

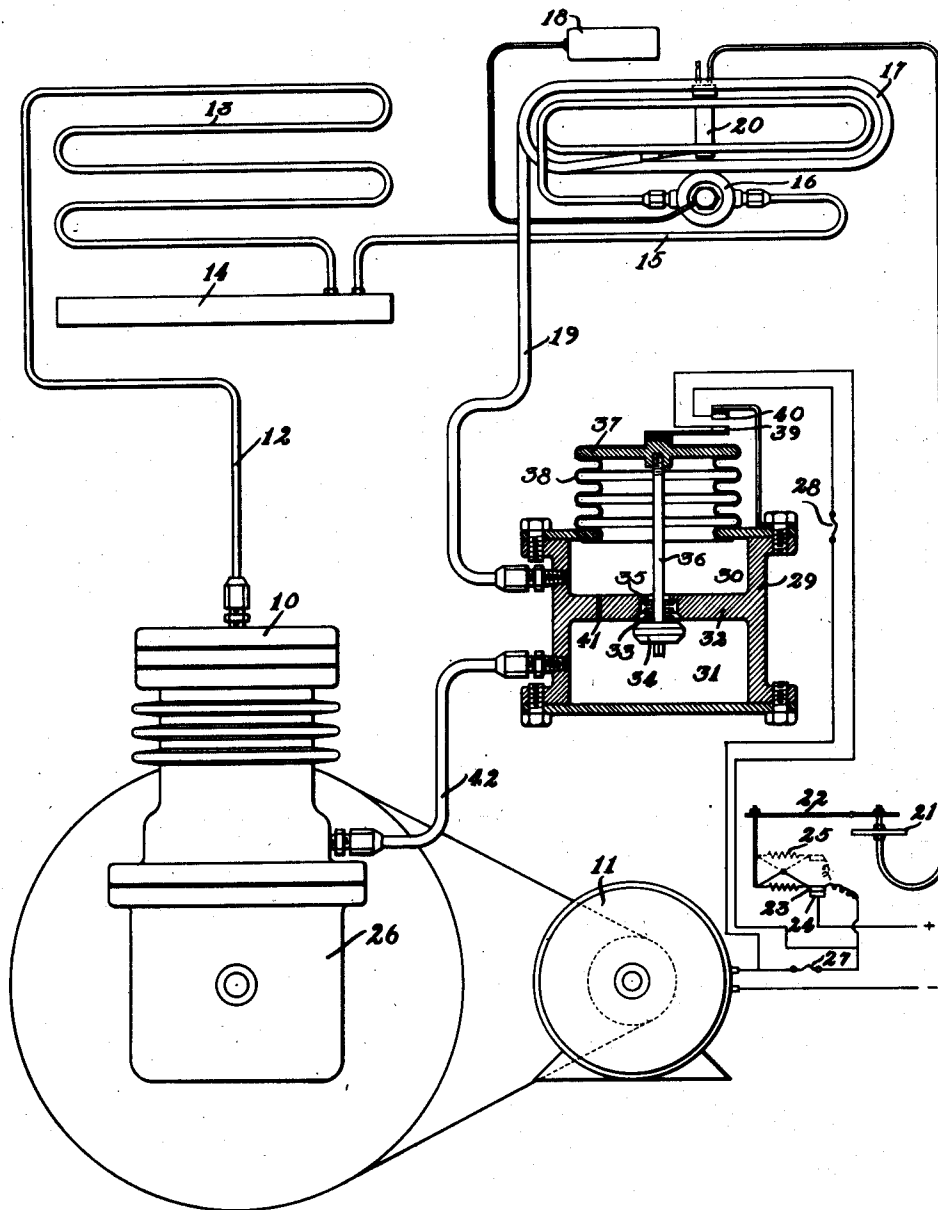
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REFRIGERATING APPARATUS

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REFRIGERATING APPARATUS

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This invention relates to improvements in refrigerating apparatus and more particularly the means used for controlling the operation of mechanical refrigerators.

5 It is an object of the invention to provide means for operating the refrigerant circulating apparatus of a refrigerating system in such a manner as to modify during certain periods the action of the safety devices used
10 for protecting the apparatus during normal operation of the same.

With this object in view the invention contemplates providing means for automatically causing the load normally borne by
15 the regular safety device of the electrical circuit of the system to be distributed and carried by a plurality of such devices during the occurrence of a transient overload and to restore the circuit automatically to
20 the normal control of the regular safety device when the transient overload is dissipated. It is a further object to arrange the devices carrying the overload in such a manner that prolonged overloading will cause
25 them to operate to protect the system by breaking the circuit.

It is still another object of the invention to utilize a single means for controlling the safety device and also prevent overloading
30 of the compressor particularly during the starting operation.

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

In the drawing:

40 There is shown a diagrammatic representation of a refrigerating system operated by a compressor and an electric motor and provided with the improved circuit protecting arrangement of the invention.

45 In the operation of refrigerating apparatus of the compressor-condenser-expander type, considerable pressure is stored up in the system, particularly after a period of idleness which pressure must be overcome by the compressor at the starting of the
50 pumping operation. This pressure resist-

ance imposes a heavy load upon the motor driving the compressor. The electrical circuit of the motor is provided with safety devices such as circuit-breakers, fuses or the like
55 which prevent burning out of the motor during stalling of the same by heavy overloads or the like. Normally the amount of protection provided, that is, the capacity of the fuses, etc., must not exceed a definite limit,
60 usually prescribed by local regulations. If heavier fuses are inserted into the motor circuit than are permitted by the regulations, the degree of protection is reduced. However, in the operation of a refrigerator it requires only a few seconds of operation or at
65 most only a few revolutions of the compressor to reduce the pressure load after which the apparatus is able to function normally.

By means of the present invention means
70 are provided for automatically connecting extra safety devices into the motor circuit during the beginning of the pumping operation so as to permit transient operation at a higher cut-out limit and providing means
75 for restoring the circuit to the normal control of the regular safety device after the apparatus has attained normal operation, the additional cut-out point or limit so obtained being designed to break the motor
80 circuit if such abnormal load is prolonged beyond a definite limit. This is accomplished by means of a valve which not only reduces the pressure load on the compressor but also operates a fuse-controlling circuit
85 in response to the starting load of the apparatus so as to insert an auxiliary safety device into the motor circuit.

Referring in detail to the drawing, the refrigerating apparatus shown for illustrating the preferred embodiment of the invention
90 comprises a compressor 10 operated by a motor 11. The compressor forces refrigerant such as sulphur dioxide through pipe 12 into a condenser 13 wherein the refrigerant is condensed and collected in a receiver
95 14. From the receiver 14 the refrigerant passes by pipe 15 through an expansion valve 16 and into the cooling coils 17 of a refrigerating element where it performs its refrigerating effect in the well-known man-
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ner. The operation of the expansion valve may be modified by a suitable thermostatic device 18. From the cooling coil 17 the vaporized refrigerant passes by means of pipe 19 back to the compressor. The thermostatic device is diagrammatically represented by 20 and is disposed so as to be responsive to the temperatures in the space refrigerated by the cooling coils 17. This device is used to actuate, as by means of a diaphragm 21 or the like, a circuit-making-and-breaking switch 22. This switch is shown in its motor operating position by the heavy lines and contacts 23 and 24 and in its non-operative position by the dotted lines 25. Normally the pipe 19 is connected directly to the crankcase 26 of the compressor 10 and when in operation only one safety device 27 is used. However, during starting the automatic means of the invention serves automatically to insert an additional safety device into the motor circuit, this device being indicated by 28. This operation is effected by passing the refrigerant from pipe 19 into a special circuit controlling valve system hereinafter described. This valve comprises a casing 29 separated into an upper chamber 30 and a lower chamber 31 by means of a separatory wall 32. The separatory wall has a valve seat 33 against which operates a valve head 34 normally held out of engagement with the seat by a spring 35 disposed in a recess within the valve seat. The valve head 34 is carried by a rod 36 which in turn is fastened to the head 37 of a diaphragm or flexible bellows 38. After the compressor has been idle for some time the pressure within the evaporator 17, pipe 19, chamber 30 and 31, pipe 42 and crankcase 26 is relatively high and this pressure acting in the flexible diaphragm or bellows 38 will expand the same and thus force the valve head 34 against the seat 33 tending to obstruct flow of gaseous refrigerant into the compressor. As the flexible diaphragm which carries the valve expands it moves contact 39 upwardly and forces the same into contact with terminal 40 to complete the circuit and insert the safety device 28 in the motor circuit.

A small bleeder passageway 41 is provided in the separatory wall 32 so that a limited amount of refrigerant will be withdrawn from the evaporator when the compressor starts. The amount of refrigerant delivered to the compressor will be metered so as to prevent overloading.

When the refrigerating system is thus idle, the expansion of the flexible chamber 38 maintains the contacts 40 and 39 in closed or contacting position. In this position the auxiliary or additional safety device is kept in the circuit in parallel with the regular safety device of the electric circuit of the motor. After the compressor has operated

for a short period, say a few revolutions refrigerant in sufficient amount will be withdrawn from the low pressure side so that the pressure is reduced sufficiently to permit the valve 34 to open thus separating contacts 40 and 39 and breaking the circuit through the auxiliary safety device. After this, the regular safety device of the motor circuit is sufficient to protect the same from protracted overloads caused by stalling and the like.

By means of the present invention an arrangement is provided for taking care of transient overloads occurring during the starting operation of refrigerating apparatus and for restoring the system to the control of the regular safety device used for normal operation, without lowering the safety factor of the system.

While the form of embodiment of the 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 is claimed is as follows:

1. A refrigerating system having a high pressure side and a low pressure side, a compressor for compressing refrigerant received from the low pressure side and supplying it at an increased pressure to said high pressure side, means for actuating said compressor, a control circuit for the actuating means, said control circuit including a plurality of safety devices, means for controlling one of said safety devices and arranged to control the amount of charge taken in by said compressor.

2. In a refrigerating system in combination, a refrigerating element, a compressor for supplying refrigerant to said element, a motor for driving said compressor, a safety device in the motor circuit, an auxiliary safety device for said motor circuit, and means operated by the pressure of refrigerant within said system for inserting said auxiliary safety device into the motor circuit.

3. In a refrigerating system in combination, a refrigerating element, a compressor for circulating refrigerant through said element, a motor for driving said compressor, a safety device for protecting the circuit of said motor from overload, an auxiliary safety device, and means operated by the pressure of the refrigerant in said system for connecting said auxiliary safety device into the motor circuit during starting of the system.

4. In a refrigerating system in combination, a refrigerating element, a compressor for circulating refrigerant through said element, a motor for driving said compressor, means responsive to overloads for rendering said motor inoperative, said means comprising a plurality of safety devices, one of said devices being permanently connected into

said circuit and adapted to render said motor inoperative upon occurrence of a predetermined overload and an auxiliary safety device adapted to cooperate with said first-named safety device for permitting transient operation of said compressor for a predetermined time at a predetermined overload and means responsive to pressure of the refrigerant within said system for inserting said auxiliary safety device into the motor circuit.

5. In a refrigerating system in combination, a refrigerating element, a compressor for circulating refrigerant through said element, a motor for driving said compressor, a valve responsive to pressure of refrigerant within said system, a safety device for said motor circuit adapted to render said circuit inoperative during overload and an auxiliary safety device adapted to be placed into the motor circuit by the operation of said valve, said auxiliary safety device being adapted to cooperate with said first-named safety device to permit operation of said motor for a predetermined overload period.

6. In a refrigerating system, in combination a refrigerant circuit including circulating means, a motor for driving the circulating means, a power circuit for the motor, means for interrupting the power circuit, and means responsive to the pressure of the refrigerant for controlling the capacity of the circuit interrupting means.

7. In a refrigerating system, in combination a refrigerant circuit including circulating means, a motor for driving the circulating means, a power circuit for the motor, means for interrupting the power circuit, and means responsive to the condition of the refrigerant circuit for controlling the capacity of the circuit interrupting means.

8. In a refrigerating system, in combination a refrigerant circuit including circulating means, a motor for driving the circulating means, a power circuit for the motor, means for interrupting the power circuit, and means responsive to the pressure of the refrigerant for controlling the capacity of the circuit interrupting means and arranged to control the amount of charge taken in by said circulating means.

9. In a refrigerating system in combination, a refrigerating element, a compressor for supplying refrigerant to said element, a motor for driving said compressor, a safety device in the motor circuit, an auxiliary safety device for said motor circuit, and means operated in response to conditions within said system for inserting said auxiliary safety device into the motor circuit.

In testimony whereof I hereto affix my signature.

HARRY B. HULL.