door when closed so that upon the opening thereof and with the said first member fixedly positioned the said second member will slide axially to rotate said actuating arm into engagement with said switch to initiate operation of said defrosting means.

7. In a refrigerator, including an evaporator, evaporator defrosting means and a door, means for initiating operation of said evaporator defrosting means comprising: a bracket having an opening therein and mounted on said evaporator in closely spaced relation therefrom; a switch carried by said bracket; first and second members parallelly disposed and slidably mounted in said bracket, and having one end of each member extending to said door when the door is in its closed position; an actuating arm pivotally secured to said first member; means slidably securing said actuating arm to said second member including a slotted opening proximate one end of said actuating arm and a pivotal stud that passes through said slotted opening and is carried by said second member; a frost-engaging member depending from said first mem-

ber and projecting through said bracket opening and into the space between said evaporator and said bracket so that when a predetermined quantity of frost bridges the space between said frost engaging member and the evaporator said frost-engaging member is fixedly positioned and said first member from which it depends is constrained against movement; resilient means urging said first and second members into engagement with said door in its closed position so that upon the opening thereof the pivotal stud in said second member is slidable in the slotted opening of said actuating arm for rotating said arm about its pivot in said first member and causing one end of said arm to engage said switch and initiate operation of said defrosting means.

References Cited in the file of this patent

UNITED STATES PATENTS

2,007,409	Schweitzer	July 9, 1935
2,064,010	Hull	Dec. 15, 1936
2,147,867	Volpin	Feb. 21, 1939
2,375,859	Marcy	May 15, 1945
2,624,180	Grimshaw	Jan. 6, 1953
2,704,441	Morton	Mar. 23, 1955