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REGULATING MECHANISM

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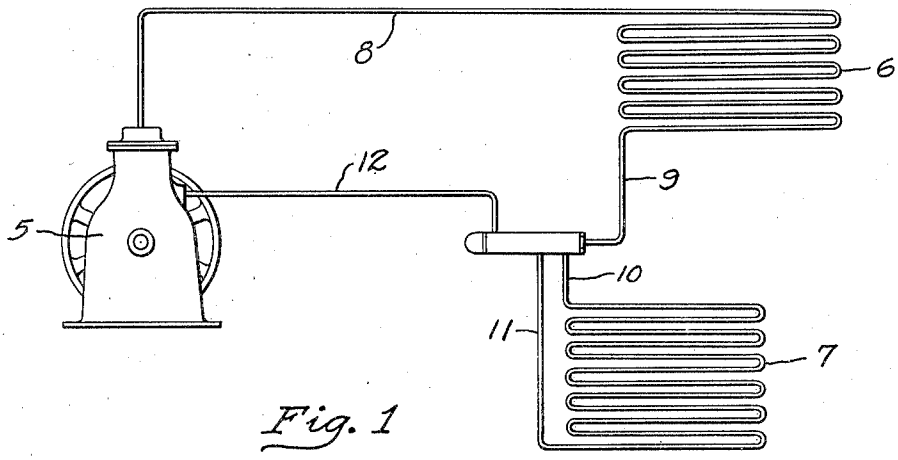


Fig. 1

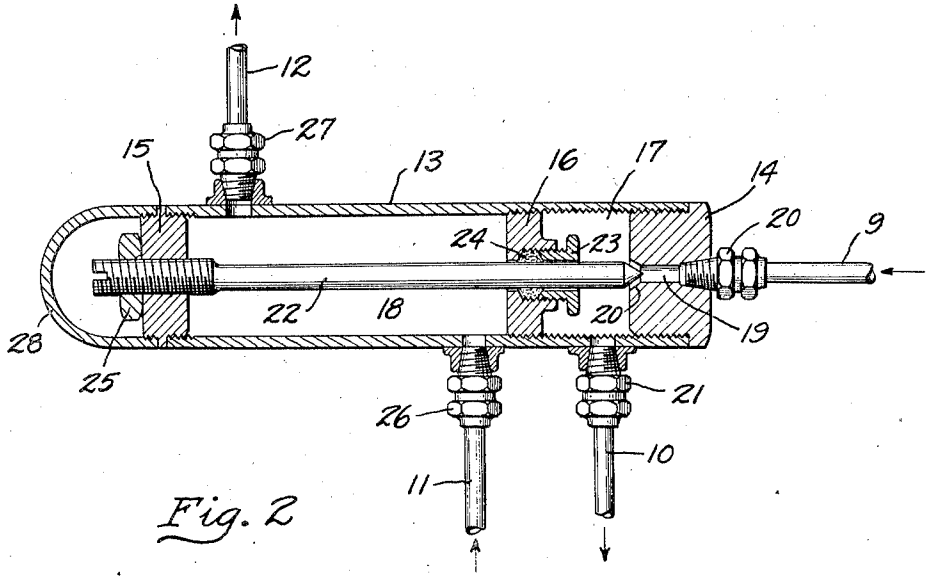


Fig. 2

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REGULATING MECHANISM.

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This invention relates to regulating mechanism 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 refrigerator 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, in combination with a refrigerator mechanism, a chamber provided with a pair of openings through which the refrigerant is adapted to pass on its way to the cooling element, a valve member being provided cooperating with one of the openings and slidably extending through a wall of the chamber, a temperture responsive element being connected to the valve member exterior to the chamber and acted upon by the refrigerant leaving the cooling element whereby to control the position of the valve in respect to its cooperating opening.

A further object is providing a temperature controlling element for refrigerator systems comprising a tubular housing provided with end walls and an intermediate wall, an axial opening being provided in one of the end walls and the other end wall being provided with an axially extending member extending through the intermediate wall and terminating in a tapered end engageable with the opening, the axially extending member being adjustable to vary the position of its tapered end with respect to the opening, refrigerant adapted to pass through the opening into the space within the housing between the intermediate wall and the first end wall and conducted therefrom to an expansion chamber and then through the housing between the intermediate wall and the end wall carrying the valve member and conducted therefrom to the compressor mechanism, the housing being formed of material having a relatively high co-efficient of expansion and the valve member having a relatively low co-efficient of expansion whereby the refrigerant after leaving the expansion chamber will act upon the housing and thereby cause it to expand or contract to control the position of the tapered end of the valve member in respect to the opening, whereby to control the flow of refrigerant into the expansion chamber in order to maintain the same at a substantially constant temperature.

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 view of a refrigerating system showing a valve constructed in accordance with the present invention interposed therein.

Fig. 2 is a sectional view taken through the temperature regulating mechanism illustrated in Fig. 1, taken vertically through the longitudinal axis of the same.

In all refrigeration systems whether employing mechanical compression or the absorption principle there are two elements, first the evaporator in which the liquid refrigerant is allowed to evaporate thus absorbing heat; second, the condensing unit which may be a compressor and condenser or it may be an absorber, boiler and condenser combination as in the customary absorption machine.

It is obvious that any particular evaporator in a chamber of a given temperature can absorb heat up to some definite maximum rate which depends upon the amount of surface exposed, the nature of fluid circulated over the surface, the rate of circulation, conductivity and the temperature difference between the evaporator and the chamber which it cools.

Should liquid refrigerant be allowed to enter the evaporator more rapidly than the evaporator is capable of evaporating it by the absorption of heat from the chamber which it cools, some of the liquid will pass through the evaporator back to the condensing unit and on the way will evaporate in the connecting (suction) pipe.

This invention among other things, is designed to obviate the loss of efficiency resulting from such return of liquid refrigerant to the condensing unit. The principle employed is to locate in the suction passage a temperature responsive element which when refrigerated by the liquid which is im-

properly returning to the condensing unit will act to close the valve in the passage carrying liquid refrigerant from the condensing unit to the evaporator.

The present invention is illustrated in the drawings in combination with a refrigerating system of the mechanical compressor type. As indicated in Fig. 1, refrigerating systems of this type comprise a compressor 5, condenser 6, and expansion chamber, vaporizer or cooling element 7. Piping such as 8 connects the exhaust side of the compressor 5 with the condenser 6, similar piping such as 9 and 10 connects the condenser 6 with the expansion chamber 7, and piping such as 11 and 12 connects the expansion chamber to the intake side of the compressor. A refrigerant such as butane or sulphur dioxide is employed in the system, it being taken in through the compressor 5 in the form of a gas, being compressed in the compressor 5, and delivered to the condenser 6 where it is cooled and transformed into a liquid. From the condenser 6 it passes through an expansion valve into the cooling element or expansion chamber 7 where the pressure is relieved and the refrigerant vaporized, thereby absorbing heat, and being returned to the compressor 5. Some means are necessary for controlling the flow of the liquid refrigerant from the condenser 6 into the expansion chamber 7, and these means usually incorporate an expansion valve which is usually controlled by the difference in pressure between the expansion chamber 7 and atmosphere. The present invention contemplates employing the temperature of the refrigerant leaving the expansion chamber 7 for controlling the expansion valve, and thereby 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 thereby tend to maintain a constant temperature within such chamber, which temperature may be controlled to meet a predetermined value.

As illustrated in Fig. 2, the device comprising the present invention comprises a tubular housing 13 preferably formed of zinc or of another metal having a relatively high coefficient of expansion. One end of the housing 13 is closed by a member 14 and the opposite end thereof is closed by a member 15, both of which members are shown as threadably engaging the housing 13. A third member 16 threadably engages the housing 13 between the end members 14 and 15 thereby forming an intermediate wall breaking up the interior of the housing 13 into two chambers 17 and 18. An axial opening 19 is provided in the end member 14, it being connected to pipe 9 from the condenser 6 by a suitable connection such as 20. The inner end of the opening 19 is flared outwardly to form a seat 20 for a purpose to be described later. The chamber 17 is connected to one side of the expansion chamber 7 through the connection 21 and pipe 10. Threadably engaging the end member or wall 15 and extending axially of the housing 13 through the intermediate wall 16 into the chamber 17 is a valve member 22. The member 22 is circular in section and terminates in a tapered end lying in closely adjacent relationship to the seat 20, thereby cooperating with the same to form a valve. At the point where the member 22 projects through the intermediate wall 16 a packing nut 23 and packing 24 are provided for preventing leakage between the wall 16 and the member 22. A nut 25 threadably received on the outer end of the member 22 is provided for locking the member 22 in any one of its adjusted positions. A cap such as 28 may be provided on the end wall 15 over the end of the member 22 and nut 25 to guard against leakage. The member 22 is preferably formed of iron or steel, preferably of a nickel alloy steel having a relatively low co-efficient of expansion. The chamber 18 through which the greatest portion of the member 22 projects is connected at one end by the connection 26 and pipe 11 to the discharge side of the expansion chamber 7 and the opposite end of chamber 18 is connected by the connection 27 and pipe 12 to the intake side of the compressor 5.

The operation of the device is as follows:

The liquid refrigerant from the condenser 6 passes through the pipe 9 into the opening 19 and between the end of the members 22 and the tapered seat 20 into the chamber 17 where it partially expands and passes through the pipe 10 into the expansion chamber 7 where the expansion is completed and heat absorbed from the chamber in which the expansion chamber 7 is located. The refrigerant from the expansion chamber 7 having absorbed heat passes through the pipe 11 into the chamber 18 and through the length of the same to the pipe 12 where it is conducted back to the compressor 5. In passing through the chamber 18 the heat absorbed by the refrigerant is communicated to the walls of the chamber 18 which are thereby caused to expand or contract in accordance with the temperature of such refrigerant. Inasmuch as the walls of chamber 18 are a part of the tubular member 13 which is formed of a material having a high coefficient of expansion as previously explained, and as the valve member 22 has a low co-efficient of expansion, the walls of chamber 18 in expanding or contracting will cause the valve member 22 to be carried thereby away from or towards the tapered seat 20, thereby varying the area between the tapered end of the valve member 22 and the seat 20 through which the refrigerant entered the chamber 17. For instance

should the refrigerant entering the chamber 18 mount in temperature the walls of the chamber 18 will be caused to expand and thereby draw the valve member 22 away from the seat 20, allowing a greater amount of refrigerant pass through the opening 19 into the chamber 17 and thence through the pipe 10 to the expansion chamber 7. This greater amount of refrigerant will lower the temperature of the expansion chamber 7 with a result that the refrigerant flowing through the chamber 18 will drop in temperature, causing the walls of chamber 18 to contract and decrease the flow of refrigerant through the opening 19 as previously explained. Inasmuch as the temperature of the refrigerant leaving the expansion chamber 7 will substantially correspond to the temperature of the chamber within which the expansion chamber 7 is located, it will be evident that the present invention will operate to hold the temperature of such chamber at a substantially constant value. This temperature may be regulated as desired by threading the valve member 22 towards or away from the tapered seat 20 and thereafter locking it in adjusted position by means of the nut 25. When once adjusted to meet any predetermined temperature value the device will continue to function with substantially no further attention.

It will be further evident that should the interior of the expansion chamber 7 become full of liquid refrigerant because of mal-adjustment of the rod member 22 or from the causes and liquid refrigerant pass into the chamber 18, its evaporation in the chamber 18 will cause a relatively great drop in the temperature of the casing 13 which will cause a correspondingly great movement of the rod member 22 which will act to close the opening 19 and will prevent such liquid refrigerant from passing through the pipe 12 to the compressor 5, thus preventing the loss of efficiency in the system resulting from liquid refrigerant being drawn into the compressor.

Although the present invention has been illustrated in connection with the mechanical compressor type of refrigerating system, it will be apparent that it is equally adapted for use in any type of refrigerating system in which a liquid refrigerant is employed to absorb heat upon evaporation, and I do not limit myself to the particular type of refrigerator shown.

It will be apparent in the foregoing that I have provided a device of the type described of extreme simplicity and minimum of parts, and one that is such that substantially no wear will occur or adjustments will be necessary. Although I have illustrated this device in the accompanying drawings as provided with an outer wall having a high co-efficient of expansion and valve member having a low co-efficient of expansion, it will be apparent that the material of these parts may be reversed and with suitable changes for reversing the co-operation between the valve member 22 and the opening 19, a device may be provided which will function in substantially the same manner as the one shown. However, it is to be understood that I do not limit myself the specific embodiment of the invention disclosed, but formal changes may be made in the same without departing from the spirit or substance of the broad invention, the scope of which is commensurate with the appended claims.

What I claim is:

1. The combination with a cooling element of a refrigerating mechanism, a pair of chambers, an opening in the walls of one of said chambers for the introduction of liquid refrigerant into said chamber, a second opening in the walls of said chamber for the escape of said refrigerant to said cooling element, a unitary valve member secured against axial movement to a wall of the other of said chambers and extending through the length of said chamber into the first mentioned chamber and into cooperative relationship with the first mentioned opening, said valve member having a co-efficient of expansion relatively widely different from the walls of said other of said chambers, and means for passing said refrigerant from said cooling element through said other of said chambers.

2. A temperature controlled element for refrigerator mechanisms, comprising a tubular housing having a relatively high co-efficient of expansion provided with end walls and a wall therebetween, a valve seat carried by one of said end walls, a valve member having a relatively low co-efficient of expansion carried by the other of said end walls and slidably projecting through the third mentioned wall into cooperative relationship with respect to said valve seat, means for introducing a refrigerant before vaporization between said valve seat and said valve member into the space between said valve seat and said third mentioned wall, and means for passing said refrigerant after vaporization between said third mentioned wall and said end wall carrying said valve member.

3. A temperature controlled element for refrigerating mechanisms comprising, in combination with a cooling element, a hollow member having a relatively high co-efficient of expansion, end walls for said member, a wall between said end walls dividing the interior of said member into a pair of chambers, an opening in one of said end walls for introducing a liquid refrigerant into the corresponding chamber, means having a relatively low co-efficient of expansion connected to the other of said end walls and slidably extending through the third mentioned wall,

means carried by said last mentioned means in co-operative relationship with said opening, a passage leading from said corresponding chamber to said cooling element, a passage leading from said cooling element to the other of said chambers, and a passage leading from said other of said chambers.

4. In a refrigerating mechanism, in combination with the cooling element thereof, a casing having a relatively high co-efficient of expansion provided with end walls and an intermediate wall dividing the interior thereof into a first and second chamber, an opening in one of said end walls for the introduction of liquid refrigerant into said first chamber, a passageway connecting said first chamber with said cooling element, a member having a relatively low co-efficient of expansion secured to the other of said end walls and projecting through said second chamber and said intermediate wall and terminating in a valve portion in co-operative relationship in respect to said opening, means for axially adjusting said member, a passageway connecting said cooling element with said second chamber, and means for allowing refrigerant in said second chamber to escape therefrom.

5. A temperature controlling element for refrigerator mechanism, comprising an elongated tubular housing provided with end walls and an intermediate wall, an axial opening in one of said walls, an axially extending member carried by the other of said end walls extending through said intermediate wall and terminating in a tapered end engageable with said opening, said member having a co-efficient of expansion different from said housing, means for preventing leakage between said intermediate wall and said member, means for adjusting the space between said tapered end and said opening, a second opening connecting the interior of said casing between the first mentioned end wall and said intermediate wall with the space exterior to said casing, and openings connecting the interior of said casing between the said other wall and said intermediate wall with the space exterior to said casing, the last mentioned openings being remote from each other axially of said casing.

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