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REGULATING MECHANISM

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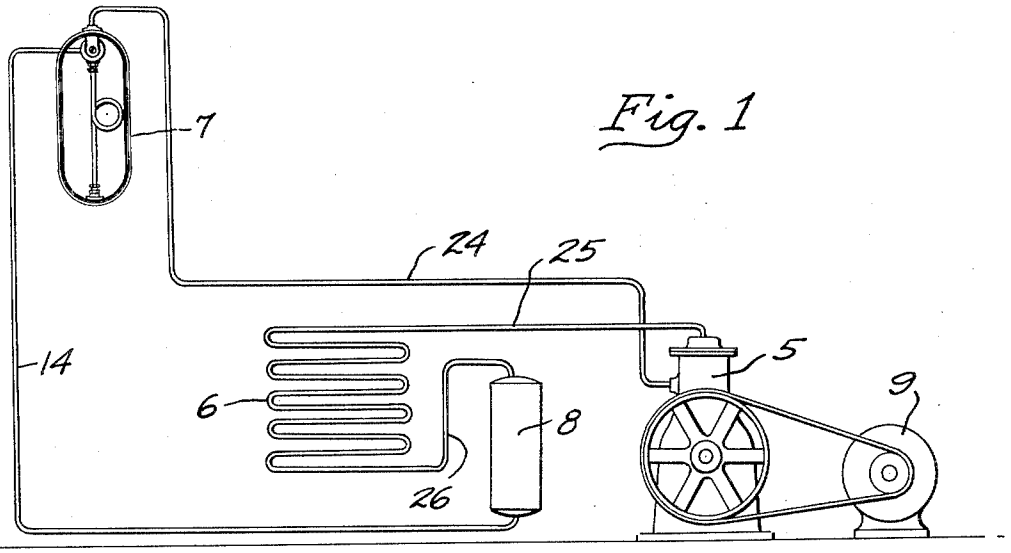


Fig. 1

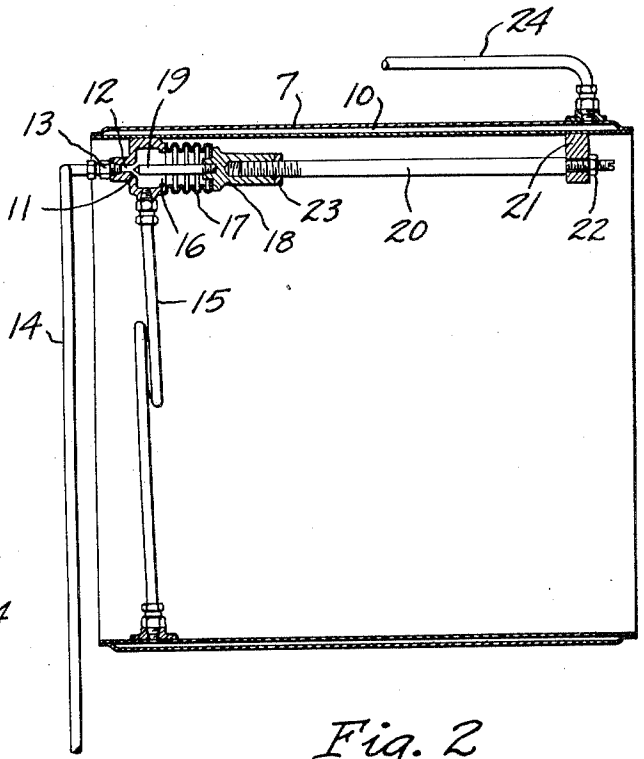


Fig. 2

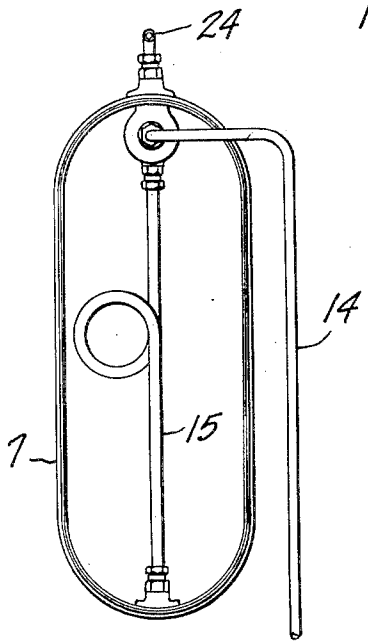


Fig. 3

Inventors

GLENN MUFFLY AND

HODGSON S. PIERCE

By J. Irving Harness

Attorney

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UNITED STATES PATENT OFFICE.

GLENN MUFFLY AND HODGSON S. PIERCE, OF DETROIT, MICHIGAN, ASSIGNORS TO COPELAND PRODUCTS, INC., A CORPORATION OF MICHIGAN.

REGULATING MECHANISM.

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This invention relates to regulating mechanisms and particularly to that type adapted to control the temperature of refrigerating systems, the principal object being the provision of a simple and economical regulating mechanism that will be efficient and accurate in operation.

Another object is to provide a temperature regulating mechanism for refrigerating systems wherein the temperature of the refrigerant leaving the expansion chamber is employed for controlling devices regulating the flow of refrigerant into the expansion chamber.

Another object is to provide a temperature controlling mechanism for a refrigerating system comprising, in combination with the expansion chamber or cooling element thereof, a casing secured to the cooling element, an opening in the casing for the passage of refrigerant, and a valve member movable in the casing and secured at one end against movement to the cooling element at a point remote from the casing, the valve member extending into cooperative relationship with the opening.

Another object is to provide, in combination with a cooling element for a refrigerating system, a casing secured to the element adjacent the top thereof provided with an opening for the passage of refrigerant, a longitudinally extending member being secured adjacent one end thereof to the upper portion of the cooling element and extending into cooperative relationship with the opening in the casing whereby expansion or contraction of the cooling element will control the position of the valve member in respect to the opening and regulate the flow of refrigerant through the opening, means being provided for conducting the refrigerant from the casing into the lower part of the cooling element, and further means being provided for conducting the refrigerant from the cooling element from the upper portion thereof.

The above being among the objects of the present invention, the same consists in certain features of construction and combinations of parts to be hereinafter described with reference to the accompanying drawing, and then claimed, having the above and other objects in view.

In the accompanying drawing which illustrates a suitable embodiment of the present invention,—

Fig. 1 is a more or less diagrammatic side view of a refrigerating system provided with a cooling element or expansion chamber incorporating a controlling mechanism constructed in accordance with the present invention.

Fig. 2 is an enlarged longitudinal sectional view taken vertically through the center of the cooling element shown in Fig. 1.

Fig. 3 is an enlarged end view of the cooling element shown in Fig. 1, taken from the back.

As illustrated in Fig. 1, refrigerating systems of the so-called iceless refrigerator type comprise generally a compressor 5, condenser 6 and cooling element or expansion chamber 7 suitably connecting in series. It is the usual practice to also include a reservoir 8 between the condenser 6 and expansion chamber 7 for the purpose of storing the liquid refrigerant coming from the condenser 6. A suitable source of power such as electric motor 9 is provided for driving the compressor 5. A refrigerant such as butane or sulphur dioxide is employed in the system, it being taken into the compressor 5 from the expansion chamber 7 in the form of gas, compressed and delivered to the condenser 6 where it is cooled and transformed into a liquid, and delivered to the reservoir 8. From the reservoir 8 it passes to the cooling element or expansion chamber 7 where it is allowed to expand into a gaseous state, and returned to the intake side of the compressor 5. Some means are necessary for controlling the flow of liquid refrigerant from the reservoir 8 into the expansion chamber 7 and these means usually incorporate an expansion valve which is usually controlled by the difference in pressure between the evaporator and the atmosphere. The present invention contemplates the employment of the temperature of refrigerant leaving the expansion chamber 7 for controlling the expansion valve, whereby to control the temperature of the expansion chamber 7. Inasmuch as the temperature of the expansion chamber 7 will vary directly as the temperature of the chamber within which it is situated, the mechanism herein provided will tend to maintain a constant temperature within such chamber, which temperature

may be controlled to meet a predetermined value.

Cooling elements or expansion chambers may be of a variety of different forms and constructions, but for the purpose of illustrating the present invention, that shown in the drawing comprises a pair of generally ring shaped sheet metal plates sealed throughout the length of their edges and slightly spaced from each other between the edges to form a chamber such as 10 therebetween.

As illustrated in Figs. 2 and 3 the device comprising the present invention comprises a casing 11 secured to the under face of the upper portion of the cooling element 7 adjacent to one end thereof. The casing 11 is provided with an axial opening 12 leading into the interior of casing 11 and connected by means of the connection 13 and pipe 14 to the reservoir 8. Another pipe 15 connects the interior of the casing 11 with the bottom of the chamber 10 formed within the cooling element 7. The casing 11 is provided at the side opposite the opening 12 with an enlarged opening 16 closed by a bellows member comprising flexible side walls 17 and a rigid end member 18. Threaded axially into the end member 18 and extending axially through the flexible side wall member 17 into the casing 11 and into cooperative relationship with the opening 12 is a valve member 19 terminating in a tapered end. Threaded axially into the end member 18 and extending therefrom in a direction opposite to the valve member 19 is a rod 20 extending therefrom to a point adjacent the opposite edge of the cooling element 7 and secured adjacent such edge against axial movement to a support 21 by means of a nut 23, the support 21 being secured against movement to the under face of the upper portion of the cooling element 7 in line with the casing 11. The distance between the member 18 and the support 21 may be varied by loosening the nut 22 and rotating the rod 20 which threads the member 18 either to or away from the support 21. The member 19 may be locked in such adjusted position by the nut 23 which is threaded on the rod and is adapted to bear against the end of the member 18. A tube or pipe 24 connects the upper portion of the chamber 10 within the cooling element 7 to the intake side of the compressor 5.

The cooling element 7 and rod 20 are formed of materials having different co-efficients of expansion, the material from which the cooling element 7 is formed having a greater co-efficient of expansion than the material from which the rod 20 is formed so that when the temperature of the cooling element 7 increases it will expand the cooling element 7 to a greater extent than the rod 20, thereby drawing the valve member 19 away from the opening 12. Likewise upon cooling of the cooling element 7, it will contract to a greater extent than will the rod 20 and the greater decrease in length will cause the rod 20 to move the valve member 19 into closer relationship with the opening 12. It will be apparent, of course, that as the valve member 19 is moved away from the end of opening 12, a greater amount of refrigerant will be allowed to flow past the valve member 19 into the casing 11 and through the pipe 15 into the chamber 10 formed within the cooling element 7, the reverse, of course, being true.

The operation of the above device will be apparent from the foregoing description. Refrigerant from the compressor 5 passes through the pipe 25 into the condenser 6 where it is cooled to a liquid state and delivered through the pipe 26 into the reservoir 8. From the reservoir 8 the refrigerant passes in liquid state through the pipe 14 to the opening 12 in the casing 11, and past the end of the valve member 19 into the interior of the casing 11. From the casing 11 the refrigerant passes through pipe 15 into the lower portion of the cooling element or expansion chamber 7 where it expands into a gas, thereby absorbing heat from the air around the cooling element 7, and passing upwardly leaves the cooling element 7 by the pipe 24 and returns to the intake side of the compressor 5. Should, for any reason, the air surrounding the cooling element 7 drop in temperature, the transfer of heat between the cooling element 7 and such air will cause more heat to be absorbed by the cooling element 7 and cause it to expand, and in expanding to draw the valve member 19 farther away from the opening 12 and thus allow a greater amount of refrigerant to enter the chamber 10, imparting to the cooling element 7 a greater capacity of heat absorption and lowering the temperature thereof. When the temperature of the cooling element 7 is lowered, the cooling element is caused to contract and due to the difference of the co-efficients of expansion between the cooling element 7 and rod 20, the rod 20 will move the valve member 19 into closer relationship with the opening 12 and reduce the amount of refrigerant flowing into chamber 10. This action takes place automatically and tends to hold the temperature of the cooling element 7 at a constant value, which value is controlled by the position of the rod 20 with respect to the end member 18 as previously described. Thus the mechanism may be adjusted to provide any suitable predetermined temperature of cooling element 7.

By placing the valve mechanism adjacent the top of the cooling element 7 it is so situated as to be extremely sensitive to temperature changes inasmuch as the refrigerant adjacent the top of the cooling element 7 has passed through the entire cooling element 7 and is adjacent the point of the discharge, thereby having absorbed a maximum of heat

from the air surrounding the cooling element 7. Were it placed adjacent the bottom of the cooling element 7 where the refrigerant is being expanded it would be less sensitive to temperature variation, inasmuch as this portion of the cooling element 7 is less affected by temperature changes of the air surrounding the same.

From the foregoing will be apparent that the present invention provides an extremely simple construction in which the natural expansion and contraction of the cooling element itself due to temperature changes of the air surrounding the same is employed for operating the expansion valve, and that the construction provided is extremely simple and employs a minimum of parts that may be of rugged construction and economically manufactured.

It will also be apparent that the materials from which the cooling element 7 and the rod 20 are formed may be reversed so that the rod 20 has a greater co-efficient of expansion than the walls of the cooling element 7, and with obvious changes in the relationship between the valve member 19 and the opening 12 a device may be provided which will function in exactly the same manner as the device shown in the drawing, but such changes are within the skill of an ordinary workman versed in the art and are within the scope of the present invention.

Formal changes may be made in the specific embodiment of the present invention without departing from the spirit or substance of the broad invention, the scope of which is commensurate with the appended claims.

What we claim is:

1. In combination, a cooling element having a relatively high co-efficient of expansion, a casing secured to said element, an opening in said casing for the passage of refrigerant, and a valve member movable in said casing secured at one end against movement to said cooling element at a point remote from said casing, said valve member extending into cooperative relationship with said opening and having a relatively low co-efficient of expansion whereby variations in the length of said cooling element due to change in temperature thereof will vary the position of said valve member relative to said casing.

2. In a refrigerator mechanism, a cooling element, a casing secured thereto, an opening in said casing for the passage of refrigerant, a valve member secured against movement to said cooling element at a point remote from said casing and extending into cooperative relationship with said opening, said valve member having a different co-efficient of expansion than said cooling element whereby expansion or contraction of said cooling element due to change of temperature thereof will vary the position of said valve member relative to said opening, and means for preventing leakage of said refrigerant between said casing and said valve member.

3. In a refrigerator mechanism, a casing provided with an opening for the passage of refrigerant, a longitudinally extending valve member extending into said casing into cooperative relationship with said opening and formed of a material having a co-efficient of expansion different from the material from which said cooling element is made, said casing and said valve member being secured to said cooling element at spaced points thereon whereby expansion or contraction of said cooling element due to variations of temperature thereof will vary the position of said valve member in respect to said opening.

4. In combination with the cooling element of a refrigerator mechanism, a casing secured thereto provided with an opening for the passage of refrigerant therethrough, a longitudinally extending valve member extending into said casing provided with a part cooperating with said opening to control the flow of refrigerant through the same, said valve member being secured to said cooling element at a point remote from said casing and having a co-efficient of expansion different from that of said cooling element whereby expansion or contraction of said cooling element due to change of temperature thereof will control the position of said valve member relative to said opening, and means for preventing leakage of refrigerant between said valve member and said casing.

5. In combination, a cooling element for a refrigerator mechanism, said cooling element having a relatively high co-efficient of expansion, a casing secured adjacent the top of said element, an opening in said casing for the introduction of refrigerant, a valve member having a relatively low co-efficient of expansion positioned adjacent the top of said element extending into said casing into cooperative relationship in respect to said opening, said valve member being secured to said cooling element at a point remote from said casing, means for conducting refrigerant out of said casing into the lower portion of said cooling element, and means for conducting refrigerant out of said cooling element from a point adjacent the top thereof.

6. In combination, a generally ring shaped cooling element for a refrigerator mechanism, said element having a relatively high co-efficient of expansion, a casing secured to said element adjacent the top thereof provided with an opening for the passage of refrigerant, a longitudinally extending member having a relatively low co-efficient of expansion secured adjacent one end thereof to the upper portion of said element and extending into cooperative relationship with said opening, means for conducting a refrigerant from

said casing into the lower portion of said element, and means for conducting said refrigerant out of the upper portion of said element.

7. In combination, a generally ring shaped cooling element, a casing member secured thereto adjacent the top thereof, a pair of openings in said member for the passage of refrigerant, a third opening in said member, a valve member secured at one end to said element adjacent the top thereof at a point remote from said casing member and extending through said third opening into cooperative relationship with one of the first mentioned openings, said valve member having a co-efficient of expansion different from that of said element, means for preventing leakage of refrigerant between said valve member and said casing at said third opening, means for adjustably controlling the length of said valve member, a passageway connecting one of the first mentioned openings with the lower part of said element, and means for conducting refrigerant out of the upper part of said element.

GLENN MUFFLY.
HODGSON S. PIERCE.