June 10, 1947. C. E. VANDENBERG 2,421,819

DEVICE FOR REGULATING THE THICKNESS OF ICE FORMATIONS ON AN EVAPORATOR COIL

Filed June 10, 1942 2 Sheets-Sheet 1

Fig. 1

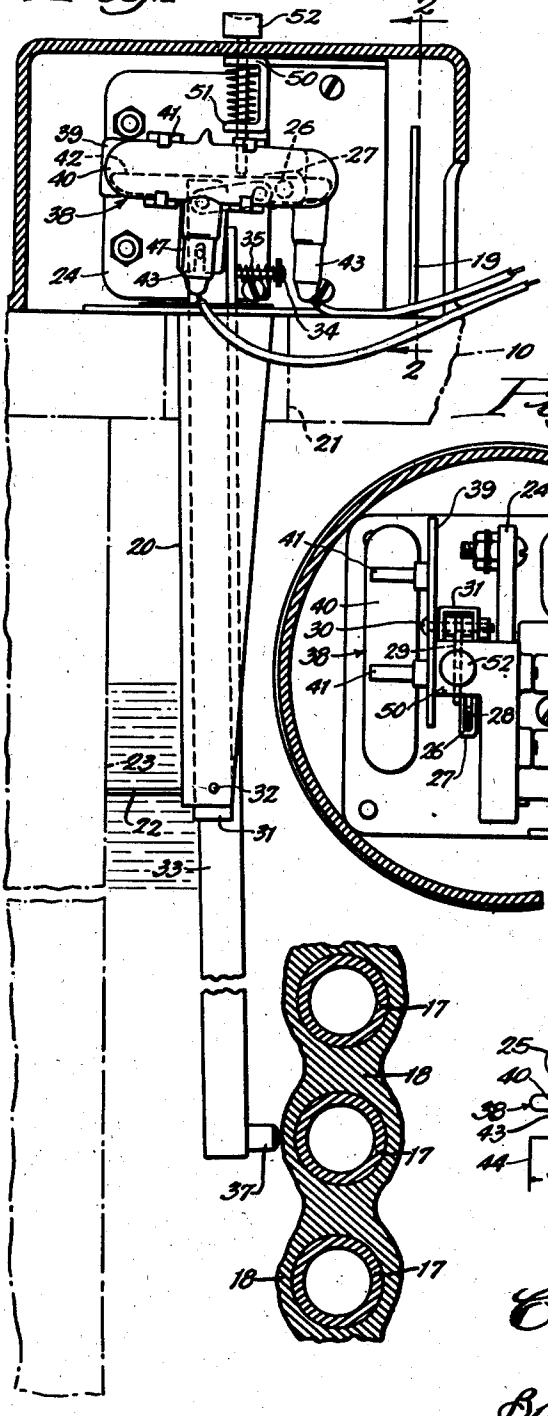


Fig. 2

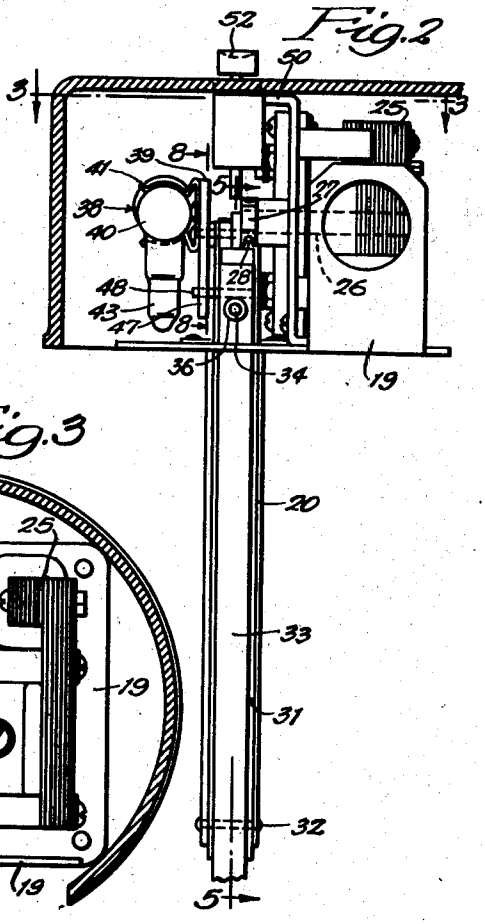
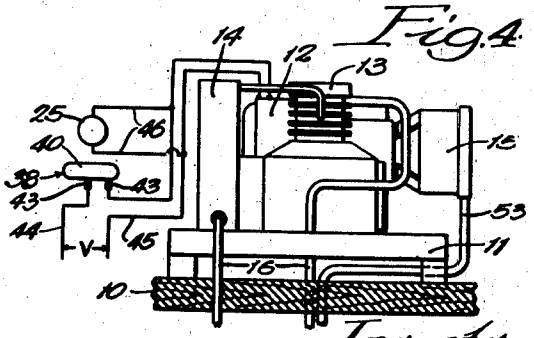


Fig. 3

Fig. 4



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June 10, 1947. C. E. VANDENBERG 2,421,819

DEVICE FOR REGULATING THE THICKNESS OF ICE FORMATIONS ON AN EVAPORATOR COIL

Filed June 10, 1942 2 Sheets-Sheet 2

Fig. 5

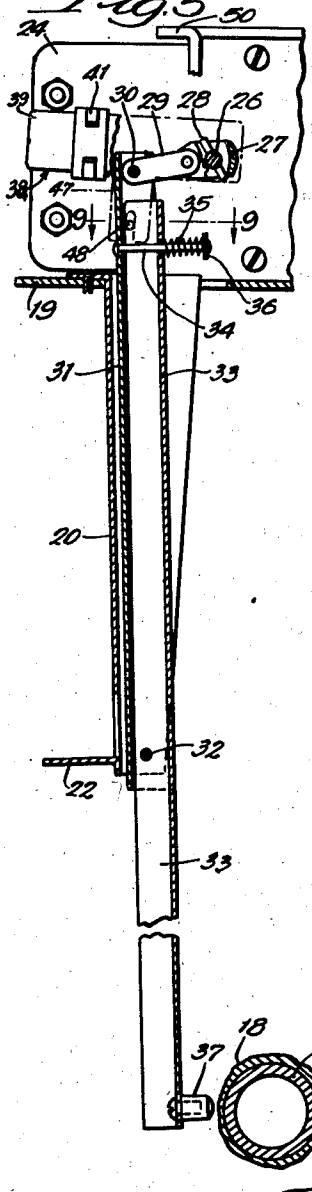


Fig. 6

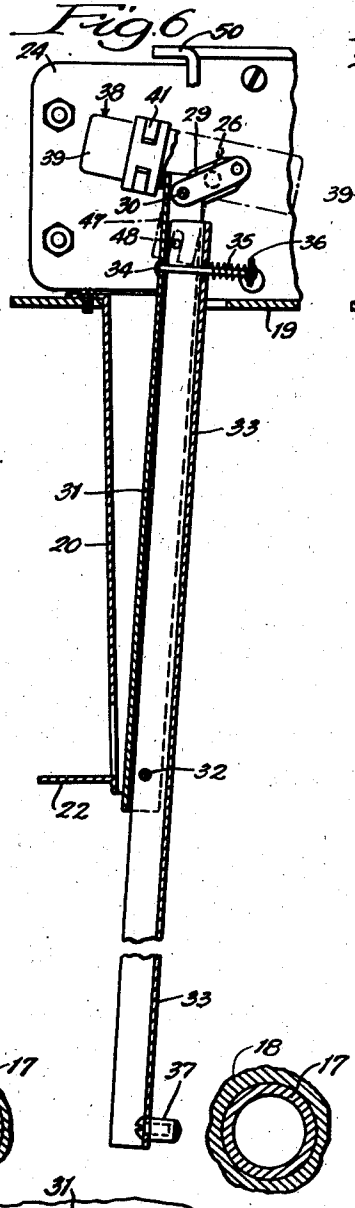


Fig. 7

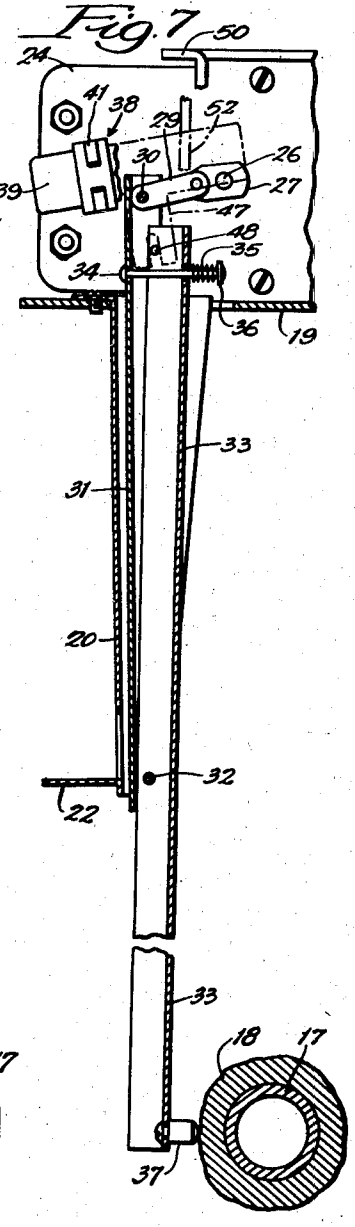


Fig. 8

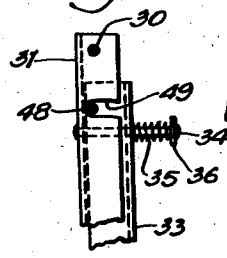
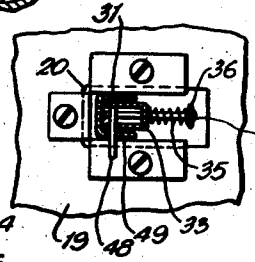


Fig. 9



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UNITED STATES PATENT OFFICE

2,421,819

DEVICE FOR REGULATING THE THICKNESS OF ICE FORMATIONS ON EVAPORATOR COILS

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Application June 10, 1942, Serial No. 446,520

14 Claims. (Cl. 62—4)

1

This invention relates to a regulating device and more particularly to a device for use with an apparatus for altering surface formations, whereby the regulating device controls or regulates the operation of said apparatus in the formation or alteration of the surface.

The invention is especially adapted for use in a device for regulating the thickness of an ice bank to be formed on the coils of a refrigerator. In the ordinary refrigerating machine of one particular type, there is provided a plurality of refrigerating coils which are immersed in a tank of water. These coils have refrigerant passed therethrough for the purpose of creating an ice bank to cool the water, the tank of water thus serving as a cooling receptacle. In such instances, it is desirable to control the operation of the refrigerator according to the size or thickness of the ice bank formed on the coils. Various devices have heretofore been employed for this purpose. However, these devices have been found to be generally defective in that they are not accurately responsive to the formation of the ice bank on the coils. According to the present invention, there is provided an improved regulating device designed to respond immediately to the attainment of a predetermined or desired thickness of an ice bank, and, being so responsive, to cut off the operation of the refrigerating mechanism.

As will be hereinafter pointed out, the principles of the invention may be embodied in devices for use with other types of apparatus that may function to alter or form or otherwise affect the dimensions of an article or an element, it being obvious that other elements or articles may be subjected to changes similar to the increase in size of an ice bank.

The principal object of the present invention is to provide an improved regulating, or control device for the purposes set forth above.

An important object of the invention is to provide a regulating device having a contactor arm movable through a range including as one of its limits a point designating a desirable position or other characteristic of a surface or element to be formed or otherwise affected.

It is an important object of the invention to utilize the movable arm or equivalent means in conjunction with regulating the maximum thickness of an ice bank in a refrigerating machine, whereby the contactor does not have permanent contact with the ice bank, thus eliminating the possibility that the ice bank will build up around the contactor.

2

Another object of the invention is to provide a regulating device which is automatic in operation in response to the alteration of a surface, such as the increase to a predetermined size of an ice bank, and which device may permit operation of the refrigerating compressor or other apparatus even though the ice bank has reached its desired thickness.

Another object is to provide the regulating device with an electrical control system.

Other objects and desirable features of the invention will become apparent as the disclosure of the invention is more fully made in the following description and accompanying sheets of drawings, in which:

Figure 1 is a view of a preferred form of the regulating device partly in section and shown in position in the cabinet of a refrigerator;

Figure 2 is an end view of the same, with the cover shown in section;

Figure 3 is a transverse sectional view taken along the line 3—3 of Figure 2;

Figure 4 is a view of a portion of the refrigerating apparatus, shown in conjunction with a diagrammatic illustration of the electrical control circuit;

Figure 5 is a view taken on the line 5—5 of Figure 2 showing the contactor arm of the regulator in one position of its operation before the formation of a desired ice bank;

Figure 6 is a similar view showing the contactor in another position of its movement;

Figure 7 is a similar view showing the contactor arm as affected by the ultimate thickness of the ice bank and the resultant operation of the control switch;

Figure 8 is a fragmentary detail view taken on the line 8—8 of Figure 2 showing the association between parts of the contactor arm; and

Figure 9 is a fragmentary view showing in section the relation between the contactor arm and carrier structure, as viewed along the line 9—9 of Figure 5.

One form of refrigerating apparatus with which the regulator may be used is illustrated in the patent to Borgerd et al. 2,077,871, April 20, 1937. For the purposes of the present disclosure, reference is had to that patent for a detailed illustration of the parts of the refrigerator. However, Figure 4 of the present case illustrates those parts of the apparatus thought necessary for the disclosure of the structure and operation of the present invention. In that figure, 10 indicates the upper portion or cover of a tank or cabinet for a refrigerator. A supporting table 11 is mounted

on the cabinet 10 and carries an electric motor 12, a compressor 13, a condenser 14, and an agitating pump 15. The motor drives the compressor in the usual manner to force refrigerant through tubes or pipes 16 which lead to a plurality of coils forming a refrigerating unit around the inside of the refrigerating cabinet 10. Parts of these coils or tubes are designated in other figures by the numeral 17.

As indicated generally in Figures 1 and 5 to 7, inclusive, the coils 17 function to form an ice bank indicated generally at 18. As shown in the patent referred to above, the coils are immersed in water contained in the refrigerating cabinet or tank, and operation of the refrigerating system results in the formation of an ice bank completely around the inside of the refrigerator. The space delineated by the ice bank is adapted for the reception of articles to be refrigerated.

As previously stated, an important object of the present invention is to provide means for the regulation of the size or thickness of the ice bank 18 formed on the coils 17. A preferred embodiment of the invention comprises a regulating device which is mounted on the top of the cabinet 10. This structure is best shown in Figure 1.

The regulating or control device comprises an upper support 19 secured to the top of the cabinet 10 and having a depending bracket 20 projecting through an opening 21 in the top of the cabinet. The bracket is rigidly secured at its upper end to the support 19, and its lower end is provided with a lug 22 adapted to engage an end or side wall of the cabinet 10, as at 23. This arrangement provides a rigid construction and maintains the position of the device in the cabinet.

The support 19 rigidly carries a vertically disposed plate 24 and also carries a driving means in the form of a small electric motor 25. The plate is apertured at its center, and a driving shaft 26 driven by the rotor of the motor 25 through extensive reduction gearing extends therethrough. At the side of the plate opposite the motor 25 the driving shaft 26 fixed to run counter-clockwise viewing it as in Figure 1 carries a crank member 27 in the form of a U-shaped member, as best shown in Figure 3. The direction of rotation of the shaft 26 may be clockwise depending on the arrangement of the associated elements. The crank and the shaft 26 may have relative angular movement to a limited extent, and the shaft carries a driving pin 28 which extends at opposite sides of the shaft to abut the bight portion of the U-shaped member 27, as best shown in Figure 5. The crank has pivoted at one end thereof a driving link 29. The other end of the link is pivoted by a pin 30 to the upper end of a vertically extending carrier arm 31. This arm extends downwardly and is mounted on the bracket 20 by means of a transverse pivot pin 32.

As best shown in Figure 9, the carrier arm 31 is of channel construction. The arm serves to carry a second or contactor arm 33, this second arm being also mounted on the pivot pin 32. The arms 31 and 33 are mounted for relative movement about the pivot pin 32, and both arms as a unit may pivot about the pin 32 with respect to the bracket 20. The arm 33 is likewise of channel construction and is disposed within the channel of the arm 31. The upper end of the arm 33 is resiliently connected to the upper end of the arm 31, preferably by means of a headed rod 34 which passes through both arms and which carries a small compression spring 35 operable to expand between an abutment 36 on the rod 34 and an

outer portion of the arm 33. This means holds the arms for normal movement in unison. The arm 33 projects a substantial distance below the end of the arm 31 and carries thereon a contacting button 37 which is adapted to contact the ice bank 18 when said bank reaches a point at or beyond a predetermined thickness.

The upper end of the arm 31 projects slightly beyond the upper end of the arm 33, at which point it carries the transverse pivot pin 30. This pin serves to mount pivotally on the arm 31 an electrical switch 38 preferably constructed as a plate member 39 mounted on the pin 30 and a sealed non-conducting tube 40 mounted on the plate 39 by clips 41. The tube preferably contains a quantity of mercury, as indicated by the dotted line at 42 in Figure 1. At spaced portions near the right end of the tube 40 there is provided a pair of depending tubular portions 43, each of which is connected in an electrical circuit, as will presently appear. The mercury 42 in the tube 40 connects the portions 43 and provides a conductor between these portions.

The electrical circuit for the operation of the regulating device is illustrated diagrammatically in Figure 4. The tubular portions 43 of the tube 40 are connected to electrical leads 44 and 45, and thus a complete circuit is established between a source of electrical energy through the switch 38 and the motor 12 for operating the refrigerating system. As is also shown in this figure, the small electric motor 25 is connected in parallel with this circuit by leads 46. From the description thus far it will be seen that the refrigerating system is operable continuously as long as the mercury 42 in the switch 38 maintains its contact between the leads that enter the tubular portions 43. As will be described below, the regulating device is operable to break this circuit in response to a predetermined thickness attained by the formation of the ice bank on the coils 17.

The plate 39, which mounts the switch 38 on the upper end of the arm 31, is provided with an integral depending portion 47, the lower end of which is slotted and engageable with a pin 48 carried at the upper end of the second or contactor arm 33. As previously stated, the arms 31 and 33 may have relative movement, this movement being ordinarily resisted by action of the small spring 35. One of the sides of the arm 31 is provided with an arcuate slot 49 which permits free operation of the pin 48 when the arms have relative movement. This structure is best shown in Figure 8.

From the description thus far, it will be seen that with the switch 38 closed the motors 12 and 25 operate, the former to drive the compressor and agitating pump and the latter to rotate the shaft 26 very slowly. Because of the linkage comprising the crank 27 and link 29, rotation of the shaft 26 causes rocking of the arms 31 and 33. These arms rock very slowly and in unison until the ice bank reaches the predetermined thickness, at which time the contact in the switch 38 is broken and the refrigerating system stops. A further and more detailed description of the operation of the control means will be set forth below.

The plate 24 on the support 19 has its upper end open to provide a horizontal flange 50 which cooperates with an integral parallel flange 51 to mount a spring-pressed plunger 52. The lower portion of this plunger is disposed directly above the linkage comprising the crank 27 on the shaft 26 and the connecting link 29. The relationship

of these parts is best indicated in Figures 1 and 2, and the position of the lower portion of the plunger 52 is shown in broken lines in Figure 7. The plunger is thus operable to be pressed downwardly on the over-center linkage formed by the parts 27 and 29 so that the crank 27 may be rotated with respect to the shaft 26. This relative rotation is permitted because of the loose connection between the shaft and the crank. Since the link 29 is connected to both the arm 31 and the switch 38, pressure on the plunger to break the over-center connection will cause the switch 38 to pivot in a clockwise direction, or toward a direction in which the switch will close the circuit.

The agitator pump 15 is of the pneumatic type, as described in detail in the patent referred to above, and through the medium of tubes or pipe lines 53 is adapted to agitate the water in the cabinet 10. The tubes 53 extend downwardly toward the bottom of the tank and cause air bubbles to rise in the water adjacent the ice banks.

In the operation of the device, the switch 38 is closed, closing the electrical circuits to both the motor 12 and the motor 25. The refrigerator then operates normally. As the refrigerating system continues to operate, ice banks are formed on the coils or tubes 17, as previously described. when the ice bank is comparatively thin, as illustrated in Figure 5, the arms 31 and 33 move back and forth in unison, driven by the small motor 25. This repeated movement of the arm is comparatively slow and is important from the standpoint of providing an accurate determination of the proper thickness of the ice bank. If the arms were so arranged as to be stationary with respect to the ice bank being formed, it would be found that the ice would build up around the contact point 37 so that the bank would attain a considerable thickness, even beyond that desired, before the control device would operate. It is accordingly preferred that the arms move back and forth, as described.

As the arms slowly oscillate or pivot, the switch 38 is unaffected, the slow rocking movement being insufficient to upset the contact or connection formed by the mercury 42. When the ice bank reaches the desired thickness, as indicated in Figure 7, continued movement of the arm 33 in a counter-clockwise direction about the pivot 32 is resisted; but, since the motor 25 continues to operate, the arm 31 is pivoted with respect to the arm 33, the resilient connection 35 permitting this relative movement. Now, since the slotted arm or leg 47 on the switch-carrying plate 39 is engaged by the transverse pin 48 in the arm 33, continued rotation of the motor shaft 26 moves the arm 31 and switch 38 to the left with respect to the arm 33. Thereupon the angular movement of the tube 40 is in a counter-clockwise direction to the extent that the contact or connection provided by the mercury 42 is broken, the mercury flowing to the left end of the tube 40 and hence out of the depending contact 43 at the extreme right end. As shown in Figure 6, the mercury tube 40 is also tilted, but contrary to Figure 7 it is tipped angularly clockwise whereupon the mercury flows to the right end of the tube. Inasmuch as both depending contact tubes 43 are substantially positioned on the right end of the main tube 40, the mercury continues to make a complete circuit between the depending contacts 43. Since the switch 38 is disconnected at the time when the tube 40 is tipped

downwardly to the left, the motor 25 is stopped and the linkage comprising the link 27 and link 29 assumes the position shown in Figure 7, with the pivot axis of the shaft 26 and pivot pin 30 in alinement with the pivotal connection between the link 29 and the crank 27. Thus, the switch 38 is held in disconnected position. At the same time, the main motor 12 is cut out and the refrigeration of the compartment by operation of the motor ceases.

Certain conditions exist when it is desired to operate the motor 12 regardless of the fact that a sufficient ice bank has been formed on the coils or tubes 17. Such a condition may exist when it is desired to operate the agitator 15, which is driven by the motor 12. Ordinarily, such operation would be impossible as long as the switch 38 is opened by the position of the arms 31 and 33 as assumed upon contact of the contact arm 33 with a predetermined or desired ice bank thickness. However, the switch 38 may be closed regardless of the size of the ice bank, this result being accomplished by the actuation of the spring-pressed plunger 52.

Figure 7 illustrates the parts in the position assumed thereby when the ice bank has reached its proper thickness. It will be noted from an examination of this figure, in conjunction with an examination of Figure 1, that the lower portion of the plunger 52 is directly above the connection between the motor shaft 26 and the carrier arm 31. Pressure on the plunger serves to move the link 29 downwardly and to rotate the crank 27 with respect to the motor shaft 26. As stated previously, this relative rotation is permitted because of the loose connection effected between the motor shaft 26 and crank 27 by the driving pin 28. In short, pressure on the plunger 52 serves to pivot the switch 38 back to a position in which the mercury 42 can complete the circuit between the contacts in the spaced tubular portions 43. Consequently, the motor 12 may be driven for a short period. This period is herein measured by one complete revolution of the motor shaft 26, after which the parts will be restored to the positions shown in Figure 7, at which time the switch 38 will again be opened.

It will be seen from the foregoing description that the present form of the regulating device incorporates all the desirable features hereinbefore enumerated. The contact arm 33 is movable with respect to the ice bank until the ice bank reaches its desired thickness, thus eliminating the possibility that the ice bank will build up around the contact member 37 and exceed its desired thickness. The switch 38 is immediately responsive to the attaining by the ice bank of its proper dimensions. In addition, the switch 38 is capable of a separable manual control for operating the refrigerating system independently of the automatic operation effected by the thickness of the ice bank. This control is not designed so as to permit excessive operation of the refrigerating system to an extent that the mechanism will be damaged, but the independent control of the switch is provided solely for the purpose of operating the motor 12 for short periods. The entire device is so constructed as to be capable of ready installation in a refrigerating cabinet, for which use it is especially adapted; although, as previously stated, the device may also be adapted for use in conjunction with other and similar types of apparatus and the use of the device is necessarily limited to the control of refrigerating apparatus.

The foregoing description of the invention will undoubtedly suggest various modifications and uses in the preferred form of the invention shown and described. However, it will be understood that such modifications and alterations may be made without departing from the spirit and scope of the invention as defined in the appended claims.

What is claimed is:

1. The combination with refrigerating apparatus including a compressor, a motor for operating the same, a condenser and an evaporator in circuit with said compressor and said condenser, of a device for controlling the operation of said apparatus to limit the size of ice formations on said evaporator; said device comprising a contactor adapted to move repeatedly to and from a predetermined position to be reached by ice forming on the surface of said evaporator, a movable carrier for the contactor, means for moving the carrier to move the contactor repeatedly to and from the said predetermined position, means resiliently connecting the contactor and the carrier to permit relative movement therebetween upon contact of the contactor with an ice formation projecting from said surface to the said predetermined position, and means actuated by relative movement between the carrier and contactor to stop operation of the carrier-moving means and to stop the operation of said motor.

2. The combination with refrigerating apparatus including a compressor, a motor for operating the same, a condenser and an evaporator in circuit with said compressor and said condenser, of a device for controlling the operation of said apparatus to limit the size of ice formations on said evaporator; said device comprising a contactor adapted to move repeatedly to and from a predetermined position to be reached by ice forming on the surface of said evaporator, a movable carrier for the contactor, means receiving electrical current from a source of power for moving the carrier to move the contactor repeatedly to and from the said predetermined position, means resiliently connecting the contactor and the carrier to permit relative movement therebetween upon contact of the contactor with an ice formation projecting from said surface to the said predetermined position, and means actuated by the relative movement between the contactor and carrier to stop the flow of electrical current to the carrier-moving means and to the motor to stop the operation of the carrier-moving means and to stop the operation of the compressor.

3. The combination, with a tank for holding a cooling liquid and a refrigeration system including an evaporator in the tank in position to be submerged by liquid therein, of a device for limiting the size of an ice bank building up on said evaporator, said device comprising a contactor having one end extending into the portion normally occupied by the cooling liquid and adapted to move repeatedly to and from a predetermined position reached by the surface of the ice bank when the latter attains the desired thickness, a movable carrier for the contactor, means for repeatedly moving the carrier to move the contactor repeatedly to and from the said predetermined position, means resiliently connecting the contactor and the carrier to permit relative movement therebetween upon contact by the contactor with the surface of the ice bank formed beyond the said predetermined position because of greater than desired thickness of the ice bank, and means connected with the contactor and the carrier so as to be responsive to relative movement therebetween to stop the carrier moving means and the contactor.

4. The combination, with a tank for holding a cooling liquid and a refrigeration system including an evaporator in the tank in position to be submerged by liquid therein, of a device for limiting the size of an ice bank building up on said evaporator, said device comprising a first arm having one end extending into the portion normally occupied by the cooling liquid in the tank and the other end projecting from the top of the tank, means including a pivot connecting the first arm to the top of the tank, a second arm pivotally mounted on the same pivot and having one end extending into a position normally occupied by such cooling liquid and carrying a contactor adapted to contact the surface of the ice bank on the evaporator and the other end projecting from the top of the tank, electrically-driven means mounted on the top of the tank connected with the arms to move the first arm and in unison therewith the contactor on the second arm repeatedly to and from a predetermined position reached by the surface of the ice bank when the latter attains the desired thickness, means resiliently holding the second arm in a certain relation with respect to the first arm and permitting movement of the second arm away from the certain relation upon contact by the contactor with the surface of the ice bank beyond the predetermined position because of greater than desired thickness of the ice bank, and an electrical switch for controlling said electrically-driven means and so associated with the arms projecting from the tank as to be responsive to the second arm's being in the certain relation with respect to the first arm to close and so as to be responsive to the second arm's being removed from the certain relation with respect to the second arm to open.

5. The combination in a refrigeration system including an evaporator, of a device for limiting the size of an ice bank building up on said evaporator, said device comprising a contactor adapted to move repeatedly to and from a predetermined position reached by a surface of the ice bank when the latter attains the desired thickness, a support, an arm rockably mounted on the support and carrying the contactor, an electric motor mounted on the support, means connecting the motor and the arm to rock the arm to move the contactor repeatedly to and from the said predetermined position, the means comprising a rotating crank connected with the motor and a connecting rod joining the crank and the arm, means resiliently holding the contactor in a certain relation with respect to the arm and permitting movement of the contactor away from the certain relation upon contact by the contactor with the surface of the ice bank formed beyond the predetermined position, an electrical switch for controlling said electric motor and so associated with the arm and the contactor as to be responsive to the contactor's being removed from the certain relation with respect to the arm to open.

6. A combination such as set forth in claim 5, in which there is a lost-motion connection between the electric motor and the crank connected thereto, whereby, without rotation of the motor, the crank may be moved angularly to move the connecting rod joining the crank and the arm

whereby, upon opening of the electrical switch due to movement of the contactor away from the certain relation with respect to the arm upon contacting the ice bank, the crank may, without turning of the motor, be moved angularly to move the arm and contactor away from the ice bank to permit the contactor to return to said certain relation with respect to the arm by virtue of which relation the switch is closed for passage of electrical current therethrough.

7. A combination such as set forth in claim 5, in which there is a lost-motion connection between the electric motor and the crank connected thereto, whereby, without rotation of the motor, the crank may be moved angularly to move the connecting rod joining the crank and the arm whereby, upon opening of the electrical switch due to movement of the contactor away from the certain relation with respect to the arm upon contacting the ice bank, the crank may, without turning of the motor, be moved angularly to move the arm and contactor away from the ice bank to permit the contactor to return to the certain relation with respect to the arm by virtue of which relation the switch is closed for passage of electrical current therethrough, the lost-motion connection being formed by virtue of the fact that the electric motor has a shaft mounting the crank for relative angular movement, the crank has an elongated slot, and a driving pin projects into the shaft and into the elongated slot in the crank.

8. The combination with a tank for holding articles to be cooled and a refrigerating system including an evaporator located in said tank, of a device for limiting the thickness of an ice formation on said evaporator, said system including an electrically operated unit for liquefying refrigerant and forcing it from said unit to and through said evaporator for cooling thereof, and said evaporator being so located in said tank as to leave a space between itself and a wall of said tank and a second space for said articles, said device comprising a first arm having one end extending into the first-mentioned space and the other end projecting above the tank, a second arm having one end extending into the first mentioned space and carrying a contactor and the other end projecting above the tank, means pivotally mounting the arms on the tank, an electric motor connected with the first arm for moving the arms repeatedly back and forth to bring the contactor to and from a predetermined position reached by the surface of the ice bank when the latter attains the desired thickness, means resiliently yieldably connecting the second arm in a certain relation with respect to the first arm and permitting movement of the second arm away from the certain relation upon contact by the contactor with the surface of the ice bank beyond the said predetermined position because of greater than desired thickness of the ice bank, an electrical switch for controlling said electrically operated unit and said electric motor and so associated with the ends of the arms above the tank as to be responsive to the second arm's being in the certain relation to the first arm to close and thereby to pass current to the motor and to the electrically operated unit for moving the arms back and forth and for cooling the evaporator, and so as to be responsive to the second arm's being removed from the certain relation to open and thereby to stop the flow of current to the motor and the electrically operated unit for stopping the movement of the arms and the cooling of the evaporator.

9. The combination with a refrigerator comprising an evaporator, a condenser, a compressor connected to said evaporator and said condenser and a first motor for operating said compressor, of a regulator for controlling the size of an ice bank forming on said evaporator; said regulator comprising a feeler movable to and from a predetermined limit point adjacent the evaporator; a second motor for reciprocating said feeler; an electrical circuit having said second motor wired in parallel with said first motor, an electrical switch in the circuit arranged to be actuated when said feeler is prevented from reaching its predetermined limit point adjacent the evaporator by ice forming thereon.

10. The device specified in claim 9, the said electrical switch being a non-conducting closed tube having a pair of depending tubular portions positioned near one end of said tube and a quantity of mercury contained in the tube and depending tubular portions.

11. A refrigerator comprising, in combination, a compressor, a condenser, and an evaporator, means for controlling the operation of said compressor, comprising a contactor adapted to move repeatedly to and from a predetermined position to be reached by formations growing on the surface of the evaporator, a movable carrier for the contactor, means driven by electricity for operating the compressor, means driven by electricity for causing the carrier to move the contactor repeatedly toward and away from the said predetermined position, means resiliently connecting the contactor to the carrier in a certain relation with respect to the carrier and permitting relative movement of the carrier away from the said certain relation upon contact of the contactor with a surface formation beyond the said predetermined position, an electrical switch associated with the carrier and the contactor so as to be responsive to the contactor's being in the said certain relation with respect to the carrier to close and thereby to cause the switch to complete the circuit of current to both the aforesaid driven means, and so as to be responsive to the contactor's being removed from the said certain relation with respect to the carrier to open and thereby to interrupt the flow of current to both the aforesaid driven means.

12. The device specified in claim 11, the said electrical switch being a non-conducting closed tube and a quantity of mercury contained in the tube.

13. A refrigerator comprising, in combination, a compressor, a condenser, and an evaporator, means for controlling the operation of said apparatus, comprising a support, a first arm, means pivotally mounting the first arm on the support so as to be movable back and forth, a second arm, means mounting the second arm for pivotal movement with respect to the first arm, means resiliently holding the second arm in a certain relation relative to the first arm so as to cause movement of the first arm back and forth to bring the second arm to and from a predetermined position and to permit movement of the second arm relative to the first arm away from the said certain relation upon contact by the second arm with a surface formation growing on and extending from said evaporator beyond the said predetermined position, electrical means for operating the compressor, electrical means for moving the first arm back and forth to bring the second arm to and away from the said predetermined position, an electrical switch associated

with said arms whereby the second arm's being in the certain relation with respect to the first arm holds the switch closed and thereby completes the circuit of current to move the arms and to operate the compressor, and whereby the second arm's being removed from the said certain relation with respect to the first arm holds the switch open and thereby interrupts the flow of current to both the aforesaid driven means.

14. The device specified in claim 11, the said electrical switch being a non-conducting closed tube having a pair of depending tubular portions positioned near one end of said tube and a quantity of mercury contained in the tube and depending tubular portions.

CLARENCE E. VANDENBERG.

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