

June 15, 1943.

R. W. JOHNSON ET AL

2,321,819

MECHANICAL REFRIGERATING SYSTEM

Filed Dec. 4, 1940

3 Sheets-Sheet 1

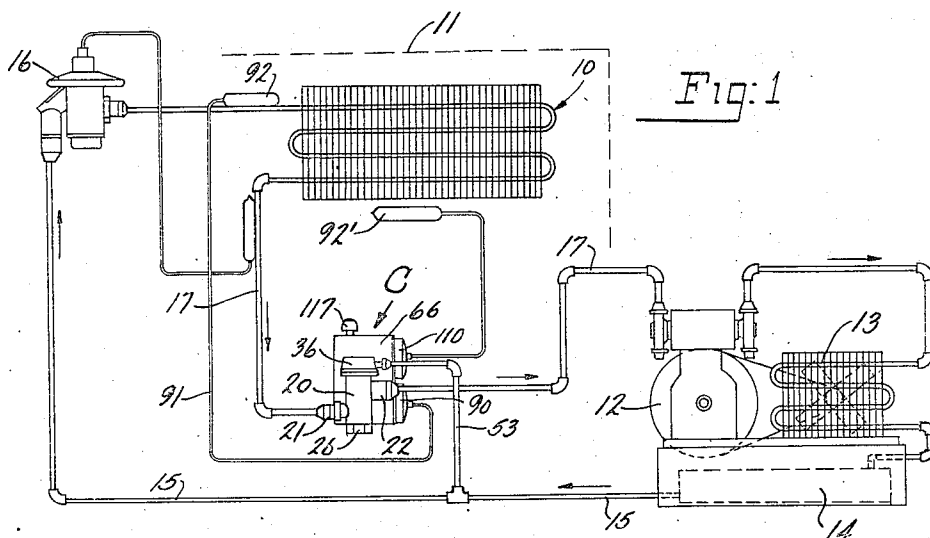


Fig. 1

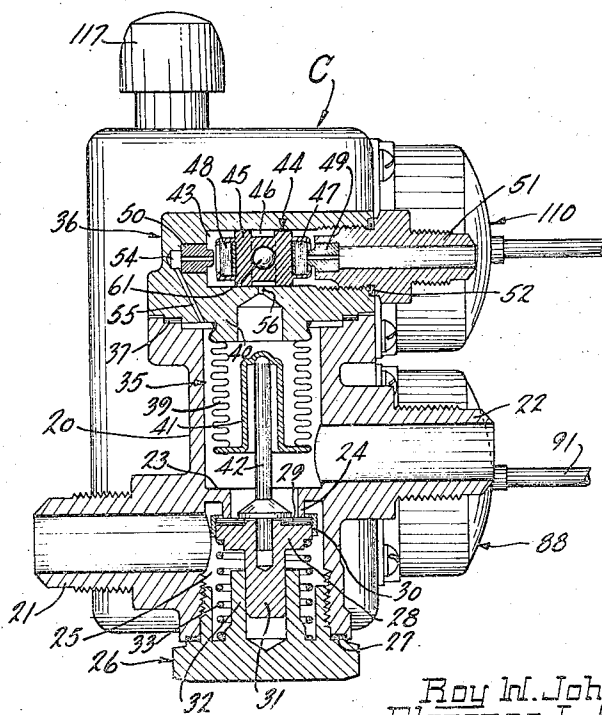


Fig. 2

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3 Sheets-Sheet 2

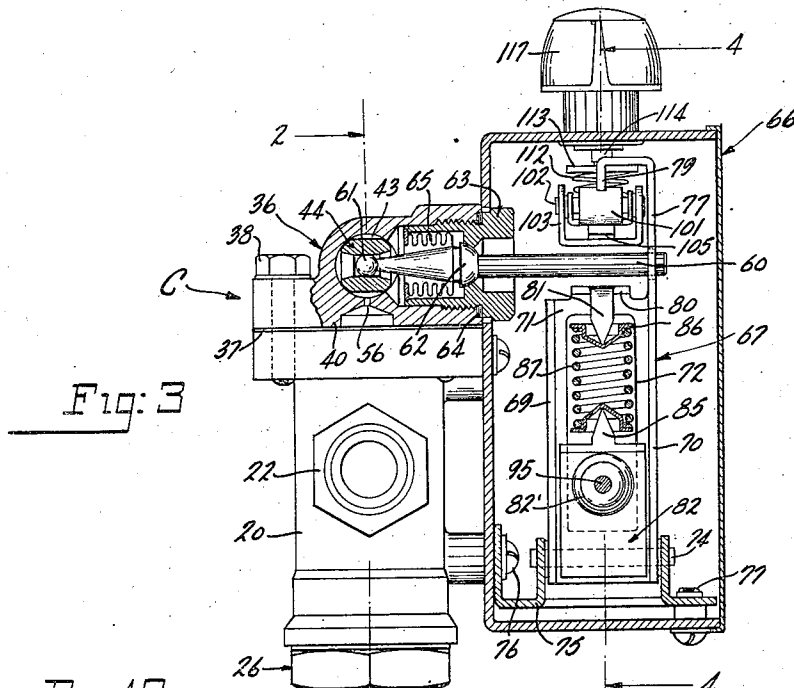


Fig: 10

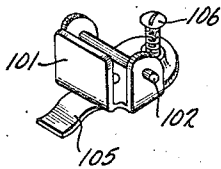
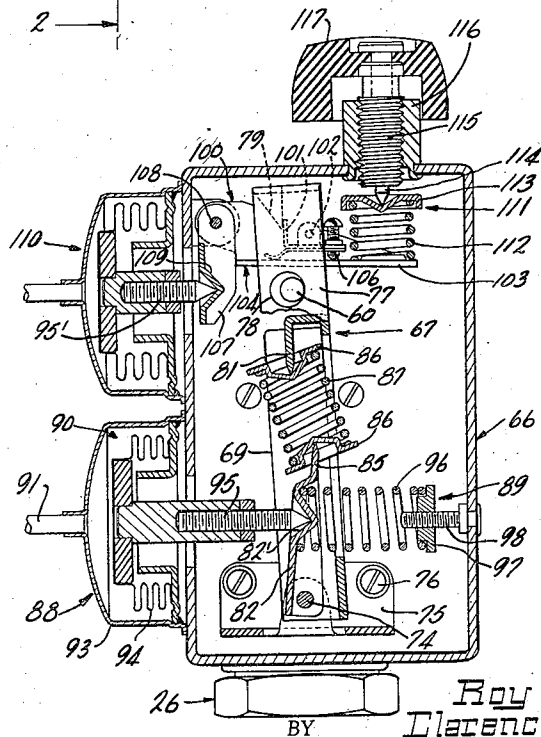


Fig: 4



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3 Sheets-Sheet 3

Fig: 5

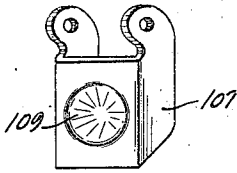


Fig: 7

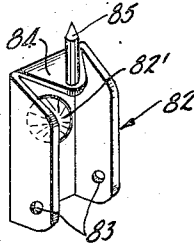


Fig: 8

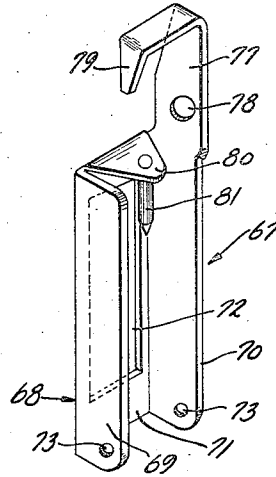


Fig: 6

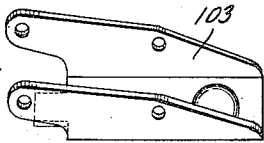
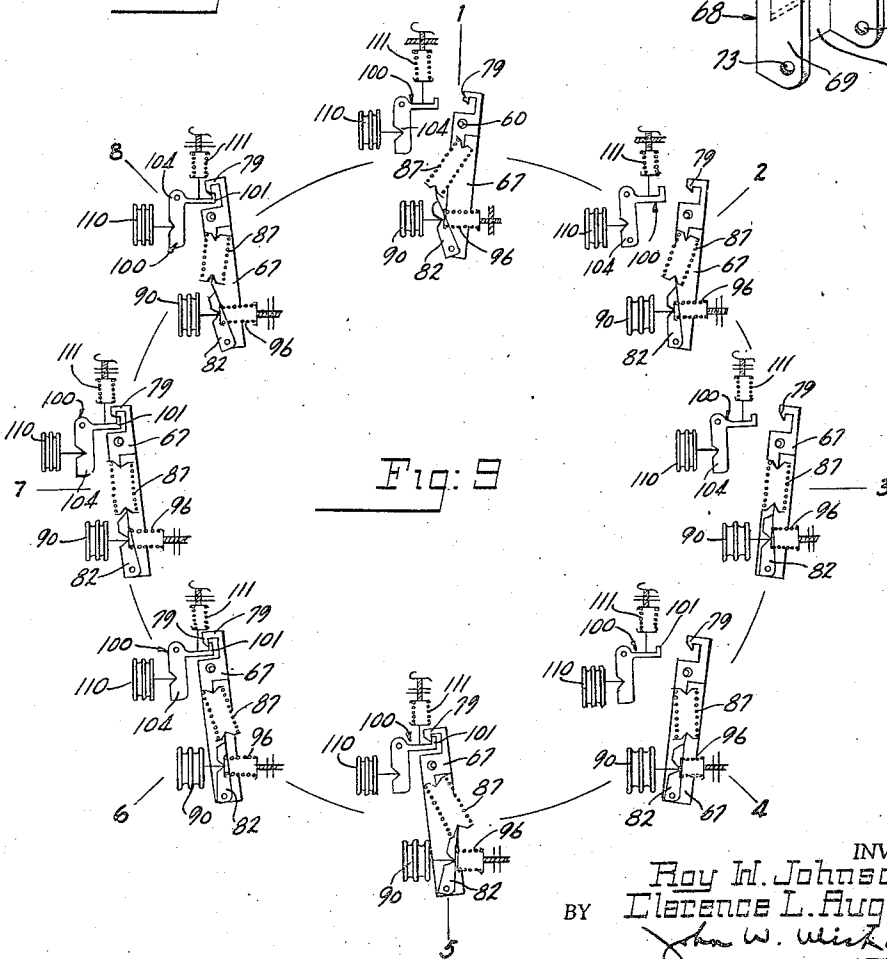


Fig: 9



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UNITED STATES PATENT OFFICE

2,321,819

MECHANICAL REFRIGERATING SYSTEM

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Application December 4, 1940, Serial No. 368,510

9 Claims. (Cl. 62—3)

This invention relates in general to mechanical refrigerating machines or systems, and more particularly to a vapor compression refrigerating machine wherein a liquid is used which can be alternately liquified and vaporized, and the refrigeration is produced by the latent heat of vaporization. Such systems comprise as their essential elements a cooling or evaporating coil connected to a compressor which is in turn connected to a condenser. The condenser discharges into a receiver, and a liquid supply line leads from the receiver of the inlet to the evaporating or cooling coil. An expansion valve is provided in the liquid supply line adjacent the inlet to the cooling or evaporating coil to produce the desired throttling effect.

Such refrigerating systems are commonly employed in commercial installations, household refrigerators, and the like, the cooling coil being disposed in the refrigerator box or receptacle, or in heat interchanging relation to the compartments thereof which contain substances to be kept cool, the refrigerator or evaporating coils functioning to absorb the heat coming into the box in order to keep the box at a predetermined temperature. The refrigerant which flows through the coils to absorb the heat is at most times below the freezing point of water, and, therefore, during the cooling cycle the moisture in the box or fixture will freeze and accumulate on the surface of the coil, forming frost or ice. After a period of time, this accumulation of frost or ice will build up to such an extent that the coil becomes inefficient. It is good practice to eliminate this frost or ice from the coil surface by melting the same. Such melting operation is called "defrosting." One method of defrosting is to isolate the coil from the refrigerating system by stopping the refrigerant from passing through the coil, thereby letting the pressure build up in the coil with a corresponding increase in temperature whereupon the ice on the exterior surface thereof will melt quite readily.

The object of the present invention is to provide a refrigerating system of this character which maintains a predetermined box or fixture temperature, and yet automatically defrosts the cooling coil on each cycle.

In carrying out the present invention a control valve is incorporated in the refrigerating system between the evaporating or cooling coil and the suction to the compressor. The control valve may be conveniently located at any point in the suction line between the cooling coil and the compressor, and is so combined with the suc-

tion line that the outlet connection of the coil is connected to the inlet to the control valve whereas the inlet or suction connection of the compressor is connected with the outlet of the control valve.

The control valve is so constituted that when open it allows free flow through the suction line from the cooling coils to the compressor, but when it is closed it blocks all flow therethrough, thereby effectively isolating the cooling coil from the compressor. This control valve is automatically regulated in its action under the conjoint influence of the coil temperature and box or receptacle temperature, and in such manner that while the selected box or receptacle temperature will be maintained, the coil will be defrosted on each refrigerating cycle.

In exercising this automatic regulation, the control valve may be controlled as to its position by means of a fluid pressure motor working against the biasing action of a spring, the spring tending to close the valve and the motor acting, when supplied with motive fluid, to open the valve. A pilot valve is preferably provided to control the supply and exhaust of fluid under pressure to the fluid pressure motor, and the arrangement is such that when fluid under pressure is supplied to the motor the control valve will be opened, whereas when its supply is cut off the valve will close under the biasing action of its spring.

Operating mechanism is provided for the pilot valve, and preferably comprises a pilot valve-operating lever connected to an actuating arm of the pilot valve and swingable to open or close the pilot valve.

Means is provided for swinging the pilot valve-operating lever to either one of its two positions, and this may advantageously comprise a toggle lever and spring mechanism which is reversible in the direction of its action, and which is combined with the valve-operating lever so that when acting in one direction it opens the pilot valve, and when acting in an opposite or reverse direction it tends to close the pilot valve. The direction of action of the toggle lever and spring mechanism is controlled by means of a thermostat which is responsive to the coil temperature. The thermostat is so combined with the toggle lever and spring mechanism that upon a rise in pressure in the coil it will act upon the toggle lever and spring mechanism to cause it to act in a direction to open the valve, and in exerting this action upon the toggle lever and spring mechanism the thermostat is opposed in its action

by a spring. Upon a decrease or fall of pressure in the cooling coil the thermostat allows the toggle lever and spring mechanism to be reversed in its action by the spring combined therewith.

A latch is cooperatively interrelated with the valve-operating lever, and when the valve operating lever is in valve-opening position, and the latch is in latching position, the latch will releasably secure the pilot valve open. A thermostat, subjected to the temperature of the box or fixture, controls the latch as to its positions, namely as to whether it is in latching position or released position. An adjustable spring acting upon the latch biases it to released position. With this construction upon a predetermined rise in temperature in the box or fixture the thermostat will overcome the action of the associated spring and will move the latch to latching position so that if the valve-operating lever is in, or is moved to, pilot valve-opening position, it will be releasably latched in such position until the box or fixture temperature has decreased to a selected value, namely one which will allow the action of the thermostat to be overcome by the action of the associated spring.

Other objects and advantages reside in certain novel features of the construction, arrangement, and combination of parts which will be hereinafter more fully described and particularly pointed out in the appended claims, reference being had to the accompanying drawings forming a part of this specification, and in which:

Figure 1 is a diagrammatic view in elevation illustrating a vapor compression refrigerating system with the present invention embodied therein;

Figure 2 is a view in longitudinal, vertical cross section taken on line 2—2 of Figure 3 and illustrating certain features of the construction of the control valve incorporated in the suction line between the cooling coil and compressor in accordance with the present invention;

Figure 3 is a view partly in end elevation and partly in transverse vertical cross section further illustrating the control valve, parts being shown in elevation for the sake of simplicity in illustration;

Figure 4 is a view in longitudinal vertical cross section taken on line 4—4 of Figure 3 and looking in the direction of the arrows;

Figures 5 and 6 are detailed perspective views of the two members which go to make up the lever for the pawl or latch;

Figures 7 and 8 are detailed perspective views illustrating respectively the toggle lever and the valve-operating lever;

Figure 9 is a diagrammatic view showing the various positions assumed by the valve-operating lever, its toggle and spring mechanism, and the latch and its lever in the defrosting and refrigerating cycles; and

Figure 10 is a detail perspective view of the pawl or detent of the latch, its associated spring, and stop screw.

Referring to the drawings, and more particularly to Figure 1, wherein the invention is diagrammatically illustrated as embodied in a vapor compression refrigerating machine, the numeral 10 designates a cooling coil which is combined in the usual way with a box or receptacle illustrated diagrammatically at 11. A compressor 12 is provided and discharges into a condenser 13, which in turn discharges into a receiver 14. A liquid supply line 15 leads from the receiver to an ex-

pansion valve 16, the outlet fitting of which is connected to the inlet of the cooling coil 10. A suction line 17 connects the outlet of the cooling coil 10 to the inlet or suction of the compressor 12. The present invention proposes to incorporate a control valve, designated generally at C, in the suction line.

As illustrated in Figure 2, the control valve C comprises a main valve casing 20 having an inlet fitting 21 connected to the outlet of the coil 10 and an outlet fitting 22 connected to the suction of the compressor. Interposed between the inlet 21 and outlet 22 the valve is provided with an internal ported partition 23, the lower side of which is formed with an annular valve seat 24. On the underside of the partition 23 the main valve casing is formed with a valve chamber 25 extending through the bottom thereof. A removable valve plug 26 is interthreaded with the lower end of the valve chamber, and, when applied, is hermetically sealed thereto by means of a sealing washer 27. A main valve 28 is disposed in the valve chamber 25 in cooperative relation to the valve seat 24 of the ported partition 23. Preferably the head of the valve 28 is provided with a valve facing 29 which is secured in place by a retaining ring 30. The valve 28 has a downwardly extending stem 31 which is guided in a tubular valve guide 32 formed, if desired, as an integral part of the plug 26. A coil spring 33 encircles the guide 32, has its lower end abutting the plug 26, and has its upper end bearing upwardly against the under side of the head of the valve 28 to bias the valve to closed position—that is, to position wherein its facing 29 has sealing engagement with the valve seat 24.

Above the partition 23 the main valve casing 20 is provided with an outlet chamber 35 which extends through the upper end thereof. The top of the main valve casing 20 is appropriately machined around the margin of the upper end of the outlet chamber 35 to adapt it to be interfitted with a pilot valve casing 36. A sealing gasket 37 is interposed between the pilot valve casing 36 and the main valve casing 20, and these parts are held assembled by a suitable number of cap screws 38 (see Figure 3).

A fluid pressure motor is provided for opening the main valve 28 and may comprise a bellows 39 accommodated in the outlet chamber 35. The upper end of the bellows 39 is mechanically engaged with and hermetically sealed to a depending annular extension 40 of the pilot valve casing 36. The lower end thereof is mechanically connected and hermetically sealed to a bellows cup 41. The bellows cup 41 has a central portion bearing against the upper end of a pin-like extension 42 of the valve stem 31 so as to provide a motion transmission train between the fluid pressure motor and the main valve 28.

The pilot valve casing 36 is formed with a pilot valve chamber 43 in which a pilot valve 44 is slidably fitted. The pilot valve 44 has a body portion 45 of non-circular cross section but having peripheral surfaces which slidably engage portions of the inner peripheral surface of the valve chamber 43, other peripheral portions of the pilot valve body 45 being, however, spaced from the inner peripheral surface of the valve chamber 43 so that fluid may flow freely from one side of the pilot valve body 45 to the other, and also from either side of the pilot valve body 45 to an annular groove 46 formed in the central peripheral portion of the valve body. The pilot valve 44 is in reality two valves with a common body 45, for at

one end of the pilot valve body is an inlet valve member 47, whereas at the opposite end of the pilot valve body is an outlet valve member 48. These valve members 47 and 48 coact with apertures or ported valve seats 49 and 50, respectively. The valve seat 49 is carried at the inner end of a high pressure inlet fitting 51, threaded into the pilot valve body and hermetically sealed thereto by a gasket 52. A high pressure line 53 connects this high pressure inlet fitting 51 with a suitable source of fluid under pressure which may conveniently be the liquid supply line 15. If desired, pressure may be supplied to line 51 by establishing connection between it and some point on the discharge gas line, or in any other suitable manner.

The port of the outlet valve seat 50 communicates through a chamber 54 and a passage-way 55 with the outlet chamber 35.

When the pilot valve 44 is positioned as shown in Figure 2, the supply of pressure to the fluid pressure motor is cut off, and any pressure therein is exhausted through the port 56, which provides for communication between the interior of the bellows motor 39 and the pilot valve chamber 43. From the port 56, the fluid under pressure passes into groove 46, thence along the spaces between the periphery of pilot valve body 45 and the inner peripheral wall of valve chamber 43 to the port of the valve seat 50, chamber 54, and passage 55, to the outlet chamber 35 of the main valve casing 20. On the other hand, if the pilot valve 44 is shifted so that its valve member 40 closes the port through the valve seat 50 and opens the port through the inlet valve seat 49, then fluid under pressure will flow through the high pressure line 53, inlet fitting 51, ported valve seat 49 to the valve chamber 43, thence around the periphery of the pilot valve body 45 through the annular groove 46 and port 56 into the interior of the bellows motor 39. The bellows 39 will then expand and its cup 41 will press down on the pin-like extension 42 of the valve 28 and open the valve against the action of its spring 33.

The pilot valve 44 is shifted from one position to the other by means of an actuating arm 60, one end of which has a ball and socket connection 61 with the central portion of the body 45 of the pilot valve. An intermediate portion of the valve-actuating arm or lever 60 has a ball and socket or universal mounting 62 in a packing gland 63 threaded into the pilot valve casing 36 and hermetically sealed thereto by means of a washer 64. A sealing bellows 65 is provided and has one end mechanically connected and hermetically sealed to the arm 60 adjacent to its universal mounting 62 and has its opposite end similarly connected and sealed to the gland 63. The arm 60 projects rearwardly from the pilot valve housing and into a control box 66 which contains the most of the elements of the mechanism which provide for the automatic operation of the pilot valve 44 and the consequent automatic operation of the main valve 28.

As illustrated in Figures 3 to 9, inclusive, this mechanism comprises a valve-operating lever, designated generally at 67. The lever 67 may be advantageously stamped from sheet metal, and when so constructed the main portion of the lever, designated at 68, is of channel shape (see Figure 8), the side flanges of the channel being indicated at 69 and 70 and the body portion thereof at 71. The body portion is provided with a cut-out or rectangular slot 72 for clear-

ance purposes, as will hereinafter appear. The lower ends of the side flanges 69 and 70 have transversely aligned openings 73 to facilitate the fulcruming of a lever on a pivot pin 74, which is mounted in a pivot pin bracket 75 suitably secured as at 76 and 77 in the control housing 66. The flange 70 of the lever has an extension 77 which is formed with an aperture 78 through which the actuating arm 60 of the pilot valve extends. The upper end of this extension is bent laterally and then downwardly to form a pointed latching projection 79. The upper end of the body of the lever is provided with an integral turned lug 80 carrying a pointed projection 81 for the purpose which will presently appear. Mechanism is provided for shifting the lever 67 to cause it to swing the actuating arm 60 and consequently move the pilot valve 44 to open or closed position.

The pilot valve 44 is considered to be in open position when its valve member 48 closes the ported valve seat 50 and the valve member 47 is spaced from and opens the valve seat 49 so that fluid under pressure is supplied to the bellows motor 39 and the main valve 28 is also opened. The closed position of the pilot valve is that shown in Figure 2 wherein fluid under pressure is exhausted from the bellows motor 39 and the main valve 28 is closed.

A reversible acting toggle lever and spring mechanism is preferably provided for shifting the lever 67 to either of its two positions and comprises a toggle lever 82 which also may be constructed of sheet metal and is of channel-shaped form (see Figure 7), with the lower ends of the flanges of the channel provided with transversely aligned apertures 83. The toggle lever 82 is of less width than the valve-operating lever 67 and is disposed between the side flanges 69 and 70 thereof, and is mounted upon the same fulcrum pin 74 as the valve-operating lever 67, the pin 74 passing through the apertures 83 of the toggle lever 82 for this purpose. The body portion of the toggle lever 82 has an integral turned lug 84 at its upper end, the lug 84 also carrying a point of projection 85.

In Figure 4, the projections 81 and 85 are shown as integral with their respective levers 67 and 82, and while these parts may be fashioned in this manner, it is preferable to have the projections 80 and 85 of separate pieces of hard steel and suitably secure them to their levers as illustrated in Figures 7 and 8.

In the assembly the projections 81 and 85 are in confronting relation and engage spring cups 86 provided at the ends of a toggle spring 87, which is compressed between the cups and consequently is interposed between the toggle lever and the valve-operating lever.

By shifting the position of the toggle lever 82 relative to the valve-operating lever 67, the action of the toggle spring 87 may be reversed. In the position shown in Figure 4, the toggle lever 82 is so angularly related to the valve-operating lever 67, and the spring 87 is consequently so inclined or positioned, that the force of the spring 87 tends to urge the valve-operating lever 67 in a counterclockwise direction as viewed in Figure 4, thereby shifting the arm 60 in such direction as to open the pilot valve 44. If now the toggle lever 82 is swung in a counterclockwise direction with respect to the valve-operating lever 67, or to a position such as shown in "Position 1" in the diagram, Figure 9, the ac-

tion of the spring 87 will be reversed and it will urge the valve-operating lever 67 in clockwise direction as viewed in Figure 4, thereby so moving the arm 60 as to move the pilot valve 44 to closed position.

The position of the toggle lever 82 is controlled by means of a thermostat, designated generally at 88, and adjustable spring means, designated at 89. The thermostat 88 comprises a bellows 90 mounted on the control box housing and combined with the conventional capillary tube 91 and bulb 92. The bulb 92 is in intimate contact and in efficient heat interchanging relation with the cooling coil 10.

The bellows 90 is of conventional construction and includes a housing 93, bellows proper 94, and driving projection 95, the pointed end of the driving projection engaging in a seat or conical depression 82' in the body of the toggle lever 82.

The adjustable spring means 89 comprises a compression spring 96 having one end engaging the convex wall of the seat 82' and having its other end bearing against a nut 97 threaded on a fixed screw 98 so as to be adjustable thereon to vary the compression of the spring 96.

With this construction, when the temperature of the coil 10 increases, the fluid in the bulb 92, capillary tube 91, and bellows 90 increases, and this increase in pressure forces the driving projection 95 to the right as viewed in Figure 4, and when it has increased to a predetermined amount, depending upon the compression of the spring 96, the toggle lever 82 will be moved to the position shown in Figure 4, and the spring 87 will thereupon so move the valve-operating lever 67 as to open the pilot valve 44. Decrease in the temperature of the cooling coil 10 will decrease the pressure in the thermostat 88 and consequently allow the spring 96 to overcome the pressure in bellows 90 and so shift the toggle lever 82 and the spring 87 to the position illustrated as "Position 8" in Figure 9, whereupon the spring 87 will tend to swing the valve-operating lever 67 in a direction (counter-clockwise) to close the pilot valve 44.

Whether or not the spring 87 will effect opening of the valve 44 under the conditions just described depends upon the position of a latch, designated generally at 100. The latch 100 comprises a pawl or detent 101 pivotally supported as at 102 on an arm 103 of a latching lever, designated generally at 104. A blade spring 105 urges the pawl 101 to latching position, and its movement to latching position under the influence of this spring 105 is limited by a stop screw 106. The latching lever 103 includes a second arm or member 107, these two arms being constructed of sheet metal, as illustrated in Figures 5 and 6, and being interfitted and pivotally supported on a common fulcrum pin 108. The arm 107 is provided with a sheet 109 which receives the driving projection 95' of a thermostat, designated generally at 110, and which may be identical in construction with the thermostat 88 save that its bulb 92', which is identical with the bulb 92 of the thermostat 88, is subject to the temperature in the box or receptacle 11.

The arrangement is such that when the temperature in the box or fixture 11 increases, a corresponding increase in the pressure of the fluid in the bellows of the thermostat 110 tends to swing the latching lever 100, and consequently the latching pawl 101, to latching position. How-

ever, this action is opposed by adjustable spring means, designated generally at 111. This adjustable spring means 111 comprises a coil spring 112 having its lower end bearing on and suitably interfitted with a spring seat provided therefor on the outer end of the arm 103 of the latching lever. A spring cup 113 engages the upper end of the coil spring 112 and is engaged with a pointed projection 114 formed at the lower end of an adjusting screw 115. The screw 115 is threaded into an internally threaded bearing 116 carried at the top of the control casing and is equipped at its upper end with a cup 117 to facilitate its adjustment.

Typical phases of the operations involved in a defrosting and refrigerating cycle are diagrammatically illustrated in Figure 9. In Figure 9 eight phases of the operation, or eight different positions of the control mechanism, are illustrated, and the several positions are respectively designated by the numerals 1 to 8 enclosed in circles.

Position 1 in Figure 9 shows the control mechanism at the start of the defrosting cycle. Due to the low temperature in the coil 10, a low temperature exists in the bellows 90 and it is in a contracted position. The defrosting spring 96 consequently forces the toggle lever 82 in a counter-clockwise direction, as viewed in Figure 9, and this so inclines the toggle spring 87 that it biases the valve-operating lever 67 to rotate clockwise, as illustrated in Figure 9. The latch 107 being released the valve-operating lever 67 will move the pilot valve actuating arm 60 in such manner as to close the pilot valve 44 and consequently result in closing of the main valve 28. The closure of the main valve 28 isolates the coil 10 from the system.

Position 2 in Figure 9 shows the control mechanism in the second stage of the defrosting cycle. The temperature in the coil 10 starts to rise, due to the shutting off of the refrigerant, and the pressure in the coil starts to increase. Defrosting bellows 90 starts to expand, due to the rise in pressure caused by the rise in coil temperature, and this expansion of the defrosting bellows 90 forces the toggle lever 82 to rotate in a clockwise direction, as viewed in Figure 9, against the action of its associated spring 96, thereby moving the toggle spring 87 closer to dead center.

Position 3 in Figure 9 shows the control mechanism in the third stage of defrosting with the pressure in the defrosting bellows 90 such that the toggle lever 82 is on dead center with the valve-operating lever 67.

Position 4 in Figure 9 shows the control mechanism in the last stage of the defrosting cycle. The pressure in the defrosting bellows 90 has overcome the force of the defrosting spring 96 with the consequence that the toggle lever 82 passes the dead center of the valve-operating lever 67, thereby putting the toggle spring 87 in such position that it is biasing the valve-operating lever 67 counter-clockwise, as viewed in Figure 9.

Position 5 shows the control mechanism at the same time period, but the valve-operating lever 67 has moved counter-clockwise, as viewed in Figure 9, due to the action of the toggle spring 87 exerting a force in that direction. Valve-operating lever 87 has moved the pilot valve arm 60 to the pilot valve open position so that fluid under pressure is supplied to the bellows motor 39, thereby opening the main valve 28 and starting the refrigerating cycle. At the same time

the pointed latching projection 79 of the valve-operating lever 67 engages the pawl or detent 101 of the latch 100 since the latch is now in latching position, for the reason that as the defrosting cycle progresses the box or receptacle temperature rises, thereby increasing the pressure in the receptacle temperature bellows 110, causing it to expand and rotate the latching lever 104 in a counter-clockwise direction, as viewed in Figure 9 and against the action of the temperature adjustment spring 111.

Position 6 shows the control mechanism in the first stage of the refrigerating cycle. Due to the characteristic of the refrigerating system, the coil temperature decreases faster than the box or receptacle temperature, and hence defrosting bellows 90 contracts, decreasing the force against the toggle lever 82 and allowing the spring 96 to rotate the toggle lever 82 in counter-clockwise direction, thereby bringing the toggle spring 87 closer to dead center.

Position 7 shows the control mechanism in the second stage of the refrigerating cycle. The coil temperature is decreased so the defrosting bellows 90 has contracted to the point that the defrosting bellows 90 has allowed the toggle lever 29, under the influence of its spring 96, to bring the toggle spring 87 to the position of forcing the valve-operating lever 67 to the pilot valve closing position. But if the box or receptacle temperature is not low enough, the box temperature bellows 110 will keep the pawl lever 104 of the latch 100 in such position that its pawl or detent 101 will remain engaged with the pointed latching projection 79 of the valve-operating lever 67, thereby latching the valve-operating lever in pilot valve open position. The box or receptacle temperature must drop to a point at which the box temperature bellows 110 will contract sufficiently to allow the box temperature adjusting spring means 111 to force the pawl lever 104 of the latch 100 in a clockwise direction, as viewed in Figure 9, thereby allowing the detent 101 to disengage the latching projection 79, thereby permitting the lever 67 to snap over to valve-closing position, as shown in position 1, starting the defrosting cycle and completing the refrigerating cycle.

The defrosting temperature depends upon the rate at which the coil 10 can become defrosted. 36° F. is a typical temperature. If the ratio of coil surface to box or receptacle content is such that a greater amount of ice accumulates on the coil, a temperature higher than 36° F. will be required. Conversely, if there is a small amount of frost and ice accumulated on the coil, a lower temperature will completely defrost the coils. Therefore, a defrosting temperature adjusting means, constituted of the spring 96 and a screw 98, is provided to vary the compression of the defrosting spring 96, so as to increase or decrease the temperature at which complete defrosting is accomplished.

Box or receptacle temperature may also be variable and must be held at the required temperature selected. Therefore, a temperature adjusting knob 117 is provided so that the proper box or receptacle temperature can be had by adjusting the knob 117 to the usual or suitable temperature markings on the indicator conveniently associated with such a control knob.

While we have shown and described one construction in which the invention may be advantageously embodied, it is to be understood that the construction shown has been selected merely

for the purpose of illustration or example, and that various changes in the size, shape, and arrangement of the parts may be made without departing from the spirit of the invention or the scope of the subjoined claims.

We claim:

1. In a refrigerator of the type wherein the refrigerating effect is obtained by virtue of the passage of a refrigerant through a cooling coil disposed in heat interchanging relation to the compartment of the refrigerator, a control valve combined with the cooling coil so as to permit flow therethrough when opened and block flow therethrough when closed, a reversible operating mechanism for said valve, said operating mechanism biasing the valve to open position when acting in one direction and to closed position when acting in the reverse direction, a thermostat subjected to the temperature of the cooling coil and combined with said operating mechanism to cause the same to bias the valve to open position upon predetermined rise of pressure in the coil and to closed position upon predetermined fall of pressure in the coil, a latch co-operable with the operating mechanism and adjustable from a latching to a releasing position, said latch functioning when in latching position and when the valve is in open position to hold the operating mechanism and the valve in valve open position, and a thermostat subjected to the temperature in the compartment and combined with the latching mechanism to move the same to latching position upon predetermined rise in temperature in the compartment and to provide for the movement of the latching mechanism to released position upon predetermined fall of temperature in the compartment.

2. In a refrigerator of the type wherein the refrigerating effect is obtained by virtue of the passage of a refrigerant through a cooling coil disposed in heat interchanging relation to the compartment of the refrigerator, a control valve combined with the cooling coil so as to permit flow therethrough when opened and block flow therethrough when closed, a pilot valve to control the action of the main valve, an operating lever for said pilot valve, a reversible toggle lever and spring mechanism combined with said valve operating lever effective when acting in one direction to shift the lever to one of its positions and when acting in the opposite direction to shift the lever to the other of its positions, a thermostat subjected to the temperature of the cooling coil and combined with the reversible toggle lever and spring mechanism to control the direction of action thereof, a latch co-operable with the valve-operating lever and acting when in latching position to retain the lever in one position and when in its released position to free the lever, and a thermostat subjected to the temperature in the compartment and controlling the action of the latch.

3. In a refrigerator of the type including a chamber, a cooling coil therein, a compressor, and means, including a suction line, for operatively interconnecting the cooling coil and the compressor, a control valve incorporated in the suction line and acting when open to permit flow therethrough and when closed to block all flow therethrough, latching means for releasably securing the valve in open position, thermo-responsive means subjected to the temperature in the chamber and coacting with said latch to release the same upon predetermined drop in temperature in the chamber and to move the

same to latching position upon predetermined rise of temperature in the chamber, mechanism operable to open the valve and also operable to close the valve when the latch is released, and thermo-responsive means subjected to the temperature of the cooling coil for causing said mechanism to bias the valve to open position upon predetermined rise of pressure in the coil and to closed position upon predetermined fall of pressure therein.

4. In a refrigerator of the type including a chamber, a cooling coil therein, a compressor, and means, including a suction line, for operatively interconnecting the cooling coil and the compressor, a control valve incorporated in the suction line and acting when open to provide for flow through said line and when closed to stop all flow therethrough, an operating lever for said valve, a reversible action toggle lever and spring combined with said lever and adjustable so as to cause the lever to bias the valve either to open or to closed position, a thermostat subjected to the temperature of the cooling coil and interconnected with said reversible action toggle lever and spring to control the direction of action thereof, a latch shiftable to latching or to released position and functioning in latching position to releasably secure the valve-operating lever in a position wherein the valve is maintained open, and a thermostat subjected to the temperature in the chamber and interconnected with said latch to release the latch upon predetermined fall of temperature in the chamber and move it to latching position upon predetermined rise of temperature therein.

5. In a refrigerator of the type including a chamber, a cooling coil therein, a compressor, and means, including a suction line, for operatively interconnecting the cooling coil and compressor, a control valve incorporated in the suction line between the cooling coil and the compressor and acting when open to permit flow of refrigerant through said line and when closed to stop all flow therethrough, latching means for releasably securing the valve in open position, means responsive to the temperature in the chamber for releasing said latching means, mechanism operable, to open the valve and also operable, when the latch is released, to close the valve, and temperature-responsive means subjected to the temperature of the coil for controlling the action of said mechanism.

6. A vapor compression refrigerating machine including a chamber, a cooling coil therein, a compressor, a suction line connecting the cooling coil and the compressor, a control valve incorporated in the suction line and acting when open to permit flow therethrough and when closed to block all flow therethrough, a latch for releasably securing the valve in open position, a spring for biasing the latch to released position, a thermostat of the expanding fluid type subjected to the temperature in the chamber, operatively interconnected with the latch and opposing the action of said spring thereon, operating mechanism for the valve, a spring for biasing the operating mechanism to cause it to close the valve, and a thermostat of the expanding fluid type subjected to the temperature of the cooling coil, operatively interconnected

with said operating mechanism and opposing the action of said last-named spring thereon.

7. A vapor compression refrigerating machine including a chamber, a cooling coil therein, a compressor, a suction line connecting the cooling coil and the compressor, a control valve incorporated in the suction line and acting when open to permit flow therethrough and when closed to block all flow therethrough, a latch for releasably securing the valve in open position, a spring for biasing the latch to released position, manually operable means for varying the compression of the spring, a thermostat of the expanding fluid type subjected to the temperature in the chamber and opposing the action of said spring, operating mechanism for the valve, a spring for biasing said operating mechanism to a position to close the valve, manually adjustable means for varying the tension of said last-named spring, and a thermostat of the expanding fluid type subjected to the temperature of the coil and coacting with the operating mechanism in such manner as to oppose the action of its associated spring.

8. A vapor compression refrigerating machine including a chamber, a cooling coil therein, a compressor, a suction line connecting the cooling coil and the compressor, a control valve incorporated in the suction line and acting when open to permit flow therethrough and when closed to block all flow therethrough, means responsive to the temperature of the chamber to hold the valve open until the temperature in the chamber falls to a predetermined value and to release the valve for closing movement when the temperature in the chamber has fallen to said predetermined value, and means responsive to coil temperature and effective to close the valve when the valve is released for closing movement by said first-named means and the temperature in the coil has fallen to a predetermined value and also effective to open the valve when the temperature of the coil rises to a predetermined value.

9. A vapor compression refrigerating machine including a chamber, a cooling coil therein, a compressor, a suction line connecting the cooling coil and the compressor, a control valve incorporated in the suction line and acting when open to permit flow therethrough and when closed to block all flow therethrough, a latch cooperable with the valve and effective, in its latching position, to hold the valve open, and in its release position to release the valve for closing movement, a thermostat responsive to the temperature of the chamber and operatively interconnected with the latch to shift the latch to latching position when the temperature in the chamber rises to a predetermined degree and to a released position when the temperature in the chamber falls to a predetermined degree, and a thermostat responsive to coil temperature and operatively interconnected with the valve to close the valve when the latch is in released position and the coil temperature has risen to a predetermined value, and to open the valve when the coil temperature rises to a predetermined value.

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