Sept. 28, 1926. 1,601,025

J. G. KING

CONTROLLING MECHANISM

Filed April 30, 1924 2 Sheets-Sheet 1

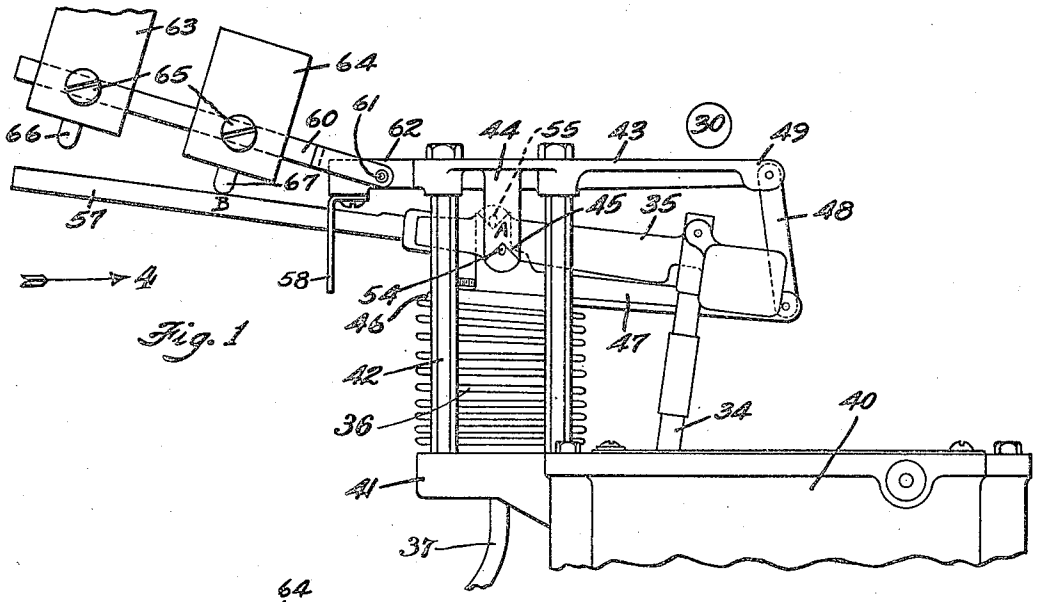


Fig. 1

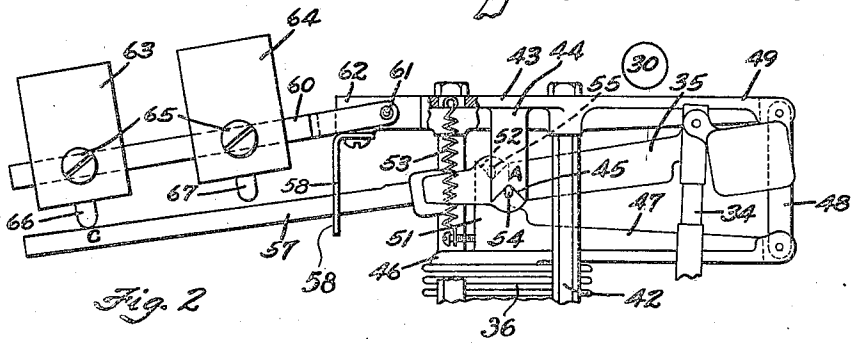


Fig. 2

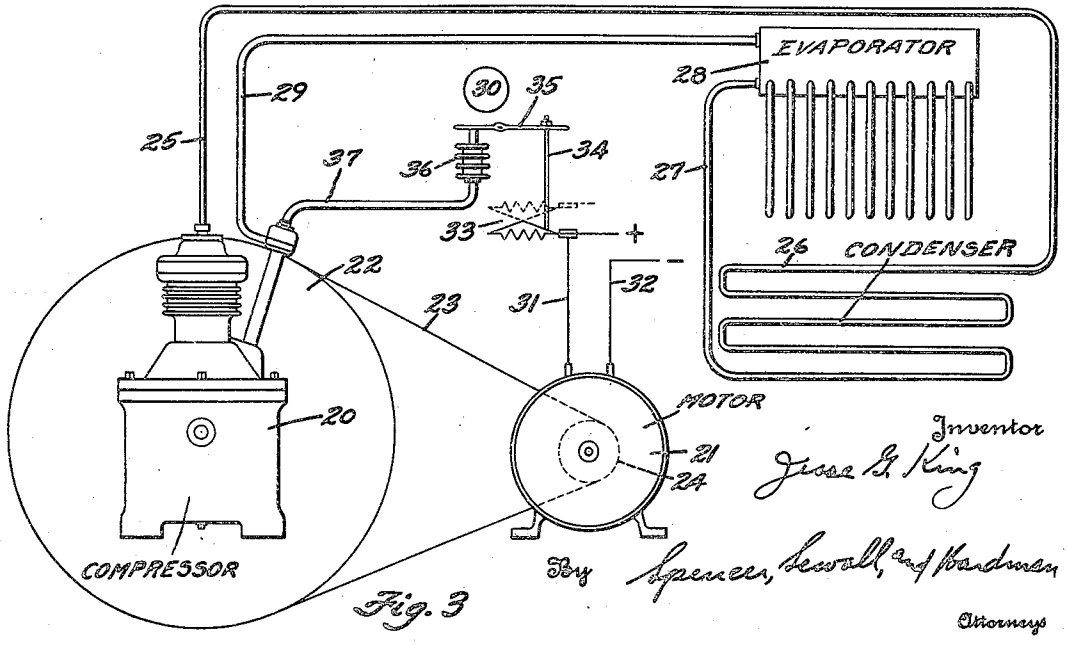


Fig. 3

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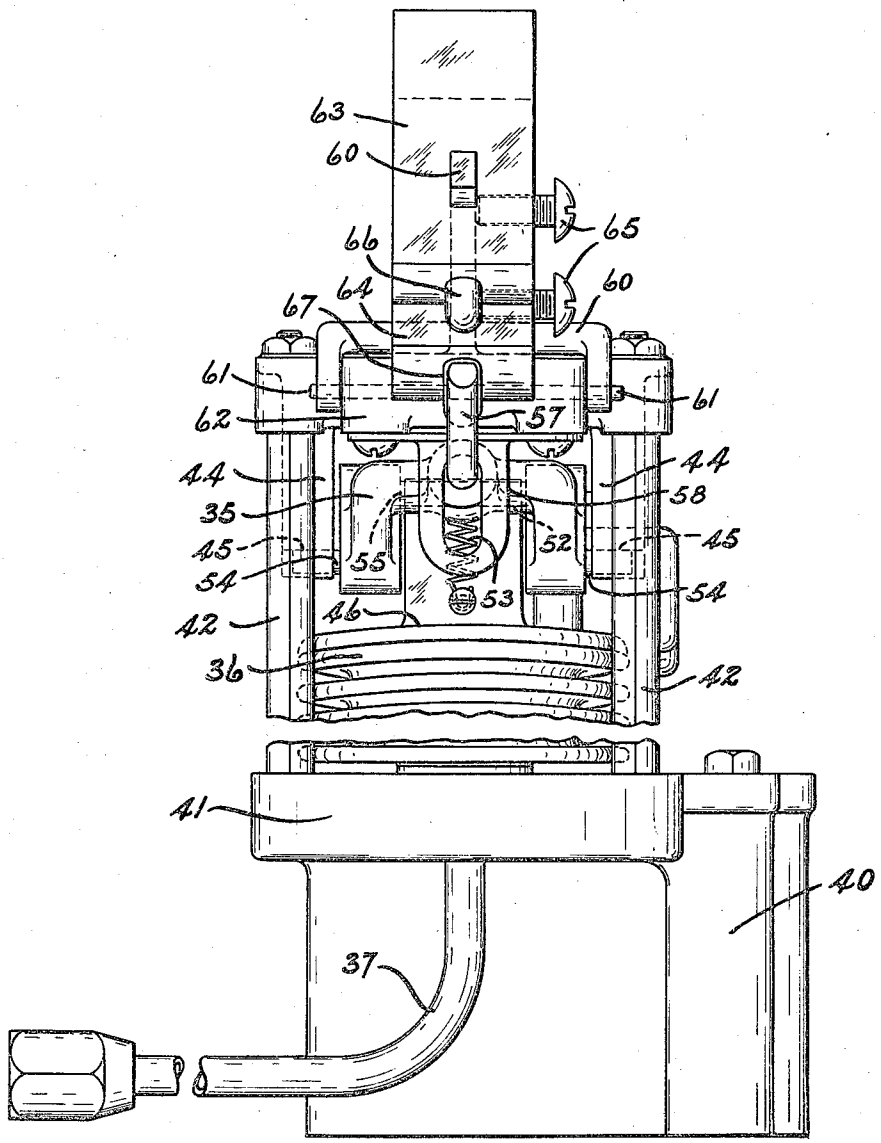


Fig. 4

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UNITED STATES PATENT OFFICE.

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CONTROLLING MECHANISM.

Application filed April 30, 1924. Serial No. 710,128.

The present invention relates to automatic controlling mechanism, and particularly to mechanism for automatically starting and stopping the compressor of a refrigerating apparatus.

Refrigerating apparatus are usually controlled by a controller which automatically starts and stops the compressor of the system, in accordance with the temperature of the compartment being cooled, generally utilizing a volatile fluid which may be the refrigerant medium or may be a volatile fluid in an extraneous circuit. In this type of refrigerating apparatus it is desirable to control the starting and stopping of the compressor independently of one another, whereby the low temperature at which the compressor is stopped can be varied at will independent of the high temperature at which the compressor is started.

One of the objects of the present invention is to simplify the construction of that part of the controller by which the independent high and low temperatures are controlled.

Further objects and advantages of the present invention will be apparent from the following description, reference being made to the accompanying drawings, wherein a preferred form of embodiment of the present invention is clearly shown.

In the drawings:

Fig. 1 is a side-elevational view of the improved controller, showing certain parts thereof in one position.

Fig. 2 is a fragmentary view similar to Fig. 1, and partly in section, with certain parts thereof in another position,

Fig. 3 is a diagrammatic view of a refrigerating apparatus of the compressor-condenser-expanded type, in which apparatus the present invention is embodied for illustration, and

Fig. 4 is an end view looking in the direction of arrow 4 in Fig. 1.

Referring to the drawings: 20 is a compressor adapted to be driven by an electric motor 21 through belt and pulley connections 22, 23 and 24. The high-pressure side of the compressor 20 is connected with a pipe 25, which in turn is connected with a refrigerant condenser 26. Condenser 26 is connected by a pipe 27 to an evaporator 28, which in turn is connected to the low-pressure side of the compressor 20, by a pipe 29. The flow of refrigerant from the condenser 26 to the evaporator 28 may be controlled in any suitable manners, such as, by a float-controlled valve, or an expansion valve (not shown).

It is the usual practice to render the compressor operative at such intervals as may be required to maintain the temperature in the compartment to be cooled below a predetermined upper limit and to continue the operation of the compressor until a predetermined low limit has been reached. In the present invention the pressure within the low-pressure side of the refrigerating apparatus is utilized for controlling a controller 30. This controller 30 is, therefore, operable for making and breaking the circuit to the electric motor 21. The circuit for the motor is indicated at 31 and 32, which is controlled by a snap switch 33. The snap switch 33 is actuated by a rod 34 operatively connected to a lever 35. Lever 35 is actuated by an expandable metallic bellows 36, which is connected by a pipe 37 to the low-pressure side 29 of the system. Bellows 36 is adapted to respond to the pressure within the low-pressure side of the system, whereby to automatically actuate the snap switch 33 to close the circuit to the motor 21 when the pressure within the low-pressure side reaches a predetermined high limit and to interrupt the circuit to the motor 21, when a predetermined low limit has been attained within the low-pressure side of the system.

Referring more in detail to the controller; the rod 34 extends into a box 40 in which the snap switch 33 is located. The box 40 is provided with an extension 41, which carries four upright standards 42, the upper end of which carry a frame 43. Between the supporting standards 42 are two depending bearings 44, which form a part of the frame 43, the lower end of each being provided with a V-shaped notch 45. Figs. 1 and 2 being side-elevationed, show only two of the standards 42 and one of the bearings 44. However, it will be understood that the other two standards 42 are located in alignment with those shown and likewise the other bearing 44 depends from the other side of frame 30. The bellows 36 is supported by the extension 41 and located between the standards 42. The lower end of said bellows is sealed to the extension 41 in a suit-

able manner and is provided with an opening (not shown) communicating with the pipe 37. The upper end of the bellows 36 is sealed to a head 46 from which an arm 47 extends in a direction substantially parallel with the frame 43 and which is connected by a link 48 with an extending hand 49 of frame 43. The head 46 is provided with an upwardly extending bearing 51 having a V-shaped notch 52 in its upper end, the center or apex line of said notch being parallel with but displaced laterally from the center or apex line of notches 45 in the bearings 44. A spring 53 is connected between the frame 43 and the head 46 and normally tends to expand the bellows 36. The lever 35 constitutes the operating member and is fulcrumed in the notches 45 by a knife bearing 54 carried by said lever. A knife bearing 55 carried by the lever 35 rests within the notch 52. One end of the lever 35 is connected with the rod 34 while the other end 57 of said lever extends beyond the frame 43. The lever 35 is preferably guided by a guide member 58 depending from the frame 43.

A lever 60 is fulcrumed at 61 to an extending portion 62 of frame 43. Lever 60 is located above the portion 57 of lever 35 and carries two independently slidable and adjustable weights 63 and 64 which are locked in position by set screws 65. Weights 63 and 64 are provided with lugs 66 and 67 respectively which lie in the path of movement of the lever portion 57 and are arranged to be engaged thereby. As shown, the fulcrum point 61 for lever 60 is horizontally located with respect to a vertical line passing thru the apex of notch 45. Since the lever 60 is rotated by the lever 35, the degree of movement through which the lever 35 is moved is less than the degree of movement of the lever 60. Since the movement in degrees is different between the lever 35 and the lever 60, the lug 67 will be in engagement with the portion 57 of lever 35, throughout a certain range of movement of the portion 57 and throughout another portion of movement of portion 57, the lug 66 will be in engagement with the portion 57. Due to the fact that the lugs 66 and 67 are located longitudinally with respect to the portion 57, the length of the lever arm of portion 57 is changed from A—B to A—C through different ranges of movement of the lever 35, as shown in Figs. 1 and 2 respectively. In this manner the force of the weights 63 and 64 acting upon the rod 57 is varied.

If sufficient pressure is admitted to the bellows 36, the latter will expand to such an extent as to cause the lever 35 to move about its fulcrum on bearing 45, thereby turning the lever so as to lift the weights 63 and 64 and to depress the opposite end of the lever 35 to force the rod 34 downwardly to actuate the snap switch 33. The controller is shown in this position in Fig. 1. In this position the snap switch 33 has been actuated to complete the circuit to the motor 21 whereby the compressor 20 is operated. The operation of the compressor causes a pressure decrease in the low-pressure side of the apparatus including the pipe 37. As the pressure within the pipe 37 and likewise in the bellows 36 recedes, the bellows 36 will collapse due to the force of the weights 63 and 64 operating through the lever 35 to bear downwardly upon the head 46 of said bellows. Throughout a certain range of movement of the lever 35, the lug 67 will engage the portion 57 of lever 35 and throughout another portion of movement of lever 35, the lug 66 will engage portion 57. It will, therefore, be apparent that the force acting upon the lever 35 is varied during the movement of said lever. The lengths of the lugs 66 and 67 are such that, prior to the time when the pressure has decreased in the bellows 36 to such an extent as to open the snap switch 33, the portion 57 of lever 35 will have moved away from the lug 67 and will be engaged by the lug 66. After the pressure within the low-pressure side has decreased to a predetermined amount, the bellows 36 will collapse sufficiently to permit the force of the weights 63 and 64 to rotate the lever 35 to such an extent as to actuate the switch 33 to break the motor circuit. As the compartment in which the evaporator is located, increases in temperature, the pressure within the low side will also increase, causing an increase in pressure within the bellows 36. This increase of pressure in the bellows 36 will cause same to expand and move lever 35. The portion 57 will first engage the lug 66 of weight 63 and after a certain movement of the portion 57, the portion 57 will engage lug 67 and rest the weights through said lug 67. After a predetermined movement of the lever 35 in this direction, the snap switch 33 will again be actuated to make the circuit to the motor 21.

By providing a controller of the present type the pressures at which the motor is started or stopped can be adjusted at will, independent of one another. For instance, if it is desirable to regulate the low pressure at which the circuit to the motor is to be interrupted, the weight 63 is adjusted along the lever 60 until the lever arm A—C is such that it will add a certain force which acts upon the portion 57 of lever 35; likewise, if it is desirable to adjust the high-pressure point at which the motor is to start, the weight 64 is adjusted longitudinally along the lever 60 until the lever arm A—B is of such a length that the force is such as to permit the switch to close at the desired degree of pressure. The shifting of the weight 64 is liable to slightly change the

force of said weights 63 and 64 and thereby slightly change the low-pressure point at which the weight 63 was previously adjusted. However, by readjusting the weight 63 the controller can be adjusted to operate at the substantially required pressure.

While the form of embodiment of the present invention as herein disclosed, constitutes a preferred form, it is to be understood that other forms might be adopted, all coming within the scope of the claims which follow.

What I claim is as follows:

1. In a refrigerating system, a controller comprising, in combination, a movable operating member, a device to be controlled thereby, and means for controlling the movement of said member comprising a pivoted arm arranged in the path of movement of said member, the member being adapted to engage the arm at various points along the length of said arm during the movement of said member.

2. In a refrigerating system, a controller comprising, in combination, a movable operating member, a device to be controlled thereby, and means for controlling the movement of said member comprising a pivoted arm, adjustable weights slidably mounted upon said arm and arranged in the path of movement of said member, one of said weights being adapted to engage the member throughout a certain movement of said member while another of said weights being adapted to engage the member throughout another movement of said member.

3. In a refrigerating system, a controller comprising, in combination, a movable operating member, a device to be controlled thereby, and means for resisting the movement of said member comprising a pivoted arm located above said member and arranged in the path of movement of said member to resist the upward movement thereof, the member being adapted to engage the arm at various points along the length of said arm during the movement of said member.

In testimony whereof I hereto affix my signature.

JESSE G. KING.