Sept. 20, 1949. E. GYGAX 2,482,171

FLOW CONTROL DEVICE FOR REFRIGERATION APPARATUS

Filed Oct. 4, 1945

Fig. 1.

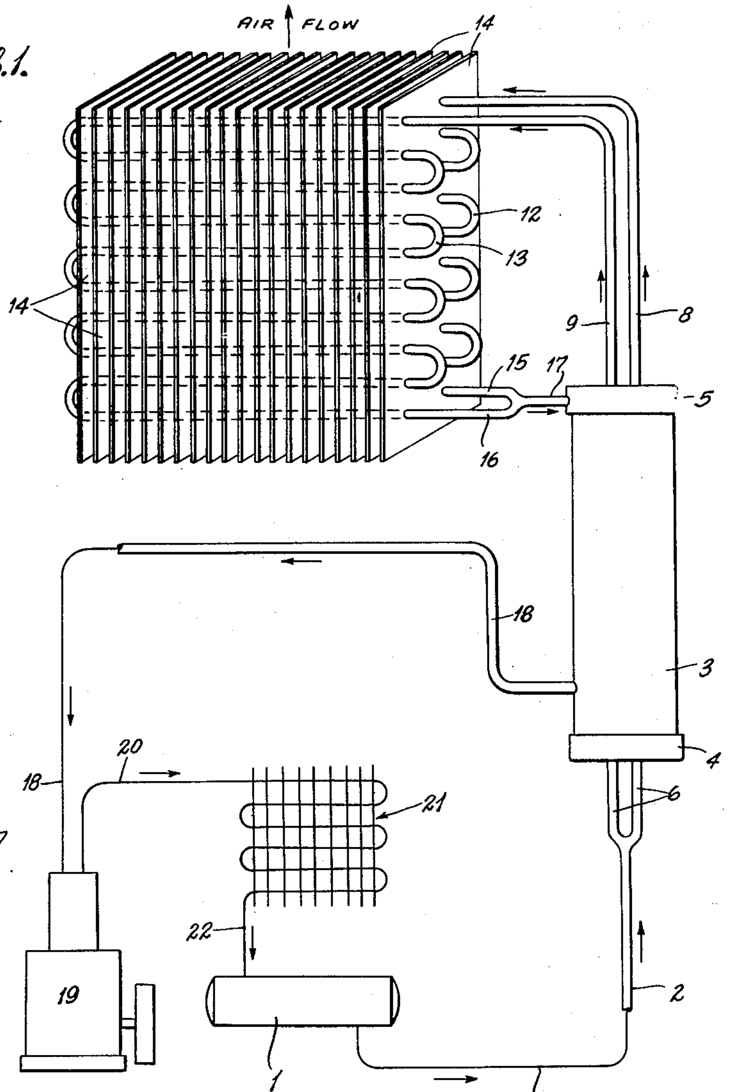
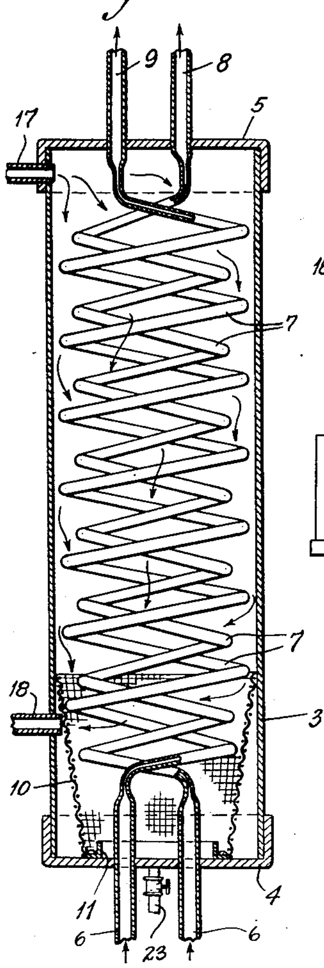


Fig. 2.



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FLOW CONTROL DEVICE FOR REFRIGERATION APPARATUS

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1 Claim. (Cl. 62—127)

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This invention relates to improvements in refrigerating apparatus, and more particularly to a unit adapted to be interposed in the refrigerating cycle for automatically controlling the feed for the refrigerant.

An object of the invention is to provide an efficient unit in combination with a refrigerating cycle, which may be connected into a refrigerant flow system and whereby the refrigerating effect of the evaporator of such system may be automatically controlled by controlling the feed to the evaporator in response to the viscosity of the refrigerant mixture in the liquid phase, the temperature of which is controlled by the cooling effect of the evaporator.

In my copending application, Serial No. 618,045, filed September 22, 1945, I have disclosed a method employing this principle of refrigerant flow control, and an apparatus for practicing the method in which the flow conduits for the refrigerant are built into the evaporator structure. The present invention contemplates the provision of an alternate construction of apparatus for performing the method of said copending application which includes a separate unit that may be connected into the standard system without alteration of the evaporator, and by which the control of the flow of the refrigerant is effected in response to the temperature of the expanded gas withdrawn from the evaporator.

Another object of the invention is to provide a unit of the type mentioned, which functions as a heat exchanger between the refrigerant in the gas phase and in the liquid phase, and which also acts as a gas liquid separator whereby the gas in the suction line of the compressor will be freed from a liquid component.

A more specific object of the present invention is to provide a heat exchanger adapted to be connected into the liquid refrigerant feed supply, and the gas discharger whereby the temperature of the gas withdrawn from the evaporator will cause a temperature change of the inflowing stream of refrigerant mixture, and thereby control the flow through the viscosity change in a component in the stream flow to the evaporator.

Additional advantages of the invention will appear from the following detailed description thereof, taken in connection with the accompanying drawing, in which:

Fig. 1 is a diagrammatic illustration of a conventional refrigerating system of the direct expansion type, and with which the control unit of the present invention is cooperatively associated.

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Fig. 2 is a vertical section through the heat exchange control unit.

The system is fed from a refrigerant receiver 1, and may be charged with any of the known standard refrigerating agents, such, for example, as Freon or methyl chloride or other agents having similar refrigerating characteristics. There is also mixed with the refrigerant an oil component, as fully disclosed in the above mentioned copending application, such as a light oil having an SAE viscosity No. 150, which is specified only by way of example. A mixture of this character, as I have already disclosed in the copending application, has a viscosity range of approximately from 250 at 0° F. to 75 at approximately 140° F. (Saybolt viscosity numbers). Since petroleum oil of this type is missible with the refrigerant, but due to its viscosity changes is responsive to temperature, it has a varying flow characteristic, which may be utilized in connection with the apparatus herein disclosed as a control for the evaporator feed, as will be more fully hereinafter explained.

The refrigerant oil mixture is withdrawn from the refrigerant oil receiver through a line 2 by which it is carried to the flow conduits of the heat exchanger, under pressure.

The heat exchanger, as disclosed in the drawing, includes a vessel having a cylindrical wall 3, bottom head 4 and a top head 5 fitted over the cylindrical wall 3 of the vessel.

The line 2 discharges into a branch conduit 6, the arms of which are extended into a pair of restricted capillary tube coils 7, which coils are formed in an interfitting relationship and with a coil diameter sufficiently less than an inside diameter of the cylindrical wall 3 of the vessel so that they may be mounted therein in the manner clearly illustrated in Fig. 2.

The coils 7 have extensions 8 and 9 that constitute supply lines for the liquid refrigerant to the evaporator. The casing for the heat exchanges comprises the cylindrical walls 3 and the top and bottom walls 4 and 5, and is constructed to provide a gastight vessel with the inlet line 6 entering through the bottom header 4 and outlet lines 8 and 9 extending through the upper header 5, having a sealed relationship therewith.

The vessel is internally provided in its lower portion with a reticulated member 10 in the form of a truncated cone which forms a screen when mounted, as illustrated in Fig. 2. On the bottom wall 4 of the vessel is a retaining flange 11 for the member 10, attached to the inner face of said wall 4. The screen member flares at the top and bears against the inner periphery of the walls 3 at a substantial elevation above the bottom thereof, in the manner illustrated in Fig. 2.

The evaporator element of the system includes as illustrated, coils 12 and 13 arranged in vertical parallel planes, which coils extend through a series of plates 14 of the conventional airflow evaporator.

The conduits 8 and 9 are connected into said coils 12 and 13, respectively, and in which coils the liquid refrigerant is expanded, producing the normal cooling effect, the degree of which is dependent upon the volume of the liquid refrigerant supply, as will be readily understood, and the degree of cooling effect will be in accordance with the examples given in my copending application above referred to.

Each of the coils 12 and 13 is connected at its lower end with an arm 15 and 16, respectively, of a branch fitting which merges into a conduit 17 entering the heat exchange vessel near the top thereof.

It will be understood that the gas is withdrawn from the heat exchange vessel through a line 18 extending through the wall 3 and elevated somewhat above the bottom of the vessel. The line 18 extends to the suction inlet of a compressor 19, conventionally illustrated in Fig. 1, and after compression is discharged from the compressor through a line 20 to a condenser 21 where the compressed gas is condensed, and then flows through a line 22 to the refrigerant receiver, completing the refrigerating cycle.

Since the temperature of the gas passing through the heat exchange vessel is determined by the volume of the liquid refrigerant supply, the cooling of the evaporator will be determined by the control of that volume.

The admixture of the oil with the refrigerant causes the streams flowing through the coils 7 to vary in viscosity, due to the regulation of the temperature of the stream as reflected by the temperature of the gas leaving the evaporator and entering the heat exchanger. If the flow of liquid refrigerant is insufficient to produce the optimum temperature of the gas in the heat exchanger to maintain the predetermined cooling capacity of the evaporator, the supply stream of the liquid refrigerant and oil reduces in viscosity and the rate of flow is thereby increased. Similarly, if the supply of liquid refrigerant exceeds the predetermined amount for refrigerating output of the evaporator, the viscosity of the refrigerant-oil stream will increase and the flow will be reduced.

It will, of course, be understood as explained in the above mentioned copending application, that the length of the coils 7 must be properly coordinated with the other factors in order to accurately automatically control the desired refrigerating effect of the evaporator.

As a basic example, with the type of oil mentioned and a refrigerant comprising a Freon mixture therewith in which the oil is from 5 to 20% by volume, a coil length of approximately thirty feet of restricted tubing of approximately .04 inch will provide an effective control within the normal range of temperature variation of the

suction gas withdrawn from the evaporator in accordance with the quantitative data referred to in said copending application.

It is known in the art that if the suction line of the compressor carries over liquid that the efficiency of the compressor is reduced, and, therefore, I make provision, by the structure of the present invention, to trap any liquid component of gas in the bottom of the heat exchange vessel by elevating the outlet pipe in the manner disclosed. I have also provided to screen out any solid particles from the gas stream by providing the screen 10 in the bottom of the heat exchange vessel, which screen extends above the gas outlet.

Since the oil specified is completely missible with the refrigerant, it will not be trapped from the gas stream but only that portion of the refrigerating agent that is liquid when it reaches the lower portion of the heat exchange vessel will be accumulated in the bottom thereof.

A valved withdrawal pipe 23 may be provided in the bottom wall 4 of the heat exchange vessel for withdrawing any accumulation of liquid from the vessel, if desired.

From the foregoing description, it will be understood that I have provided a construction that fully accomplishes its purposes. It will, likewise, be understood that certain changes in form and dimension of the parts may be made without departing from the spirit and scope of the invention.

What I claim and desire to secure by Letters Patent is:

A refrigerant flow control attachment for refrigeration apparatus adapted to automatically control the flow of a refrigerant and a missible oil mixture comprising a sealed casing, a plurality of capillary coils disposed in said casing having inlets at one end and outlets at the other end thereof, said inlets being adapted to be connected to a refrigerant receiver, said outlets being adapted to be connected to separate evaporator coils, an inlet in the casing adjacent said coil outlets adapted to be connected to an evaporator outlet, an outlet in the casing adjacent said coil inlets adapted to be connected to the suction side of a compressor, said refrigerant gas outlet being disposed above a bottom level of said casing to provide a liquid trap, and means for withdrawing any accumulated liquid from the casing, whereby a heat exchange relationship obtains between a refrigerant and oil liquid mixture in said coils and refrigerant gas in said casing when said attachment is installed.

ERNEST GYGAX.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
2,393,854	Carpenter	Jan. 29, 1946

FOREIGN PATENTS

Number	Country	Date
11,177	Great Britain	Oct. 24, 1896