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REGULATING MECHANISM

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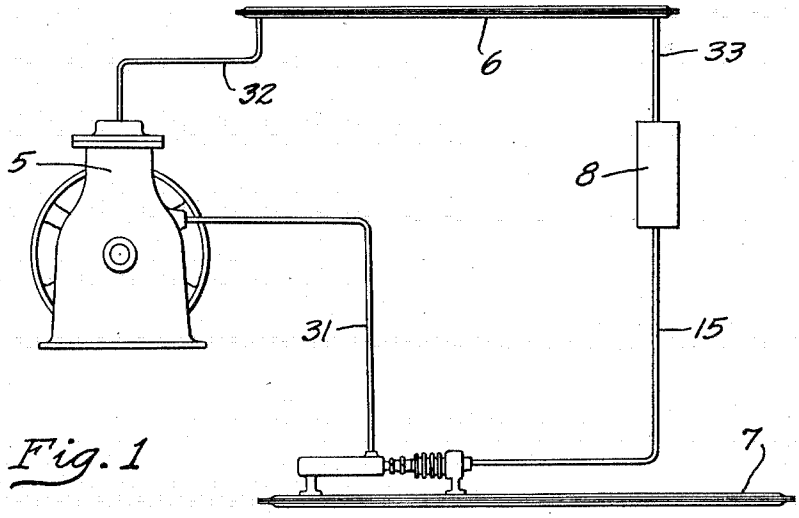


Fig. 1

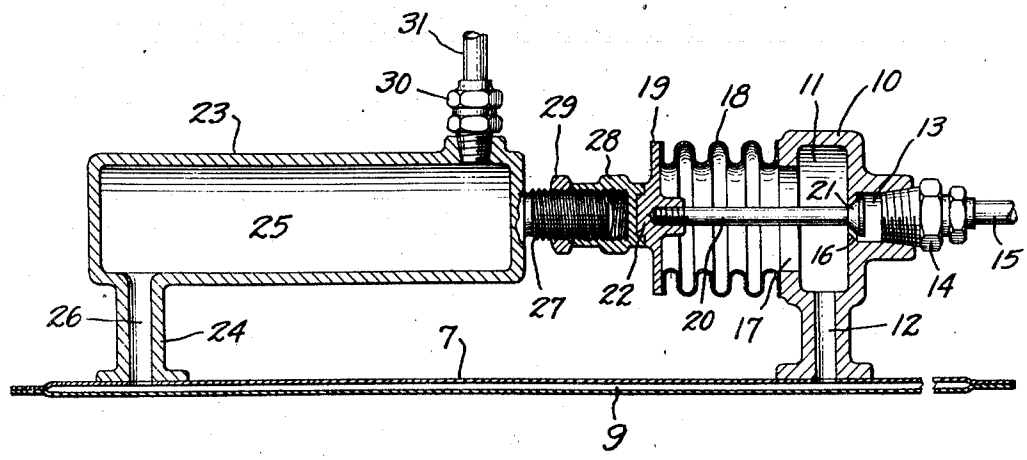


Fig. 2

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REGULATING MECHANISM.

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This invention relates to regulating 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.

A further object is to provide, in combination with a support, a casing secured thereto provided with a deformable wall, an opening being provided in the casing, and a valve member carried by the deformable wall extending into cooperative relationship with respect to the opening, a second casing being secured adjacent one end to the support and extending into contacting relationship with the deformable wall, refrigerant passing through the opening into first mentioned casing and into an expansion chamber from which it is conducted through the second casing, the walls of which are formed of a material having a relatively high co-efficient of expansion.

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 controlling mechanism constructed in accordance with the present invention provided therein.

Fig. 2 is a vertical sectional view taken centrally through the controlling mechanism shown in Fig. 1.

In all refrigerating 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 improperly returning to the condensing unit will act to close the valve in the passage carrying liquid refrigerant from the condensing unit to the evaporator.

This invention is illustrated in connection with a refrigerating system of the mechanical compressor type. As illustrated in Fig. 1, refrigerating systems of this type comprise generally a compressor 5, condenser 6 and cooling element, vaporizer or expansion chamber 7 suitably connected 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 refrigerant such as butane or sulphur dioxide is employed in the system, it being taken into the compressor 5 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 the 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 expansion

chamber and the atmosphere. The present invention contemplates the employment of the temperature of the refrigerant leaving the expansion chamber 7 for controlling the expansion valve, thereby controlling the temperature of the expansion chamber 7 and preventing liquid refrigerant from being carried as such to the compressor. 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 tendency may be controlled to meet a predetermined value.

Condensers and expansion chambers may be of a variety of different constructions and designs, but for the purpose of illustrating the present invention the expansion chamber is shown in the drawings as comprising a pair of super-imposed plates sealed throughout their edges and spaced slightly at all other points of their surfaces in order to provide a chamber 9 therebetween.

As illustrated in Fig. 2 the device comprising the present invention comprises a casing 10 supported on the expansion chamber or cooling element 7. The interior of casing 10 is connected by means of the passage 12 with the chamber 9 of the cooling element or expansion chamber 7. The casing 10 is also provided with an axial opening 13 which is connected by the connection 14 to the pipe 15 which extends from the casing 10 to the reservoir 8, the walls of the opening 13 adjacent to the point where the opening 13 joins the interior 11 of the casing 10 slightly converged to form a seat 16.

The wall of the casing 10 opposite the opening 13 is provided with a relatively large opening 17, and secured to the outer surface of the casing 10 about the opening 17 is a bellows member comprising flexible side walls 18 and a stiff end member 19. Threaded axially into the end member 19 is a valve member 20 extending axially through the opening 17, the casing 10, and into the opening 13 where it is provided with an enlarged outwardly flared end 21 cooperating with the seat 16 to form a valve. The valve member 20 is so proportioned in length with respect to the side walls 18 of the bellows member that the side walls 18 exert a constant tendency tending to force the end member 19 away from the casing 10, thus tending to draw the flared end 21 of the valve member 20 into contact with seat 16 and thereby close the opening 13 against passage of the refrigerant through the same. The outer face of the end member 19 is preferably formed with a central boss 22 for a purpose explained later.

A second casing member 23 is provided with a support 24 at one end thereof which is secured to the expansion chamber 7 in line for the casing 10 and at a point relatively remote from the same. The chamber 25 formed within the casing 23 is connected to the chamber 9 within the expansion chamber 7 by means of a passage 26 extending down through the support 24. The casing extends from the support 24 towards the end wall 19 and into spaced relationship with respect to the same, its end being formed to provide a stud like projection 27. Threadably received on the stud portion 27 is a nut 28 provided with a socket end portion rotatably receiving the boss 22 therein. A nut 29 is provided on the stud portion 27 for locking the nut member 28 in any one of its adjusted positions. The chamber 25 is connected to the intake side of the compressor 5 by means of the connection 30 and pipe 31. The system is completed by the pipe 32 which connects the exhaust side of the compressor 5 with the condenser 6, and the pipe 33 which connects the condenser 6 with the reservoir 8.

In operation, liquid refrigerant from the reservoir 8 passes through the pipe 15 into the opening 13 and into the chamber 11 between the end 21 of the valve member 20 and the tapered seat 16, and then passes down through the passage 12 into the chamber 9 where it vaporizes. Upon vaporization in the chamber 9 the refrigerant absorbs heat from the atmosphere surrounding the expansion chamber 7 and then passes up through the passage 26 into the chamber 25 and through the pipe 31 back to the compressor 5. In passing through the chamber 25 a heat exchange occurs between the refrigerant and the walls of the chamber 25. These walls are formed of a material having a high coefficient of expansion, such as zinc or the like, and heat transferred between the same and the refrigerant causes either an expansion or contraction of the casing 23 which varies the horizontal distance between the support 24 and the free end of the stud member 27. As this distance varies the end member 19 of the bellows member is caused to move accordingly, thus controlling the position of the end 21 of the valve member 20 in respect to the seat 16, and thereby controlling the flow of refrigerant from the opening 13 into the inner chamber 11 of casing 10.

It is to be understood, of course, that when the walls of casing 23 contract, the resiliency of the flexible side walls 18 of the bellows member causes the valve member to follow this movement, and when the walls of the casing 23 expand the flexible side walls 18 of the bellows member are compressed to accommodate this movement. The amount which the flared end 21 of the valve member 20 is spaced from the seat 16 is adjustably controlled by the nut member 28, this distance being adjustable in order to set the mechanism to maintain a predetermined temperature value of the expansion chamber 7.

The operation of the foregoing device will

be readily apparent. Supposing, for instance, that the mechanism shown in Fig. 2 is positioned within an ice box and the door of the same is opened. The warm air entering the box through the door opening will heat up the expansion chamber 7 and the refrigerant therein, and this refrigerant in passing through the chamber 25 will cause a transfer of heat to the walls of the same which will cause expansion of the casing 23 which in turn will move the end 21 of the valve member 20 away from the seat 16, thus increasing the amount of refrigerant passing into the casing 10 and chamber 9. This greater amount of refrigerant will act to cool the chamber 9 and expansion chamber 7 and bring it back to the same temperature at which it stood before the door was opened.

Again, supposing that the door of the ice box is now closed, the expansion element 7 will no longer be so greatly heated and the refrigerant passing into the chamber 25 will drop in temperature and will absorb heat from the walls of the chamber 23 which will contract the same and draw the flared end 21 of the valve member into closer relationship with the seat 16 and reduce the amount of refrigerant flowing into the chamber 9. This action is automatically carried on as is apparent and tends to maintain the temperature of the expansion element 7 at a constant value which is determined by the position of the nut member 28 on the stud 27 and which temperature may be regulated by the nut 28 to suit any desired conditions.

If, for some reason or other, when the temperature of the expansion chamber 7 drops as explained above, the valve mechanism does not act quickly enough and the chamber 7 becomes filled with refrigerant in the liquid state, such liquid will be drawn into the chamber 25 where it will refrigerate and cause a quick and marked contraction of the walls of the chamber 25 sufficient to close the valve end 21 and stop the flow of refrigerant to the expansion chamber 7 until the temperature of the latter has increased.

Although I have shown the mechanism of the present invention as being mounted on the expansion chamber or element 7, it is to be understood that this is merely done for simplicity of construction and convenience, and the casings 10 and 23 may be secured to any suitable supporting member and connected to the expansion element 7 without any particular variations in the functioning other than slight changes within the mechanical skill of an ordinary workman familiar with this art.

Formal changes may be made in the specific embodiment of the invention described 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. In combination with a support, a casing secured thereto, a deformable wall on said casing, an opening in said casing, a valve element carried by said deformable wall extending into operative relationship in respect to said opening, a second casing secured adjacent one end to said support and extending into contact with said deformable wall, and an evaporator comprising a passageway connecting said casings, said second casing having a relatively high co-efficient of expansion whereby movement thereof due to change in temperature thereof will control the position of said valve element relative to said opening.

2. In combination with a supporting member having a relatively low co-efficient of expansion, a casing mounted thereon provided with a deformable element closing a face thereof, an opening for introducing liquid refrigerant into said casing, a valve member carried by said deformable element in cooperative relationship in respect to said opening, means for conducting said refrigerant from said casing, a second casing having a relatively high co-efficient or expansion in contact with said deformable element, and means for passing said refrigerant after vaporization through said second casing whereby the temperature thereof will vary the length of said second casing to thereby control the position of said valve member relative to said opening.

3. In combination with a supporting element, a casing secured thereto provided with an opening, a deformable element closing said opening to the atmosphere, a second opening in said casing for the passage of refrigerant there-through, a valve member secured to said deformable element extending through the first mentioned opening into cooperative relationship with said second opening, a third opening in said casing for the passage of said refrigerant, a second casing provided with means at one end thereof contacting with said deformable element, means securing said second casing at a point remote from said contacting end to said supporting element, and means for passing said refrigerant through said second casing after it has passed through the first mentioned casing.

4. In combination with a supporting member, a casing secured thereto provided with an opening for the introduction of a refrigerant, said casing being provided with a deformable wall, a valve element carried by said deformable wall in line with the line of maximum deformation thereof and extending into cooperative relationship with respect to said opening, a second casing secured to said supporting element at a point remote from said deformable wall and provided with a part in contact with said wall, said second casing having a relatively high co-efficient of expansion, means for conducting refrigerant from the first mentioned casing into said second casing, and

means for conducting said refrigerant from said second casing.

5. In a refrigerator mechanism, in combination with the condenser, cooling element and compressor thereof, a support having a relatively low co-efficient of expansion, a casing element secured to said support provided with a deformable wall, an opening in the wall of said casing connected to said condenser, a valve element carried by said deformable wall extending into cooperative relationship with said opening, a passageway connecting said casing with said cooling element, a second casing having relatively high co-efficient expansion supported on said support adjacent the end thereof more remote from said deformable wall, adjustable means extending between said deformable wall and said second casing, a passageway connecting said cooling element with said second casing, and a passageway connecting said second casing with said compressor.

6. In a refrigerator mechanism, in combination with the condenser and compressor thereof, a cooling element, a casing secured to said cooling element provided with a plurality of openings, a bellows closing one of said openings, a valve element carried by said bellows extending through said opening closed by said bellows and into cooperative relationship with another of said openings, said last mentioned opening being connected to said condenser, one of said openings being connected to said cooling element, a second casing secured adjacent one end to said cooling element and provided with a part at the opposite end in contact with said bellows, a passageway connecting said cooling element with said second casing, and a passageway connecting said second casing with said compressor.

7. In a refrigerator mechanism, in combination with the condenser and compressor thereof, a cooling element, a casing secured to said cooling element, a deformable member closing a side of said casing, a passageway connecting the interior of said casing with said condenser, a second passageway connecting the interior of said casing with said cooling element, a valve element carried by said wall engageable with the first mentioned opening, a second casing secured at one end to said cooling element having a co-efficient of expansion greater than the co-efficient of expansion of said cooling element, adjustable means between the other end of said second casing and said wall, a passageway connecting said cooling element with the interior of said second casing, and a passageway connecting the interior of said second casing with said compressor.

8. In combination, a support having a relatively low co-efficient of expansion, a casing secured thereto provided with a deformable wall, an opening for the introduction of a liquid refrigerant into said casing, a valve element secured to said wall and extending into cooperative relationship with respect to said opening, a second opening for conducting said refrigerant out of said casing, a second casing having a relatively high co-efficient of expansion secured adjacent one end to said support and extending therefrom to a point adjacent said deformable wall, an adjustable member threadably received on said second casing rotatably socketed on said deformable wall, and means for passing said refrigerant after vaporization through said second casing.

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