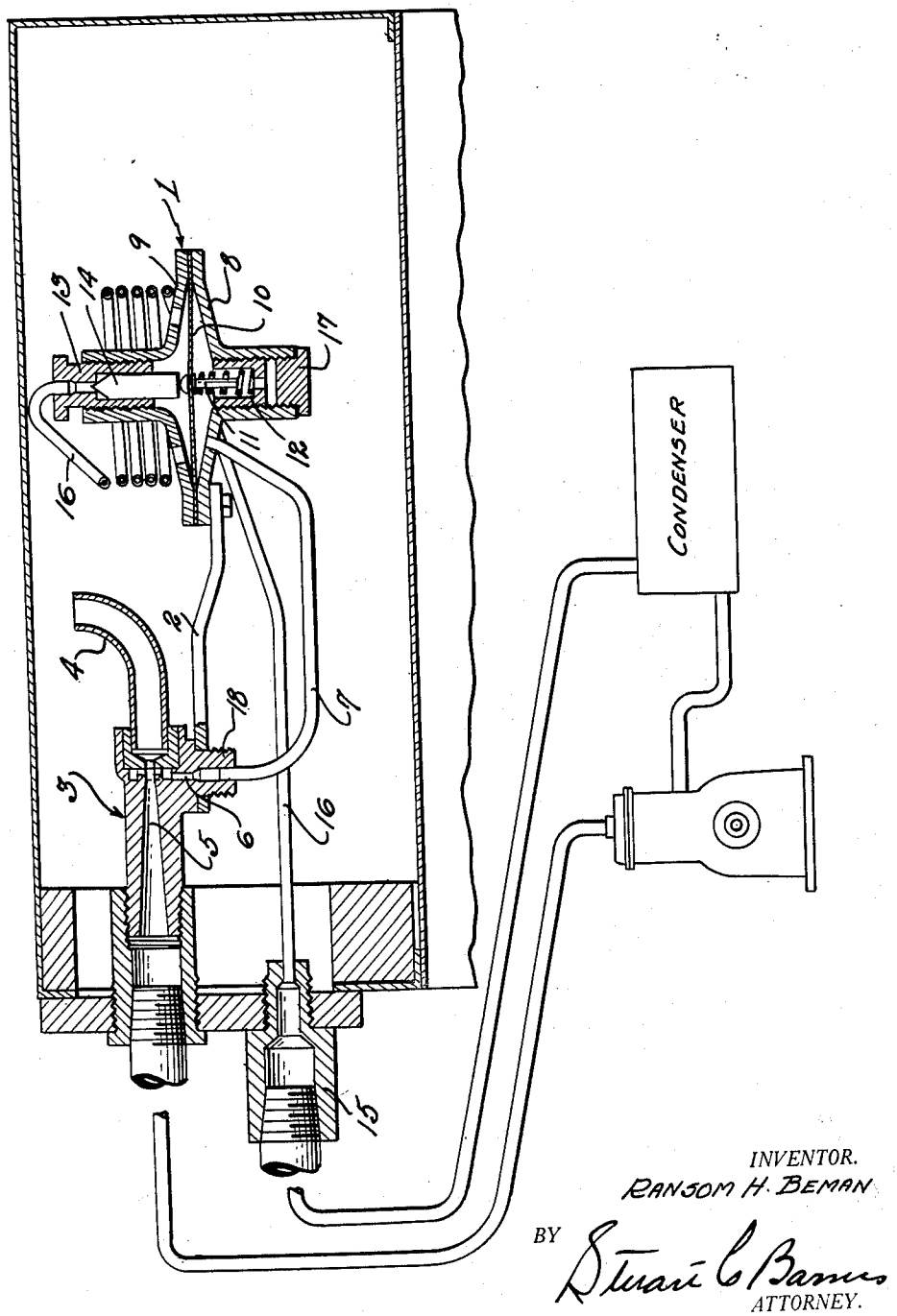
May 29, 1934. R. H. BEMAN 1,960,433

METHOD OF AND APPARATUS FOR CONTROLLING THE FLOW OF REFRIGERANT

Filed Jan. 16, 1930



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UNITED STATES PATENT OFFICE

1,960,433

METHOD OF AND APPARATUS FOR CONTROLLING THE FLOW OF REFRIGERANT

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Application January 16, 1930, Serial No. 421,133

9 Claims. (Cl. 62—8)

This invention relates to a method of and apparatus for controlling the flow of refrigerant, and has to do particularly with an extremely compact and simple unit for effectively predetermining the flow of refrigerant to the evaporator during the refrigerating or exhausting period of the refrigerating cycle.

It is the object of the present invention to directly control the flow of refrigerant to the evaporator by the exhausting of the evaporated or expanded refrigerant from the evaporator. More specifically, the present invention contemplates the provision of a novel control unit or what might be termed an injection unit for supplying the compressed and condensed refrigerant to the evaporator and which in turn is connected to the outlet conduit from the evaporator in such a manner than the inlet of refrigerant is directly controlled by the exhausting of the gaseous refrigerant. The structure for carrying out this method preferably embodies a diaphragm one side of which is subjected to pressure within the evaporator and the other side of which is controlled by the relative pressure produced by novel means formed in the outlet from the evaporator.

In the drawing I have shown one form of control unit embodying the present invention wherein the entire unit is positioned within the evaporator, the compressor and condenser being shown diagrammatically.

The gist of the present invention resides in the use of pressure differential for controlling the introduction of refrigerant into the evaporator and roughly this may be carried out by practically any form of diaphragm structure, one side of which may be connected to a form of Venturi tube in the outlet and the other side of which is in direct communication with the pressure within the evaporator.

In the device illustrated for carrying out this method of control, I have shown a diaphragm unit which may be generally designated 1. This unit may be supported by any suitable means, such as an arm 2 which in turn is carried by what I call a Venturi outlet unit 3.

This Venturi outlet unit 3 may be provided with the usual outlet conduit 4 which terminates in a typical Venturi tube 5. A suitable passageway 6 is formed in this Venturi unit so as to lead from the point of highest velocity of the venturi. A conduit 7 may be used to connect passageway 6 with one side of the diaphragm in the unit 1.

This unit 1 may be formed of two halves 8 and 9 which form chambers on opposite sides of the diaphragm 10. A spring pressed plunger 11 is preferably secured to the diaphragm 10 and the pressure of this plunger may be regulated by means of a plug 12.

The other half 9 of the diaphragm is preferably provided with suitable openings for effecting communication with the atmosphere in the evaporator and the upper part of the member 9 preferably terminates in an opening for receiving a valve plug 13. A suitable plunger or valve 14 is adapted to slide in this valve plug and such plunger 14 is adapted to be actuated by the spring pressed plunger 11. The pressure of the spring around the plunger 11 and upon the diaphragm 10 is preferably only such as to just overcome the tension of diaphragm, or, in other words, the normal action of the plunger 11 is just such as to overcome the weight of the valve member 14.

The valve plug 13 is preferably connected to the inlet 15 by means of a relatively small conduit 16. The tube 16, part of which is in the form of a coil about the diaphragm unit, does not necessarily predetermine the flow of refrigerant to the evaporator but merely forms a convenient manner of restricting and feeding the refrigerant to the valve head.

In operation, whenever the temperature of the unit becomes high enough to start the compressor, whether by temperature control or pressure control, a certain amount of volatilized refrigerant will be drawn off from the evaporator. This drawing off of the gaseous refrigerant will continue as long as the compressor operates or, of course, until the thermostat unit stops the compressor. During the discharge of the gaseous refrigerant through the outlet tube 4, it will be obvious that as this refrigerant passes the entrance of the Venturi tube it will be given a maximum velocity with the result that a negative or lower pressure will be set up in the passageway 6. In other words, the Venturi tube will act as an ejector.

It will be obvious that prior to the time the compressor starts that the relative pressures on each side of the diaphragm 10 will be equal because of the apertures in the housing 9 and because of the connection of the other half 8 of the housing with the atmosphere in the evaporator by means of the conduit 7, the passageway 6, and outlet conduit 4. However, when negative pressure is set up in the passageway 6 by the flow of outlet gases through the Venturi tube, then the pressure within the chamber formed by the half 8 will be lowered with the result that the diaphragm (as viewed in the drawing) will

be moved downwardly to overcome the action of the spring pressed plunger 11 and open the valve 14. Thus, as long as sufficient negative pressure is created in the passageway 6 by the outflow of gases, the valve 14 will remain open to allow refrigerant to flow into the evaporator.

It will thus be obvious that I have completely eliminated the use of a float valve or similar form of device for controlling the flow of refrigerant into the evaporator. Instead, the entire control of refrigerant is dependent upon the exhausting of the gaseous refrigerant from the evaporator. The period of operation of the compressor will control the amount of refrigerant injected into the evaporator and not the level of the liquid or the pressure of the liquid. It will also be seen that this system readily adapts itself to multiple installations because of the fact that the pressure in the return line will be equalized so as to balance up the various systems in the multiple installations.

It will be understood that the unit 1 may be placed in any position desired and one such other position may be obtained by removing the plug 17 and screwing the entire unit 1 onto the threaded projection 18 of the Venturi unit. This would do away with the connecting conduit 7.

What I claim is:

1. The method of controlling the flow of refrigerant in refrigerating systems having means for supplying refrigerant to and withdrawing refrigerant from an evaporator, which comprises setting up a differential pressure between the gas in the evaporator and the gas in the exhaust line and controlling the flow of refrigerant into the evaporator solely by the differential between the pressure in the evaporator and the pressure in the exhaust line leading from the evaporator.

2. The method of controlling the flow of refrigerant to and from a cooling unit, which comprises stopping the flow of refrigerant to the unit during the inoperative period of the refrigerating system, permitting the flow of refrigerant into the cooling unit and setting up a differential pressure between the gas in the evaporator and the gas in the exhaust line during the operating cycle of the system and controlling the starting and stopping of flow of refrigerant solely by the differential between the pressure in the evaporator and the pressure in the exhaust line leading from the evaporator.

3. In a refrigerating system of the type having a compressor, condenser, and evaporator, means for controlling the flow of refrigerant from the condenser into the evaporator, said means consisting of a valve member and a diaphragm for actuating the same, one side of the diaphragm being subject to the pressure within the evaporator and the other side being subject to a differential pressure produced in the exhaust line relative to the pressure in the evaporator for controlling the position of the diaphragm and the actuation of the valve.

4. A refrigerating system of the type having an evaporator, and means for supplying compressed refrigerant to the evaporator and withdrawing the refrigerant gases from the evaporator, comprising in combination a unit for controlling the flow of refrigerant into the evaporator, and means actuated by a differential pressure produced in the exhaust line relative to the pressure in the evaporator for actuating said unit.

5. A refrigerating system comprising an evaporator, means for supplying refrigerant to and exhausting the refrigerant gases from the evaporator, an ejector device in the exhaust line, means for controlling the flow of refrigerant into the evaporator and means actuated solely by the exhausting of gases from the evaporator through said ejector device to produce a pressure differential relative to the evaporator gases for operating said control means.

6. Means for controlling the flow of refrigerant to and from the evaporator in a refrigerating system, comprising an ejector device positioned in the exhaust line from the evaporator, and a diaphragm actuated valve device in the intake line of the evaporator, said ejector being connected to said valve device for controlling the operation of the same.

7. Means for controlling the flow of refrigerant to and from the evaporator in a refrigerating system, comprising an ejector device positioned in the exhaust line from the evaporator, and a diaphragm actuated valve device in the intake line of the evaporator, said ejector being connected to said valve device for controlling the operation of the same, one side of said diaphragm being subjected to the pressure within the evaporator and the other side to said ejector device whereby the exhausting of the gases from the evaporator will effect a differential pressure on opposite sides of the diaphragm.

8. Refrigerant control means for use in refrigerating systems having a compressor, condenser, and evaporator, comprising an ejector device operating in the exhaust line from the evaporator, a relatively small tube for conducting refrigerant into the evaporator, and a control unit positioned adjacent the end tube consisting of a valve and spring pressed diaphragm for normally maintaining the valve closed, both sides of said diaphragm being normally subjected to pressure prevailing in the evaporator, and one side being connected to said ejector whereby the exhausting of gases from the evaporator will set up a differential pressure to move the diaphragm and open the valve.

9. Refrigerant control means for refrigerating systems having an evaporator, compressor, and condenser, comprising an outlet for the refrigerant gases in the form of a Venturi tube, means for controlling the flow of refrigerant to the evaporator, a diaphragm for controlling said means, a housing forming a chamber at one side of said diaphragm and a conduit connected at one end to the Venturi tube at approximately the point of highest velocity and at the other end to said chamber, whereby exhausting of gases through said Venturi tube will set up negative pressure in said conduit and on one side of said diaphragm.

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