Oct. 25, 1932. F. D. PELTIER ET AL 1,884,186

REFRIGERATION

Filed Dec. 6, 1926 2 Sheets-Sheet 1

Fig. 1.

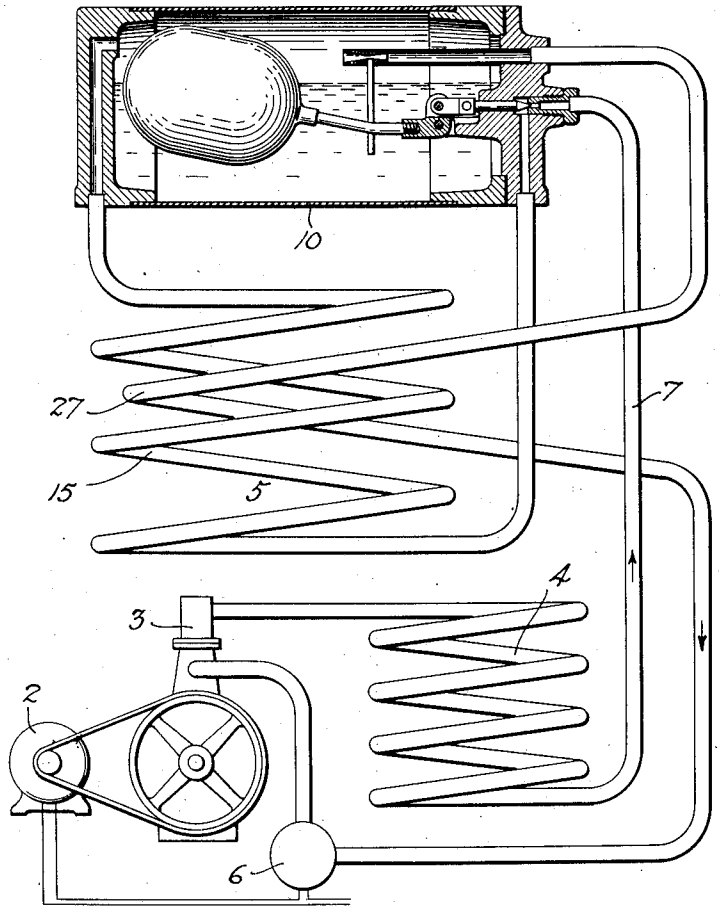


Fig. 3.

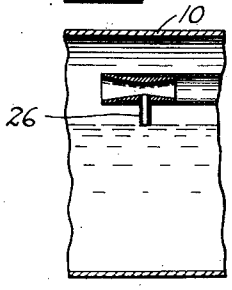
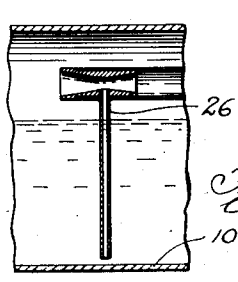


Fig. 4.



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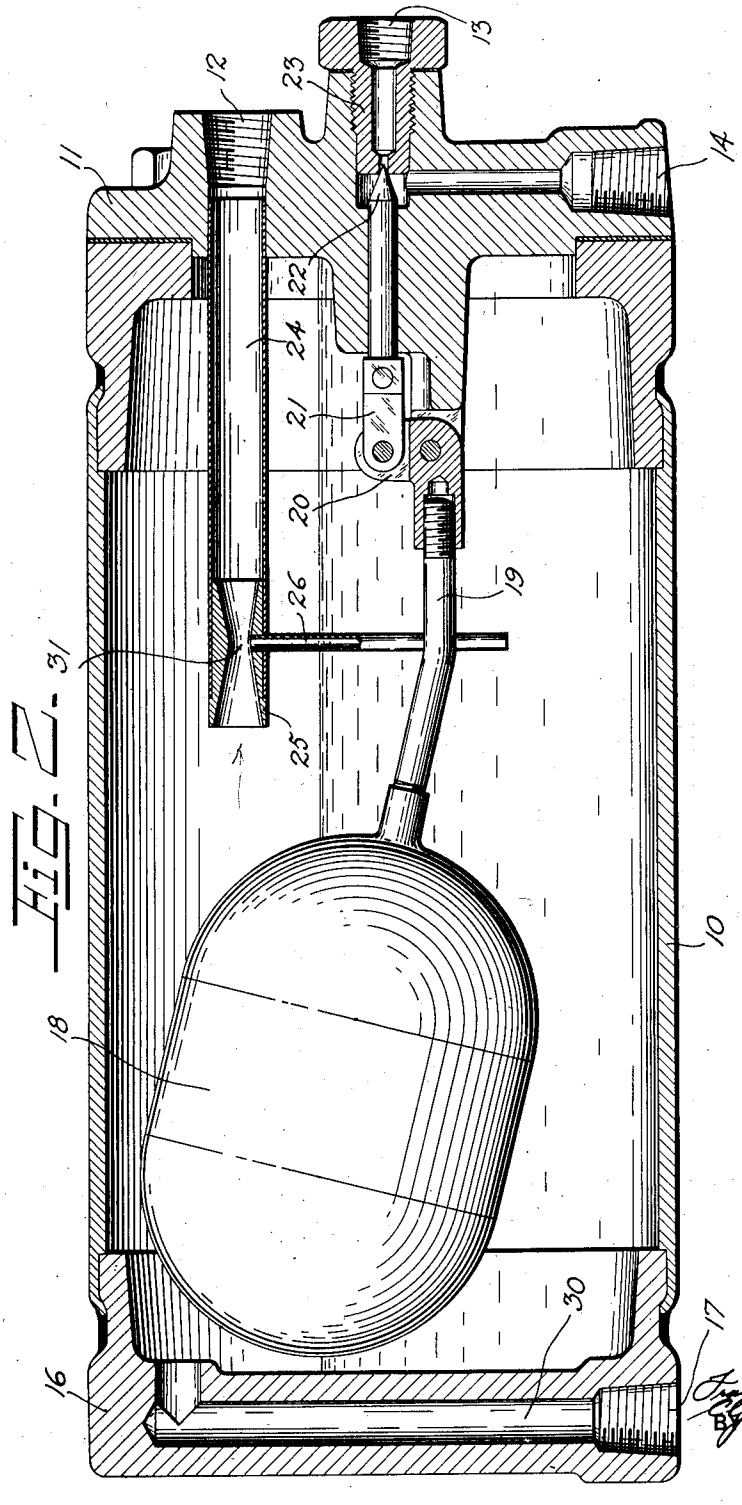


Fig. 2.

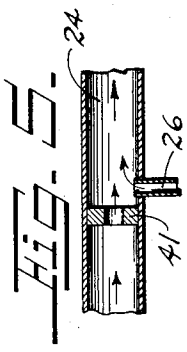


Fig. 5.

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UNITED STATES PATENT OFFICE

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REFRIGERATION

Application filed December 6, 1926. Serial No. 152,902.

Our invention relates to refrigerating apparatus and more particularly to apparatus employing a compressor and the flooded type of evaporator.

Amongst the objects of the invention are to afford an improved lubrication; to assure a uniform flow of lubricant to the compressor; to provide a novel, improved, and highly effected means of causing flow of lubricant; to provide a novel process of refrigeration; to positively return lubricant from a float valve chamber to the compressor and, in general, to improve the operation of refrigerating apparatus wherein a lubricant is used.

With the above and other objects in view, the invention consists in the novel features of construction, arrangement of parts and combination of elements hereinafter described and such variations thereof as fall within the scope and spirit of the invention and method and process involved in the operation of such apparatus.

The invention is described with reference to the accompanying drawings on which Fig. 1 shows more or less diagrammatically a system embodying one form of the invention; Fig. 2 is an enlarged view in section of a portion of the apparatus shown in Fig. 1; Fig. 3 shows a modified form of the invention adaptable to different conditions as will more fully hereinafter appear; Fig. 4 shows a still further modification for a still further variation of conditions, and Fig. 5 shows a modified form of pressure reducing device forming part of the invention.

Referring more particularly to Fig. 1, a refrigerating apparatus or system is shown which includes a motor 2, a compressor 3 driven by the motor, a condenser 4 supplied with refrigerant by the compressor, an evaporator designated generally by reference character 5, and a control switch 6. The condenser is connected to supply liquid refrigerant to the evaporator and the evaporator is connected with the suction side of the compressor for passage of evaporated refrigerant to the compressor. Member 6 is an electric switch controlling the operation of the motor in response to pressure within the suction line to the compressor. Switches of this type responsive to various agencies are known per se. The above constitutes a layout to which our invention is applicable but it is to be understood that we are not limited to the system thus diagrammatically illustrated. Various types of control may be used, the condenser may be cooled in any way and, as will be apparent, the invention is not limited to a particular system.

Referring more particularly to Fig. 2, reference character 10 designates the casing of a float chamber. This float chamber may constitute a portion of the evaporator 5. The casing is provided with an end cover 11 and an end cover 16. In cover 11 is an opening 13 arranged to be connected with the discharge side of the compressor and with the condenser which is interposed in series between opening 13 and the compressor discharge. Cover 11 is also equipped with an opening 14 which is connected to the inlet of the evaporator coils or surfaces 15. The outlet end of the coil 15 is connected to opening 17 which is in turn connected to a passageway 30 extending within cover 16 and opening into the upper part of the float chamber. Cover 11 is also equipped with an opening 12 for connection to the suction side of the compressor. Between this opening and the compressor, an evaporator portion is arranged in series, such portion comprising, in one form, a tubular member 27.

Within casing 10 is a float 18 which rests upon the surface of a body of liquid therein and in turn determines the level of liquid surface therein which separates the liquid space of the chamber from the vapor space of the chamber. Changes of the surface level of liquid within the float chamber cause movement of float 18. This movement is transmitted through lever 19, bell-crank 20 and link 21 to the needle valve 22 which controls the orifice of valve member 23. Needle 22 is a small diameter needle in a relatively long bore. Hence there will be only a negligible leakage of liquid refrigerant past the needle 22 into the float chamber.

A tube 24 is fitted into cover 11 connecting with opening 12 and with the suction side of the compressor and extending into the casing 10 within the vapor space thereof. Within

tube 24 is situated a restricted portion 31. This restricted portion is preferably formed as the contracted portion of a Venturi tube 25. The Venturi tube has a gradually contracting passageway towards the restricted portion and a gradually expanding passageway away from the restricted portion as is chracteristic with Venturi tubes. The restricted portion of the Venturi tube, otherwise known as the throat, has connected thereto a tube 26 of relatively small internal diameter or bore which extends below the surface level of liquid refrigerant within casing 10.

The system illustrated in Fig. 1 is intended to contain a refrigerant and a lubricant of such nature that, in operation, the lubricant is dissolved in or is emulsified in the refrigerant. As an example of such fluids, methyl chloride may be used as the refrigerant and mineral oil as the lubricant.

The mode of operation is as follows:

Refrigerant compressed in compressor 3 passes into condenser 4 where it is liquefied and thence passes through conduit 7 and into opening 13, assuming that needle valve 22 is open. Assuming needle valve 22 to be open, liquid refrigerant passes into coil 15 and a portion is evaporated, which evaporation absorbs heat from the surroundings and produces refrigeration. A mixture of vaporous refrigerant and liquid refrigerant passes through opening 17 from the evaporator coil and through passageway 30 into the float chamber. Rise of liquid quantity within the float chamber causes a lifting of float 18 and this operates, through lever 19, bell-crank 20 and link 21, to close needle valve 22 to a greater or less extent. If needle valve 22 is entirely closed, no liquid refrigerant passes from the condenser into opening 13 and to the evaporator. The compressor at the same time draws vapor through conduit 24 and some of the liquid within float chamber 10 evaporates, thus lowering the liquid level therein. The float 18 consequently is lowered and needle valve 22 again opens to permit entry of liquid refrigerant into the evaporator. Float 18 thus operates to maintain the liquid level within the float chamber constant or substantially constant.

The vapor passing out through Venturi tube 25 increases in velocity in the throat 31 and there is a corresponding drop in pressure at this point which produces a suction acting through tube 26. This suction causes liquid to flow through tube 26 and into conduit 24 and thence on to the compressor. The liquid passing through tube 26 is composed of methyl chloride or other refrigerant and dissolved or suspended oil. The fluid passing through conduit 24 passes on into evaporator coil 27 where the liquid refrigerant is entirely vaporized and passes into the suction line proper as a gas together with the separated liquid oil which is formerly held in solution or suspension.

The oil entering the evaporating section with the refrigerant accumulates within the float chamber and the concentration of oil in the float chamber increases in the beginning of operation until the point is reached where the oil drawn through tube 26 equals the entrained oil entering the evaporating section. Our arrangement therefore automatically maintains a proper flow of lubricant.

The invention is not limited to suspended or dissolved lubricant. Fig. 3 shows an arrangement adapted for use in a system employing sulphur dioxide having as lubricant an oil which is lighter than sulphur dioxide and which floats on the top of the same. In this case tube 26 is extended to the surface of liquid in the float chamber and the suction in the Venturi tube draws oil from the surface. By using a tube 26 extending to the bottom of casing 10, as shown in Fig. 4, the invention is applicable to a refrigerating system using ethyl chloride or methyl chloride with glycerine as a lubricant, glycerine being heavier than ethyl chloride or methyl chloride and insoluble therein. In either of the two cases illustrated in Figs. 3 and 4, the second evaporator 21 (Fig. 1) is not necessary as there would not be sufficient liquid refrigerant entrained by the lubricant and sucked up through tube 26 to the return line to the suction side of the compressor to require a second evaporator. In these cases, opening 14 should be connected directly by a pipe to the suction side of the compressor, the switch being interposed in this pipe.

Fig. 5 shows a restriction or orifice 41 which may be used for the same purpose as the Venturi tube in conduit 24. When an orifice is used the tube 26 communicates with conduit 24 a short distance in the direction of flow beyond the orifice 41. The use of an orifice would cause a permanent pressure drop in the outlet conduit beyond the orifice. Such connection has also an asperating effect.

Having thus described our invention what we claim is:

1. Refrigerating apparatus comprising, in combination, a chamber, a float in said chamber and means co-operating with said float to define a liquid space and a vapor space in said chamber, a discharge connection in the vapor space of said chamber, said connection having a restricted portion and a communication between said restricted portion and the liquid space of said chamber.

2. Refrigerating apparatus comprising, in combination, a compressor, a condenser, an evaporator, said compressor, condenser and evaporator being connected to form a circulating system for refrigerant and lubricant, said system including a float chamber, a float within said chamber, a valve controlled by said float and operating to control flow of re-

frigerant within the system, a conduit within said float chamber connected to the compressor, a restricted portion within said conduit, and a tube connected to said restricted portion and extending downwardly therefrom within said float chamber.

3. Refrigerating apparatus comprising, in combination, a float chamber containing a float, an evaporator tube connected to said float chamber, a valve controlling the flow of fluid through said tube and in turn controlled by said float, a conduit within said chamber adapted to be connected to a compressor, a Venturi tube within said conduit having a restricted throat, and a connection from said throat to a lower portion of said chamber.

4. Refrigerating apparatus comprising, in combination, a compressor, a condenser, an evaporator, said compressor, condenser and evaporator being connected to form a circulating system for refrigerant and lubricant, said system including a float chamber, a float within said chamber, a valve controlled by said float and operating to control the flow of refrigerant within the system, a conduit connected to an upper portion of said chamber, a Venturi tube interposed in said conduit, and a tube connected with a lower portion of said chamber and connected to the restricted portion of said Venturi tube.

5. In a refrigerating apparatus, an evaporator comprising a continuous conduit, means to produce flow of fluid through said conduit, a valve at the inlet to said conduit, a chamber at the exit from said conduit, means responsive to variations of liquid level in said chamber operable to control said valve, a discharge connection for removing vapor from one part of said chamber, said connection having a restricted portion operating to produce a space of diminished pressure and a communication between said space of diminished pressure and a lower part of said chamber.

6. A refrigerating system comprising, in series, a compressor, a condenser, a valve, an evaporator and a float chamber together with a float in said float chamber, mechanical connecting means between said float and said valve, said mechanical connecting means being contained wholly within said system, said float, valve and connecting means therebetween operating to define a liquid space and a vapor space in said float chamber, a discharge connection for conveying fluid from said chamber to said compressor connected to the vapor space of said chamber, said discharge connection having a restricted portion and a communication between said restricted portion and the liquid space of said chamber.

7. A refrigerating system comprising, in series, a compressor, a condenser, a valve, an evaporator and a float chamber together with a float in said float chamber, mechanical connecting means between said float and said valve, said mechanical connecting means being contained wholly within said system, said float, valve and connecting means therebetween operating to define a liquid space and a vapor space in said float chamber, a discharge connection for conveying fluid from said chamber to said compressor connected to the vapor space of said chamber, a Venturi tube interposed in said connection and means forming a communication between the liquid space of said chamber and the restricted throat of the Venturi tube.

8. In a refrigerating apparatus, an evaporator comprising a continuous conduit, means including a compresor to produce flow of fluid through said conduit, a valve at the inlet to said conduit, a chamber at the exit from said conduit, the arrangement being such that fluid passing through said valve must pass through said conduit before entry into said chamber, means responsive to variations of liquid level in said chamber operable to control said valve, a discharge connection for removing vapor from one part of said chamber and conducting the same to the compressor, said connection being adapted on operation of said compressor to have a diminished pressure therein and a communication between said conduit and a lower part of said chamber for causing the diminished pressure in said conduit to remove liquid from the lower part of said chamber.

9. Refrigerating apparatus comprising, in combination, a first evaporator member, means to supply liquid to said evaporator member, a closed vessel connected to said evaporator member to receive liquid and vapor therefrom, means to regulate the supply of liquid to said evaporator member to define a liquid space and a vapor space in said vessel, a second evaporator member, a conduit connecting the vapor space of said vessel with said second evaporator member, means to produce a space of diminished pressure in said conduit and a connection between said liquid space and said space of diminished pressure.

10. Refrigerating apparatus comprising, in combination, a first evaporator member, means to supply liquid to said evaporator member, a closed vessel connected to said evaporator member to receive liquid and vapor therefrom, means to regulate the supply of liquid to said evaporator member to define a liquid space and a vapor space in said vessel, a second evaporator member, a conduit connecting the vapor space of said vessel with said second evaporator member, a restricted portion in said conduit and a connection between said liquid space and said restricted portion.

In testimony whereof we hereunto affix our signatures.

FRANK DESNOYERS PELTIER.
CLYDE EDWARD PLOEGER.