Oct. 17, 1961 W. F. KELLER 3,004,399

AUTOMATIC DEFROST CONTROL FOR REFRIGERATORS OR HEAT PUMP SYSTEMS

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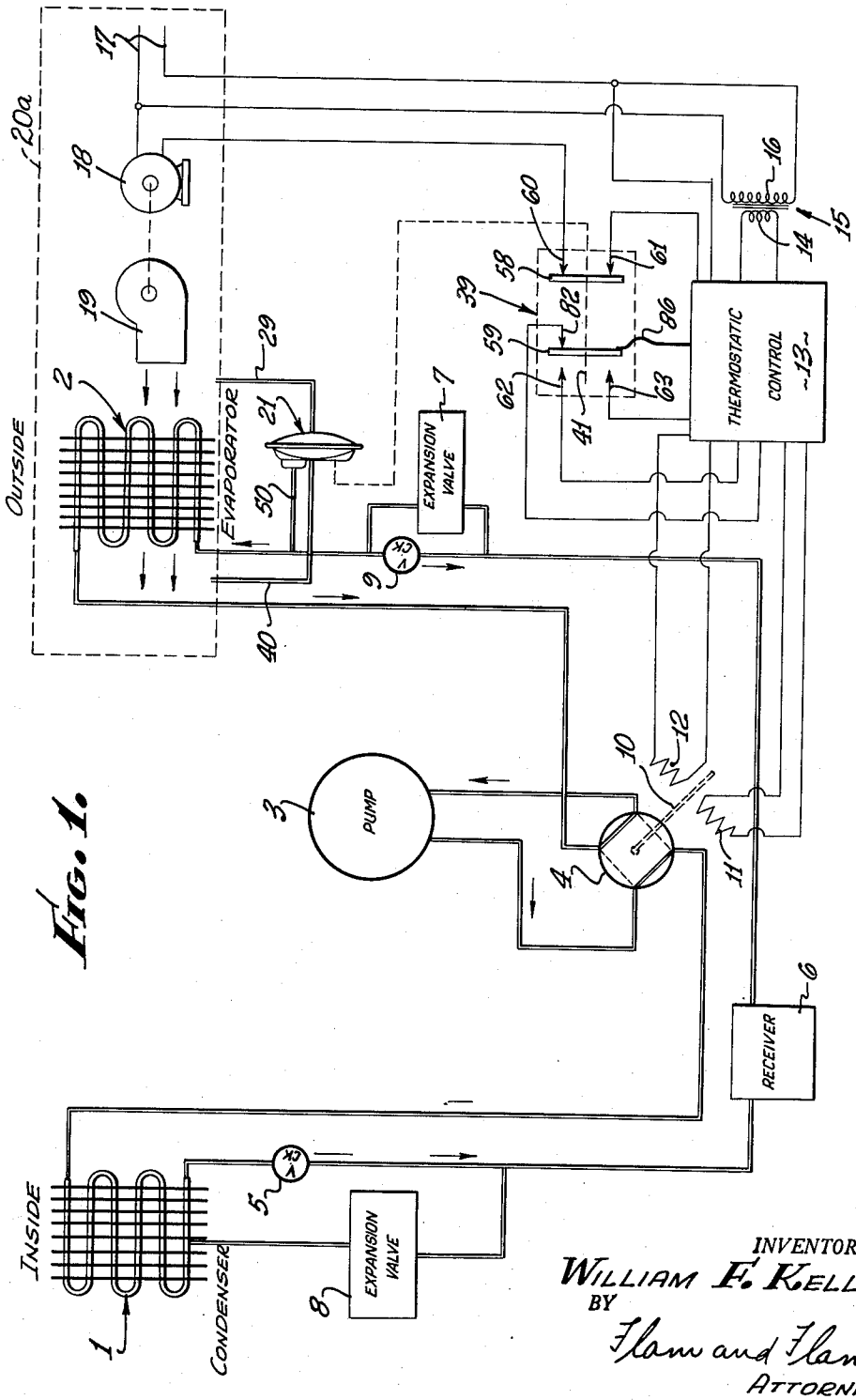


FIG. 1.

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Filed Dec. 1, 1958 4 Sheets-Sheet 2

FIG. 2.

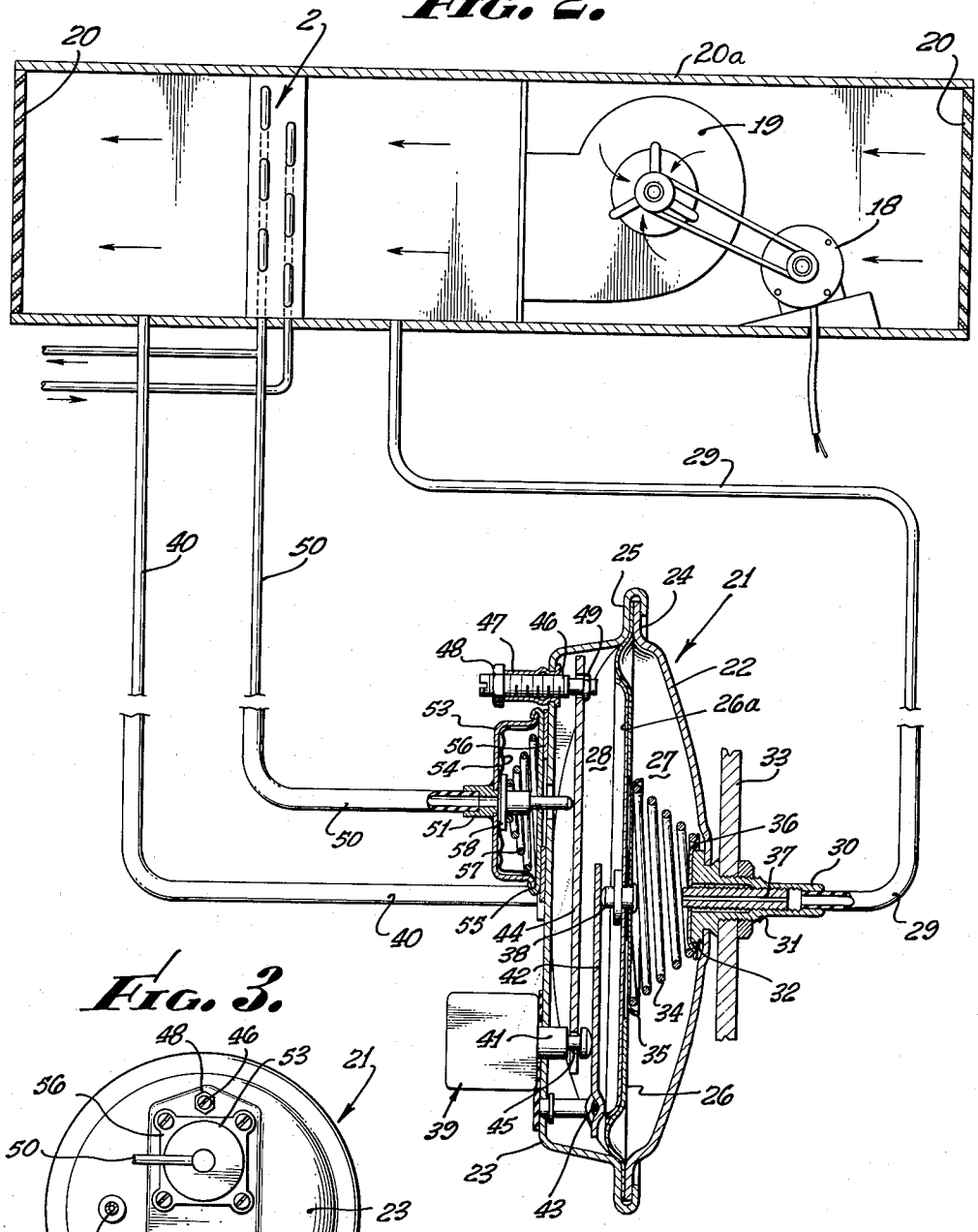


FIG. 3.

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AUTOMATIC DEFROST CONTROL FOR REFRIGERATORS OR HEAT PUMP SYSTEMS

Filed Dec. 1, 1958 4 Sheets-Sheet 3

FIG. 4.

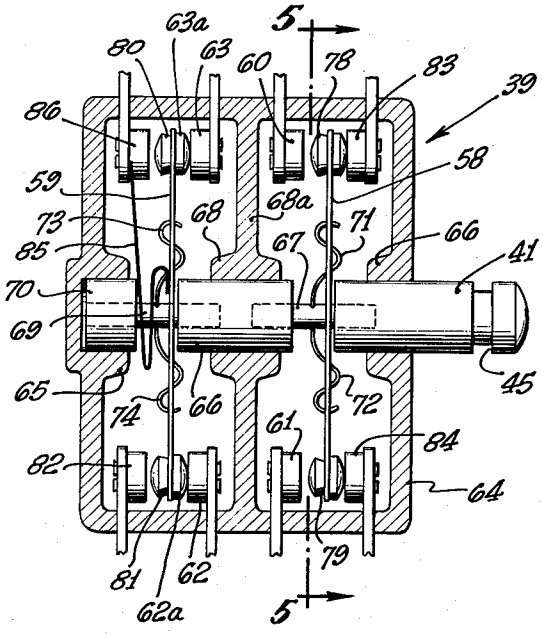


FIG. 5.

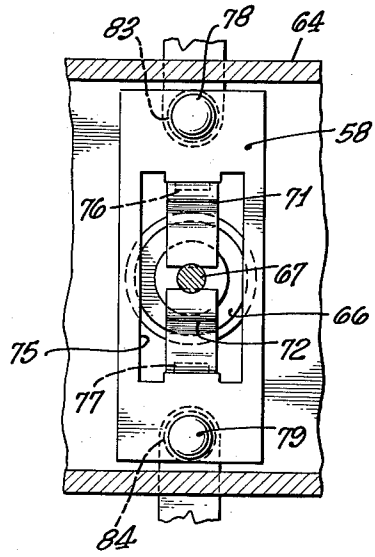


FIG. 6.

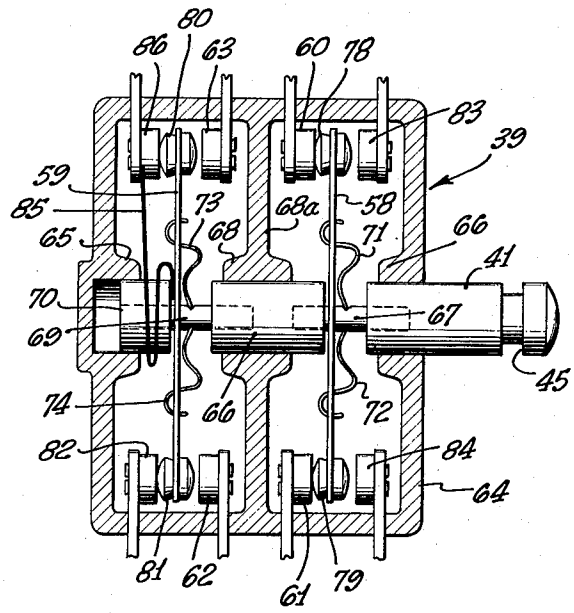
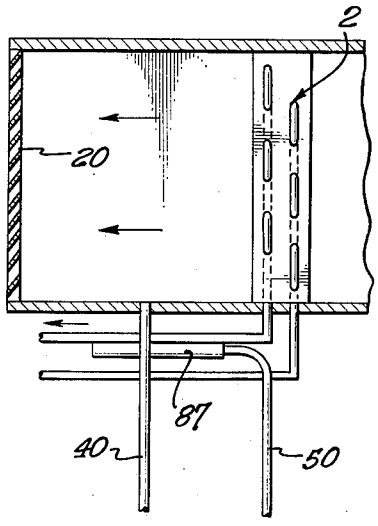


FIG. 8.



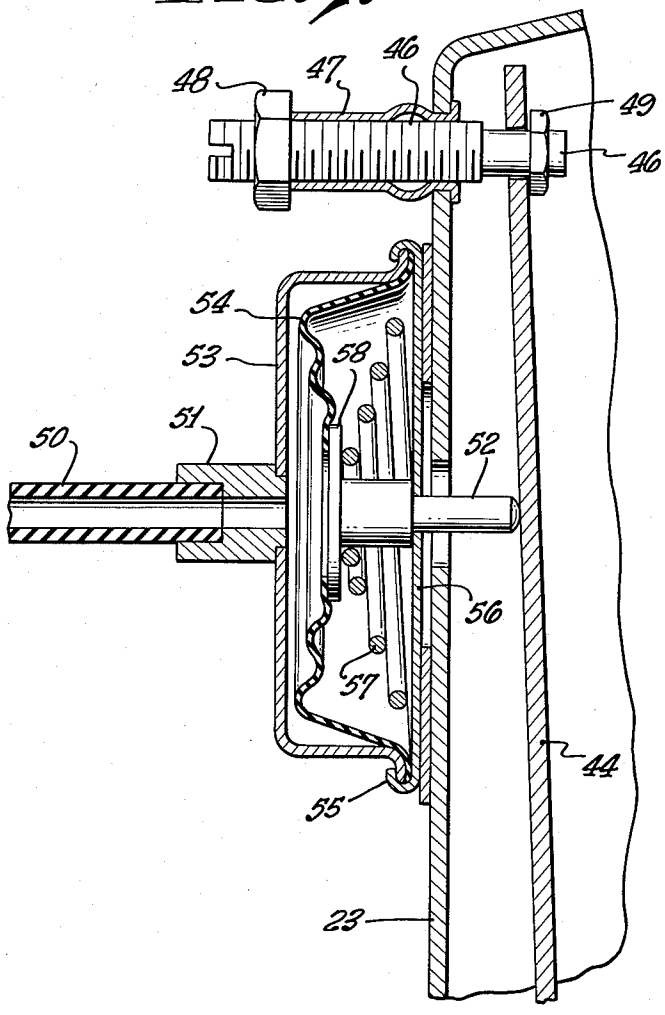
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Filed Dec. 1, 1958 4 Sheets-Sheet 4

FIG. 7.



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United States Patent Office 3,004,399 Patented Oct. 17, 1961

3,004,399

AUTOMATIC DEFROST CONTROL FOR REFRIGERATORS OR HEAT PUMP SYSTEMS

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Filed Dec. 1, 1958, Ser. No. 777,446
11 Claims. (Cl. 62—140)

This invention relates to systems utilizing a refrigerator coil that absorbs heat by expansion therein of a refrigerant. Such heat absorbing coils are in common use for refrigerators. They are also commonly used in heat pump systems for furnishing heat to an inside room, the coil being placed outside for efficient heat absorbing relation to the outside air. To obtain a quick heat absorbing effect, a fan is used to move the air past the coil. When used in a low temperature refrigerator, the coil is used for cooling the circumambient air, and again, quick heat transfer is effected by providing a current of air to be cooled, past the coil.

In a heat pump installation, in cold weather the outdoor coil normally acts as a heat absorber to collect heat to be transferred to indoors, where the heat is to be used. In warm weather, the coil is used to transfer heat to the outdoors; the reversibility of the heating and cooling cycles makes possible the use of the usual elements of a refrigerating system, including a pump, a condenser, and an expansion coil. For reversing the system from cooling to heating, the roles of the condenser and of the expansion coil are interchanged.

When operating on a heating cycle, and with outside temperatures at or near freezing, the outdoor coil is quite apt to frost over, since heat is being absorbed by the coil. Excessive collection of frost is detrimental, since heat exchange is retarded; and the movement of air past the coil is obstructed.

In order to defrost the outdoor coil, it has been common temporarily to reverse the cycle from heating to cooling. Under such circumstances, the outdoor coil transfers heat from the coil to the outside air. This temporary change reversal has the effect of extracting heat from indoors, and transferring it to the outdoors.

The reversal of the cycle and its return to the normal heating cycle have usually been effected by the aid of complex relay circuits.

It is one of the objects of this invention to simplify such controls.

As above stated, a blower is used to pass outside air over the outdoor coil. When the coil is heavily frosted, the passage of the air is impeded, with a resultant increase in air pressure at that side of the coil nearest the blower or fan. This increase in pressure has been commonly used to initiate the reverse (or cooling) cycle for defrosting.

It is another object of this invention to provide a device responsive to such air pressure for mechanically operating a circuit controller to cause a cycle reversal. The same device is caused to respond to a condition of the refrigerant (such as pressure or temperature) in the outdoor coil, for terminating the defrosting.

It is still another object of this invention to simplify the mechanisms used for automatic defrosting, and particularly by the aid of a device that responds to the air pressure build-up at the outdoor coil.

This invention possesses many other advantages, and has other objects which may be made more clearly apparent from a consideration of several embodiments of the invention. For this purpose there are shown a few forms in the drawings accompanying and forming part of the present specification. These forms will now be

described in detail, illustrating the general principles of the invention; but it is to be understood that this detailed description is not to be taken in a limiting sense, since the scope of the invention is best defined by the appended claims.

Referring to the drawings:

FIG. 1 is a diagram of a control system incorporating the invention, the control being in such position as to provide indoor heating;

FIG. 2 is a fragmentary view, illustrating on an enlarged scale, portions of the control system, the apparatus being in defrosting position;

FIG. 3 is an elevation of an element of the control apparatus illustrated in FIG. 2;

FIG. 4 is an enlarged sectional view of a circuit controller utilized in connection with the invention, the circuit controller being shown in a position providing for defrosting;

FIG. 5 is a fragmentary sectional view taken along a plane corresponding to line 5—5 of FIG. 4;

FIG. 6 is a view similar to FIG. 4 but illustrating the position of the circuit controller at the conclusion of the defrosting operation;

FIG. 7 is an enlarged fragmentary sectional view of one of the elements of the control apparatus, and in a position corresponding to the conclusion of the defrosting period; and

FIG. 8 is a fragmentary view similar to FIG. 2 of a modified form of the invention.

In FIG. 1 there are two substantially identical coils 1 and 2, both operating as heat exchangers. Coil 1 may be the inside coil located in a room or other space to be heated or cooled. Coil 2 is located outside of the space to be heated or cooled. It may be partially enclosed by louvred walls 20 (FIG. 2).

Both coils 1 and 2 can operate optionally either as an evaporator or a condenser.

When the system is used for heating, the coil 2 operates as an evaporator to absorb heat from the external air, and to pass this heat to coil 1. Both coils are shown as provided with fins for facilitating the exchange of heat between the exterior of the coil and the circumambient atmosphere.

FIG. 1 illustrates a heating operation, coil 2 being an evaporator, and coil 1 operating as a condenser. Accordingly, a pump 3 is shown as connected by way of a four-way valve 4 to compress the refrigerant received from the output side of coil 2, to pass the refrigerant in compressed form to coil 1. The refrigerant is sufficiently cooled in coil 1 to liquefy, whence it passes a check valve 5 to a receiver 6. The liquid refrigerant from the receiver 6 can then progress through an expansion valve 7 to the coil 2 and thence back to the pump 3, for completing the cycle of expansion and liquefaction.

The check valve 5 associated with coil 2 is bridged by another expansion valve 8, making it possible for liquid refrigerant to pass through the expansion valve to the coil 1 when it is desired to operate the coil 1 as an evaporator. The check valve does not permit flow of refrigerant from the receiver 6 to the coil 1. Similarly a check valve 9 is placed in parallel with expansion valve 7, making it possible for the refrigerant from coil 2 to pass to the receiver 6 when that coil operates as a condenser. The valve 4 is illustrated diagrammatically as having an actuator 10, which can be operated from the position shown to one in which the outlet side of the pump 3 is connected to the coil 2 instead of the coil 1, and in which the inlet side is connected to the coil 1, instead of the coil 2. The dotted lines in the circle indicating the moving part of valve 4 illustrate this alternative position. Valve 4 has an appropriate actuator 10, diagrammatically illustrated, which can be moved

so as to place the valve 4 in either of its two operative positions.

The electromagnet or solenoid 11 is energized for placing the system in a position for inside heating. Solenoid 12 operates on valve actuator 10 to reverse the cycle.

The circuits for the coils 11 and 12 are normally controlled by thermostatic controls indicated diagrammatically by the block 13. The thermostatic control circuits are energized by the secondary winding 14 of a step-down transformer 15, having a primary winding 16. This primary winding is connected to commercial supply mains 17.

The thermostatic controls incorporated in block 13 also serve to energize a motor 18 for driving a blower 19 to provide a flow of air past the coil 2 when the coil 2 is operating as an evaporator.

Since the mode of operation of this reversible heat exchange system is well known, further description is deemed unnecessary.

The outside coil 2 is shown in FIG. 2 as supported within the louvred walls 20 of a duct 20*a*. Motor 18 as well as blower 19 are located within these walls. When the system is operating as illustrated in FIG. 1 for heating purposes and when the external temperature is near 32° F., frost accumulates upon the coil 2 and after a while, builds up sufficiently to impede the flow of air through it. The frost also retards the transfer of heat from the air to the coil. Generally, therefore, such frosting reduces the efficiency of the system. Various ways have been proposed and used to melt off the frost. In the present instance, the defrosting is effected automatically.

Thus under frosted conditions, the air pressure on the entrance side of the coil represented by the right hand side in FIG. 2 is increased. This increase in pressure, when sufficient, is used as a means for initiating the defrosting operation. Thus an increase in pressure at the entrance side of coil 2 operates a control device 21 to reverse the cycle and convert the coil 2 to a condenser, thereby transferring heat from the coil to the outside atmosphere, and melting off the frost. When the defrosting is finished, the control device 21 automatically returns the system to the position of FIG. 1.

In the position of FIG. 2, the control device 21 is operative to convert the operation of coil 2 to that of a condenser, for defrosting purposes. This control device includes a casing formed of two halves 22 and 23. The casing half 22 has a flange 24 opposing a turned-over flange 25 of the casing half 23. Clamped between these two halves is a flexible diaphragm 26. Thus the casing 22—23 is divided into two chambers 27 and 28. A dished metal plate 26*a* extends on the left hand side of the diaphragm 26 to maintain the center area of the diaphragm 26 in flat condition.

A conduit 29 leads from the entrance side of the coil 2 to the interior of the chamber 27. The end of the conduit 29 is firmly attached to the reduced end 30 of a fitting 31. This fitting 31 has a head 32 attached to the half 22 and fastened to a wall support 33. The diaphragm 26 is urged toward the left by the aid of a conical compression spring 34. The large end of the compression spring 34 engages a dished washer 35 attached to the diaphragm 26. Its right hand end engages a disc 36 mounted on a screw 37 threaded within the reduced portion 30 of the fitting 31. This screw has a central aperture forming a port for the passage of the air into a chamber 27.

By appropriate adjustment of the screw 37 the force exerted by the spring 34 to urge the diaphragm 26 toward the left is adjusted. Added to the force of the spring is the air pressure corresponding to the pressure at the entrance side of coil 2. Accordingly, the pressure required to cause the control device 21 to operate is determined by the adjustment of screw 37. The more the pressure of spring 34, the less need the air pressure be at the entrance side of the coil 2 to initiate the defrosting operation.

The pressure in chamber 28 on the opposite side of diaphragm 26 is kept substantially constant by the aid of the conduit 40, which is subjected to the leaving side of the coil 2. This pressure is usually close to atmospheric.

At the center of the diaphragm 26 is located a button 38 for operating a circuit controller 39, to be hereinafter described. It is utilized to alter the circuits of the system to one such as to provide defrosting of the coil 2. The circuit controller is operated by an axially movable actuator 41.

The operation of this diaphragm 26 is thus dependent upon the combination of forces exerted by the spring 34 and the pressure of the air entering the chamber 27. Adjustment of the screw 37 thus provides the means, as heretofore explained, for determining at what air pressure the system is caused to operate. This operation is dependent upon sufficient movement of the button 38 to the left, as viewed in FIG. 2.

Actuator 41, as viewed in FIG. 2, has been urged to its extreme left-hand position by the flexure of the diaphragm 26 in response to a demand for defrosting. This leftward movement is accomplished by the aid of a lever 42 located in chamber 28 and pivoted on an appropriately positioned pin 43.

It is noted that while defrosting occurs, the blower 19 is inactive and the pressure applied to chamber 27 is materially reduced. Although there is thus no force exerted on lever 42, the circuit controller 39 remains in defrosting position. This is true because, as explained hereinafter, a substantial force toward the left is required upon actuator 41 before the cycle can be reversed.

In order automatically to return the circuit controller 39 to the normal heating position corresponding to FIG. 1 at the end of the defrosting cycle, another lever 44 in chamber 28 is provided. This lever 44 has a lower end straddling the reduced neck portion 45 of the actuator 41. The lever 44 is movably mounted with respect to an adjustable stem or post 46. This stem is threaded to cooperate with a threaded sleeve 47 mounted in the half casing 23 (see also FIG. 7). The stem 46 has a check nut 48 as well as a button 49 to provide a fulcrum for the lever 44.

The lever 42 may be urged in a counter-clockwise direction by the movement of the diaphragm 26, to move the actuator 41 toward the left.

Engaging neck 45, the lever 44 causes the opposite movement of actuator 41. When defrosting is to be terminated, this lever moves the actuator 41 to its extreme right-ward position, as indicated in FIG. 6. By aid of the adjustment provided by threaded stem 46 (FIGS. 2 and 7), termination of the defrosting action can be made to depend upon a specific degree of a condition in coil 2. For example, in the form illustrated in FIG. 2, this condition is the fluid pressure of the refrigerant in the coil 2. This response is effected by the aid of a conduit 50 leading to a fitting 51 (see also FIG. 7). This fitting 51 is mounted in a supplemental casing 53 and leads the refrigerant under pressure to the left hand side of the diaphragm 54. In FIG. 7, this diaphragm is shown as urged inwardly to cause termination of the defrosting operation. This diaphragm 54 has its edge in sealing relationship with the supplemental casing 53 as by the aid of the turned-over flange 55 of a base plate 56. This base plate 56 may be appropriately supported upon the casing half 23.

The diaphragm 54 carries a button 52 that is urged toward the right to operate lever 44 when the pressure in conduit 50 reaches a definite high value, signifying sufficient defrosting. A spring 57 operating against a flange 58 on button 52 opposes right-hand movement of the button 54. By appropriate adjustment of the threaded

stem 46 the operation of the actuator 41 toward the right by the lever 44 is caused to be effected at a definite pressure attained by the refrigerant in coil 2.

While the coil 2 acts as an evaporator, there is little pressure in the coil and accordingly button 52 is kept in its extreme left-hand position by spring 57. Accordingly it is only in the defrosting process that sufficient pressure can be attained in coil 2 to reverse the cycle. In using the conventional refrigerant, such as F–12 or F–22, the pressure can rise to 110 p.s.i. for F–12, or as high as 190 p.s.i. for F–22.

The circuit controller 39 is such that when the actuator 41 is urged sufficiently strongly toward the left in response to this increased pressure, it will snap suddenly into the position illustrated in FIG. 4. It will thus serve to disconnect the circuit for the motor 18 and to reverse the operation of the coils 1 and 2. Thus as soon as the defrosting is completed the lever 44 returns the actuator 41 by snap action to the normal position, returning the system to the condition of FIG. 1.

As illustrated in FIG. 1, the circuit controller 39 is shown in a position in which the coil 2 is operating normally for heating purposes. This circuit controller 39 has two contact arms 58 and 59. The contact arm 58, carrying points 78 and 79 (FIGS. 4 and 6) bridges the contact points 60 and 61 to energize motor 18 from the mains 17. In the position of FIG. 2 the contact arm 58 has been moved to a position opening the circuit to contact points 60 and 61 (see also FIG. 4). The opposite contact points 83 and 84 are left unconnected, so that in the position of FIG. 4 they merely act as stops for arm 58. Upon attainment of the position of FIG. 4, there is an interruption of the circuit of motor 18. Furthermore the arm 59 in the normal operating position of FIG. 1 serves to complete the circuit through the thermostatic controls 13 to the solenoid 11, by the aid of which the valve 4 is placed in the full line position. This corresponds to the position of the circuit controller 39 illustrated in FIG. 6. Point 82 is in contact with arm 59, completing the circuit for the heating solenoid 11. Furthermore, point 86 serves as a stop for arm 59. While defrosting, the arm 59 is moved to that position shown in FIG. 4 so as to contact point 62 as well as contact point 63 leading to the thermostatic control. In this position, points 62*a* and 63*a*, carried by arm 59, engage points 62 and 63; solenoid 11 is disconnected and the solenoid 12 is energized to move the valve 4 to the defrosting position.

The structure of circuit controller 39 may be best explained in connection with FIGS. 4, 5 and 6. The actuator 41 extends out of an insulation casing 64. This actuator is substantially cylindrical and is guided for axial movement by the bosses 65 and 66 formed on the casing 64. The actuator 41 is connected to a central portion 66 as by the aid of a bar or rod 67. Portion 66 is guided for axial movement in a hub 68 formed on an intermediate wall 68*a*. The rod or bar 69 connects the cylindrical member 66 to the left-hand cylindrical member 70. The connecting bars 67 and 69 have notches in them for the accommodation of the inner ends of the snap action springs 71, 72, 73 and 74. These springs are bent to engage the corresponding arms 58 and 59. These arms 58 and 59 are quite wide, and apertured, as indicated by reference character 75 (FIG. 5) so that the outer ends of the springs 71, 72, 73 and 74 can engage lips such as 76 and 77 formed on the upper and lower edges of the aperture 75. The outer ends of the springs are provided with appropriate slots to engage these lips. Thus in the position of FIG. 4 actuator 41 is in its extreme left-hand position and the springs 71, 72, 73 and 74 have snapped the arms 58 and 59 rightward to cause disengagement of contact points 78 and 79 from the stationary points 60 and 61 and also to move the contact points 62*a* and 63*a* on the arm 59 to engage stationary contacts 62 and 63. This snap over action occurs just as soon as arms 58 and 59 are moved beyond aligning position with the notches in rods 67, 69.

Stationary contacts 83 and 84 do not need to be connected for the operation of this system. Furthermore, connection 85 extends from the contact point 86 to the arm 59. In order to return the circuit controller 39 to the normal position of FIG. 1 the actuator 41 must be moved with a sufficient force to snap the springs 71, 72, 73 and 74 over center. This position is shown in FIG. 6.

It is thus seen that a substantial amount of axial movement of the actuator 41 is necessary to move the circuit controller from one operating position to another. This results from the necessity to move the springs 71, 72, 73 and 74 over center before there is any force urging the contact arms 58 and 59 in the opposite direction.

Accordingly the defrosting period is not terminated until there is substantial increase in pressure in the coil 2 corresponding to a sufficiently desired degree of defrosting. This degree of pressure of course can be adjusted by adjustment of the threaded stem 46 in the fitting 31 (FIG. 2).

In the form shown in FIG. 8, conduit 50 is connected to a temperature responsive pressure cell 87 which is in heat exchanging contact with the outlet side of the coil tube. In this way the temperature attained by the exterior surface of coil 2 determines when the defrosting action will be terminated.

Ordinarily, the defrosting operation lasts from five to seven minutes, and accordingly there is little cooling off of the room to be heated by operation of the defrosting cycle. The thermostat controls 13, however, may be so arranged in a well known manner, to energize auxiliary heaters while defrosting. Such auxiliary systems are in common use.

A short résumé of the mode of operation can be set forth in connection with FIG. 1.

When the thermostatic controls 13 demand more heat, solenoid 11 is energized and the pump connections are as illustrated in FIG. 1. The indoor coil 1 transfers heat into the room and the outdoor coil 2 operates as an evaporator.

The outdoor coil 2 after a while accumulates frost, especially when the outdoor temperature neighbors 32° F. The frost retards the flow of air from the entrance side to the exit side of the coil 2. Air pressure builds up and accordingly when the pressure reaches a predetermined limit the device 21 assumes the position of FIG. 2. In this position coil 12 is energized and coil 11 is de-energized. This causes the coil 2 to transmit heat to the air around the coil 2.

In the form shown in FIG. 2 the pressure in coil 2 builds up as the defrosting continues. The button 52 then causes reversal of the cycle by appropriate motion of the actuator 41 to the right. Under such circumstances, the system returns to the position of FIG. 1.

In the form shown in FIG. 8, the termination of the defrosting cycle is effected by the aid of a pressure cell 87 having a volatile fluid therein. This pressure cell absorbs heat from the outlet side of the coil 2. When the temperature reaches a sufficient value the button 52 performs the termination of the defrosting operation.

The inventor claims:

1. In an automatic defrost control of a heat exchange system including a vaporizable refrigerant, a compressor, two coils each capable of operating either as an evaporator or a condenser, a duct surrounding the first of the coils and an electric motor operated blower for passing air through the duct and over the first of the coils, said duct having an entrance and an exit for the air; the combination therewith of: a circuit controller; a first circuit for energizing the motor, and controlled by said circuit controller; a second circuit for reversing the functions of the two coils, also controlled by said circuit controller, the circuit controller having two stable positions,

the first in which the motor is energized and the first coil absorbs heat and the second coil acts as a condenser, and the second position in which the motor is de-energized, the first coil acts as a condenser and the second coil absorbs heat; a control device for operating said circuit controller; means for transmitting the air pressure in the duct, on the blower side, to the control device; said control device being responsive to the air pressure transmitted from the duct, such that a pre-selected air pressure causes the control device, through the elements cooperable with the circuit controller, to move the circuit controller to the second stable position.

2. The combination as set forth in claim 1, in which the circuit controller has resilient means urging the controller to maintain each of its stable positions, the force of which must be overcome to move the controller to the other stable position.

3. The combination as set forth in claim 1, in which the circuit controller has a reciprocable actuator, and in which the control device means responsive to the air pressure includes a lever acting on the actuator, as well as a movable wall operating said lever and actuated by air pressure.

4. The combination as set forth in claim 1, in which the circuit controller has a reciprocable actuator, and in which the control device includes a pair of independently operable levers operating the actuator, respectively to move the actuator in opposite directions, a movable wall for operating one of said levers and actuated by the threshold air pressure to move the circuit controller to the second position, and the other lever being moved in response to a threshold condition of the refrigerant at the first coil, corresponding to the termination of a defrosting operation.

5. In a heat exchange system of the character described: a coil adapted to receive refrigerant, the refrigerant serving either to receive heat from the air passing the coil, or to transfer heat from the coil to the air; a duct surrounding the coil and having an entrance and an exit for air; a blower for passing air over the coil when the coil acts as a heat absorber; means forming an enclosure; a movable wall in the enclosure, and forming a pressure chamber on one side of the wall; conduit means for transmitting the air pressure from the entrance side of the duct to the said pressure chamber; said conduit means being the sole path for entry or exit of air from said chamber, and means for causing the coil to operate as a condenser, and for rendering the blower ineffective, in responsive to movement of the wall upon the attainment of a threshold pressure in said chamber.

6. The combination as set forth in claim 5, in which the means for causing the coil to operate as a condenser includes a circuit controller operated by the movement of the wall, and having an overcenter spring.

7. In an automatic defrost control of a heat exchange system including a vaporizable refrigerant, a compressor, two coils each capable of operating either as an evaporator or a condenser, and an electric motor operated blower for passing air over the first of the coils, said first coil having an entrance and an exit for the air; the combination therewith of: a circuit controller; a first circuit for energizing the motor, and controlled by said circuit controller; a second circuit for reversing the functions of the two coils, also controlled by said circuit controller, the circuit controller having two stable positions, the first in which the motor is energized and the first coil absorbs heat and the second coil acts as a condenser, and the second position in which the motor is de-energized, the first coil acts as a condenser and the second coil absorbs heat; means responsive to the existence of a threshold air pressure on the entrance side of the first coil for moving said circuit controller to said second position; and means responsive to a threshold condition of the fluid pressure of the refrigerant in the said first coil for moving said circuit controller to said first position.

8. In a heat exchange system of the character described: a coil adapted to receive refrigerant, the refrigerant serving either to receive heat from the air passing the coil, or to transfer heat from the coil to the air; the coil having an entrance and a leaving side for the air; a blower for passing air over the coil when the coil acts as a heat absorber; means forming an enclosure; a movable wall in the enclosure, and forming a pressure chamber on one side of the wall; conduit means for transmitting the air pressure from the entrance side of the coil into the said pressure chamber; means for causing the coil to operate as a condenser, and for rendering the blower de-energized in response to movement of the wall upon the attainment of a threshold pressure in said chamber; means forming a second pressure chamber on the other side of the movable wall in the said enclosure; and means responsive to an increase in pressure in the coil for terminating the defrosting function.

9. In a heat exchange system of the character described: a coil adapted to receive refrigerant, the refrigerant serving either to receive heat from the air passing the coil, or to transfer heat from the coil to the air; the coil having an entrance and a leaving side for air; a blower for passing air over the coil when the coil acts as a heat absorber; a circuit controller having means causing the coil to operate as an evaporator or as a condenser and for rendering the blower either energized or de-energized; an overcenter spring in the said circuit controller; means forming an enclosure; a movable wall in the enclosure, and forming a pressure chamber; conduit means for air from the entrance side of the coil into said chamber; members connecting the movable wall and the overcenter spring, such that the attainment of a threshold pressure on the movable wall motivates the circuit controller to cause the coil to act as a condenser and to de-energize the blower; and means responsive to an increase in the pressure of the refrigerant in the coil, for motivating the circuit controller to cause the coil to act as an evaporator and to energize the blower.

10. In a heat exchange system of the character described: a coil adapted to receive refrigerant, the refrigerant serving either to receive heat from the atmosphere or to transfer heat from the coil to the atmosphere; a duct surrounding the coil; a blower for directing air through the duct and over the coil when the coil acts as a heat absorber; a circuit controller having means causing the coil to operate as an evaporator or as a condenser and for rendering the blower respectively energized and de-energized; means forming an enclosure; a movable wall in the enclosure, and forming a pressure chamber on one side of the wall; means for transmitting the air pressure on the blower side of the duct to the said pressure chamber, in which the movable wall is responsive to the air pressure in the duct; an overcenter spring in the said circuit controller; members connecting the movable wall with the overcenter spring, such that a pre-selected air pressure moves the circuit controller to a position in which the coil functions as a condenser; means forming a second enclosure constituting a second pressure chamber; a diaphragm in the second pressure chamber; means for transmitting the pressure of the refrigerant in the coil to the second pressure chamber, such that the diaphragm is responsive to the pressure changes in the coil; members connecting the diaphragm of the second pressure chamber to the overcenter spring in the circuit controller, such that a pre-selected refrigerant pressure moves the circuit controller to a position in which the coil functions as an evaporator.

11. The combination as set forth in claim 10, in which the enclosure forms a third chamber on the other side of the movable wall, and that this third chamber houses the members connecting the said two pressure chambers to the circuit controller.

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