July 9, 1929. H. B. HULL 1,719,841

REFRIGERATING APPARATUS

Filed Sept. 30, 1927

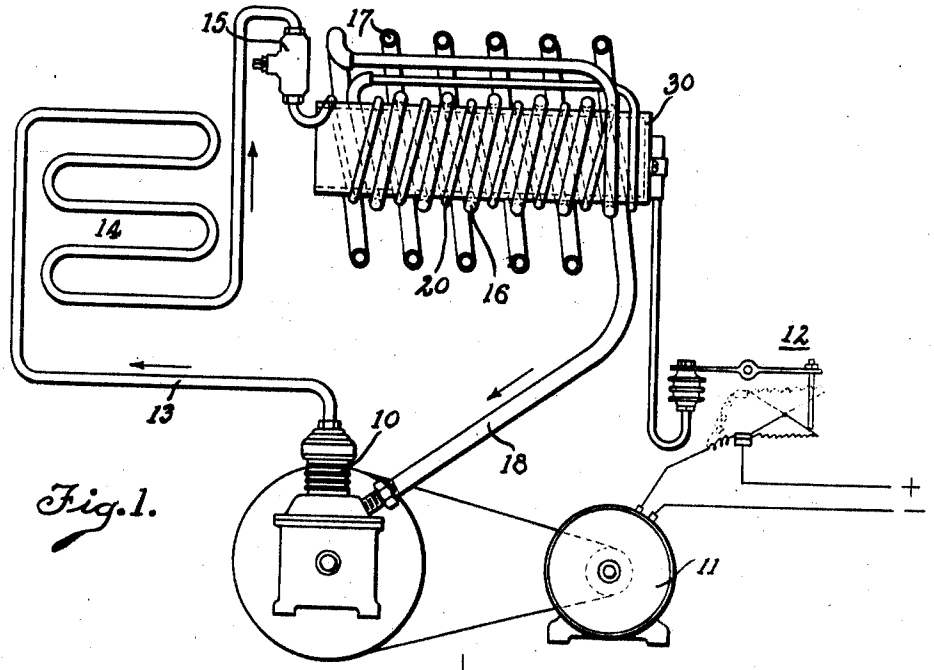


Fig. 1.

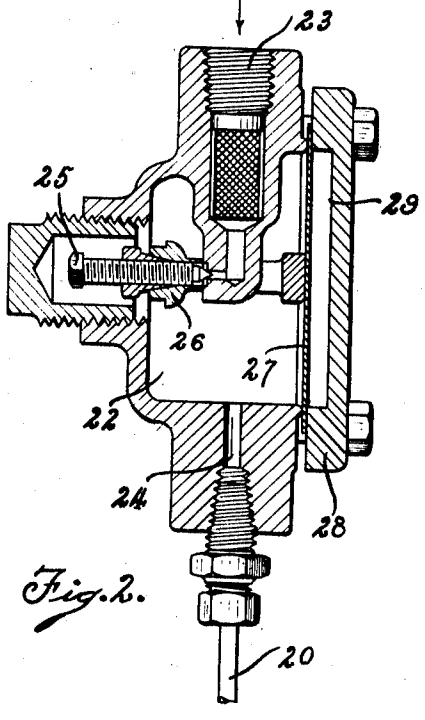


Fig. 2.

Inventor
Harry B. Hull

By Spencer, Hardman, and Fehr
Attorney

Patented July 9, 1929. 1,719,841

UNITED STATES PATENT OFFICE.

HARRY B. HULL, OF DAYTON, OHIO, ASSIGNOR, BY MESNE ASSIGNMENTS, TO FRIGIDAIRE CORPORATION, A CORPORATION OF DELAWARE.

REFRIGERATING APPARATUS.

Application filed September 30, 1927. Serial No. 223,108.

The present invention relates to improvements in refrigerating apparatus and more particularly to the mechanically operated type in which a refrigerating medium is circulated through an evaporator and which circulation is controlled by a regulating valve or the like, the refrigerating effect being produced in the well-known manner.

It is an object of the invention to provide a refrigerating system of the type in which the flow of refrigerant to an evaporator is controlled by an expansion valve responsive to the pressure conditions within the evaporator and to control the system so that a differential in pressures may be maintained between the valve and the evaporator.

It is a further object of the invention to provide a system of the character described in which the expansion valve may be operated at substantially atmospheric pressure, while the pressure and likewise the temperature of the evaporator are maintained at a substantially lower level.

It is another object of the invention to simplify the construction of the expansion valve by so arranging the system that the use of springs or similar adjusting means may be obviated in such a valve.

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

In the drawings:

Fig. 1 shows a diagrammatic representation of the improved refrigerating system of the invention.

Fig. 2 is a cross sectional view of the expansion valve used in the circuit.

Referring in detail to the drawings, the refrigerating circuit to which the invention is applied by way of illustration comprises a refrigerant circulating means for example a compressor 10 driven by motor 11 which is controlled by a thermostatically operated switch 12 responsive to the temperature of the system.

The compressor 10 forces a refrigerating medium, for example sulphur dioxide, through pipe 13 into condenser 14 where the medium is cooled. The refrigerating medium thereupon passes through an expansion valve 15 whence it passes into the coils 16 and 17 of an evaporator unit where it produces its refrigerating effect in the well-known manner. The expanded refrigerant is withdrawn from the evaporator coil 16 by the compressor 10 through a pipe 18.

In its general aspects the invention contemplates the provision of means for restricting the flow of refrigerant to the evaporator coils 16. The means used may comprise, for example, a coil of pipe 20 having a substantially smaller diameter or passage than coils 16 or 17 and which is herein shown connected in series circuit relation with the evaporator coils 16 and 17.

The flow of refrigerant to the evaporator coils is controlled in response to the pressure prevailing within the chamber 22 of an expansion valve shown in Fig. 2. In the valve shown by way of illustration the refrigerating medium enters at 23 and issues at 24 passing into the pipe 20. The valve comprises a casing having a chamber 22 into which the refrigerating medium enters, its flow thereto being controlled by a needle valve 25. This needle valve is carried by a yoke 26 attached to a diaphragm 27 which forms one wall of the chamber, the diaphragm being held in place by a plate 28. The air or the like in space 29 between diaphragm 27 and plate 28 is under atmospheric pressure. Under these conditions it is obvious that the operation of the needle valve 25 is responsive to the pressure prevailing within the chamber 22.

Reduction of pressure in the two pipes 16, 17 forming the evaporator produces a reduction of pressure in the pipe 20. However, due to the fact that this pipe has a constricted passage, the pressure in chamber 22 will be somewhat higher than the pressure in coils 16 and 17. In actual practice a partial vacuum will prevail in coils 16 and 17 while the pressure maintained within chamber 22 will be substantially atmospheric due to the restriction above referred to, and due to the fact that as soon as the pressure within the chamber 22 becomes slightly less than atmospheric, the pressure within chamber 29 will force the diaphragm inwardly and thus permit the needle valve to admit more refrigerant. By suitably controlling this restriction, a considerably lower pressure may be maintained within the coils 16 and 17 than is present in diaphragm chamber 22. A relatively low temperature may thus be maintained by the evaporator while the pressure within the

chamber 22 is maintained substantially atmospheric and in this manner it is possible to dispense with the use of springs for counteracting the pressure in chamber 22 acting on the diaphragm 27. With this type of system a temperature somewhat lower than freezing may be maintained in the evaporator, while a temperature somewhat above freezing may be maintained at the expansion valve. A spring (not shown) may be provided for securing a balance between the expansion valve chambers. With the system described, it may not be necessary to enclose the diaphragm since the frost which would ordinarily hinder the operation of the valve would not collect upon the valve since the same is maintained above freezing temperature.

As shown in Fig. 1 the coil 20 may also be utilized as the freezing coil and used to form an ice-making compartment indicated diagrammatically by the sleeve 30 in the drawing, Fig. 1.

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. In a refrigeration system in combination, an evaporator, means for circulating a refrigerating medium through said evaporator a valve for controlling the flow of refrigerating medium to said evaporator and responsive to pressure conditions of said evaporator, and means interposed between the valve and said evaporator for producing a pressure differential between said valve and said evaporator.

2. In a refrigeration system in combination, an evaporator, means for circulating a refrigerating medium through said evaporator, a valve for controlling the flow of refrigerating medium to said evaporator and responsive to pressure conditions of said evaporator, and a conduit connecting said valve and said evaporator, said conduit having means for obstructing the flow of refrigerant therethrough for producing a pressure differential between said valve and said evaporator.

3. In a refrigeration system comprising in combination an evaporator, means for circulating a refrigerating medium through said evaporator, a valve for controlling the flow of refrigerating medium to said evaporator and responsive to pressure conditions of said evaporator, said evaporator including a coil having a relatively restricted passage for causing a pressure differential between said valve and said evaporator.

4. In a refrigeration system comprising in combination an evaporator, means for circulating a refrigerating medium through said evaporator, a valve for controlling the flow of refrigerating medium to said evaporator and responsive to pressure conditions of said evaporator, and a coil in series with said evaporator and connecting the valve with said evaporator, said coil having a restricted passage for causing a pressure differential between said valve and said evaporator.

5. In a refrigeration system comprising in combination an evaporator, means for circulating a refrigerating medium through said evaporator, a valve for controlling the flow of refrigerating medium to said evaporator and responsive to pressure conditions of said evaporator, and a coil in series with the evaporator and connecting the valve with said evaporator, said coil constituting part of said evaporator, and having a restricted passage for causing a pressure differential between said valve and said evaporator.

6. In a refrigeration system comprising in combination an evaporator, means for circulating a refrigerating medium through said evaporator, a valve for controlling the flow of refrigerating medium to said evaporator and responsive to pressure conditions of said evaporator, and a coil in series with said evaporator and connecting said valve with said evaporator, said coil constituting part of said evaporator and defining an ice freezing compartment and having a restricted passage for causing a pressure differential between said valve and said evaporator.

7. In a refrigerating system in combination an evaporator containing sulphur dioxide, means for circulating sulphur dioxide through said evaporator, a valve for controlling the flow of sulphur dioxide to said evaporator and responsive to pressure conditions of said evaporator, and means interposed between said valve and said evaporator for producing a pressure differential between said valve and said evaporator.

8. The method of operating a refrigerating system which comprises circulating sulphur dioxide through an evaporator by a means for receiving gaseous sulphur dioxide and liquefying it, the circulation of the sulphur dioxide through the evaporator being regulated by a valve responsive to atmospheric pressure and to the pressure of the sulphur dioxide as it passes through said valve, and impeding the flow of the sulphur dioxide between the evaporator and the valve sufficiently to maintain the sulphur dioxide in the evaporator at a substantial sub-atmospheric pressure and the pressure of the sulphur dioxide as it passes through said valve at substantially atmospheric pressure.

9. In a refrigerating system, means for liquefying a refrigerant, an evaporator receiving refrigerant from and returning refrigerant to said means, an expansion valve for controlling the flow of refrigerant to said evaporator, a pressure-responsive member controlling said valve, said member being responsive to a substantially atmospheric

condition as one factor and to the pressure of the refrigerant as it passes said valve as another factor, and a restricted passage for refrigerant between said valve and evaporator maintaining a substantial difference in refrigerant pressure between said evaporator and the refrigerant affecting said pressure-responsive member.

10. In a refrigerating system, means for liquefying sulphur dioxide, an evaporator receiving sulphur dioxide from and returning sulphur dioxide to said means, an expansion valve for controlling the flow of sulphur dioxide to said evaporator, a pressure-responsive member controlling said valve, said member being responsive to a substantially atmospheric condition as one factor and to the pressure of the sulphur dioxide as it passes said valve as another factor, and a restricted passage for sulphur dioxide between said valve and evaporator maintaining a substantial difference in sulphur dioxide pressure between said evaporator and sulphur dioxide affecting said pressure-responsive member.

11. The method of controlling the flow of sulphur dioxide to an evaporator in a closed automatic refrigerating system which comprises regulating the flow of the sulphur dioxide by means of a valve responsive to a substantially atmospheric condition as one factor and to the pressure of the sulphur dioxide as it passes said valve as another factor, and restricting the flow of the sulphur dioxide between said valve and evaporator whereby the pressure of the sulphur dioxide as it passes said valve is substantially atmospheric and the pressure in said evaporator is substantially sub-atmospheric.

12. The method of controlling the flow of refrigerant to an evaporator in a closed automatic refrigerating system which comprises regulating the flow of the refrigerant by means of a valve responsive to a substantially atmospheric condition as one factor and to the pressure of the refrigerant as it passes said valve as another factor, and restricting the flow of the refrigerant between said valve and evaporator whereby the pressure of the refrigerant as it passes said valve is substantially atmospheric and the pressure in said evaporator is substantially sub-atmospheric.

13. In a refrigerating system in combination an evaporator containing sulphur dioxide, means for circulating sulphur dioxide through said evaporator, a valve for controlling the flow of sulphur dioxide to said evaporator and responsive to pressure conditions of said evaporator, and a resistance pipe interposed between said valve and said evaporator for producing a pressure differential between said valve and said evaporator.

14. In a refrigerating system, means for liquefying a refrigerant, an evaporator receiving refrigerant from and returning refrigerant to said means, an expansion valve for controlling the flow of refrigerant to said evaporator, a pressure-responsive member controlling said valve, said member being responsive to a substantially atmospheric condition as one factor and to the pressure of the refrigerant as it passes said valve as another factor, and a resistance pipe for refrigerant between said valve and evaporator maintaining a substantial difference in refrigerant pressure between said evaporator and the refrigerant affecting said pressure-responsive member.

15. In a refrigerating system, means for liquefying sulphur dioxide, an evaporator receiving sulphur dioxide from and returning sulphur dioxide to said means, an expansion valve for controlling the flow of sulphur dioxide to said evaporator, a pressure-responsive member controlling said valve, said member being responsive to a substantially atmospheric condition as one factor and to the pressure of the sulphur dioxide as it passes said valve as another factor, and a resistance pipe for sulphur dioxide between said valve and evaporator maintaining a substantial difference in sulphur dioxide pressure between said evaporator and the sulphur dioxide affecting said pressure-responsive member.

In testimony whereof I hereto affix my signature.

HARRY B. HULL.