Dec. 11, 1934. T. W. CARRAWAY 1,984,053

AUTOMATICALLY CONTROLLED REFRIGERATIVE SYSTEM

Filed July 7. 1930 2 Sheets-Sheet 1

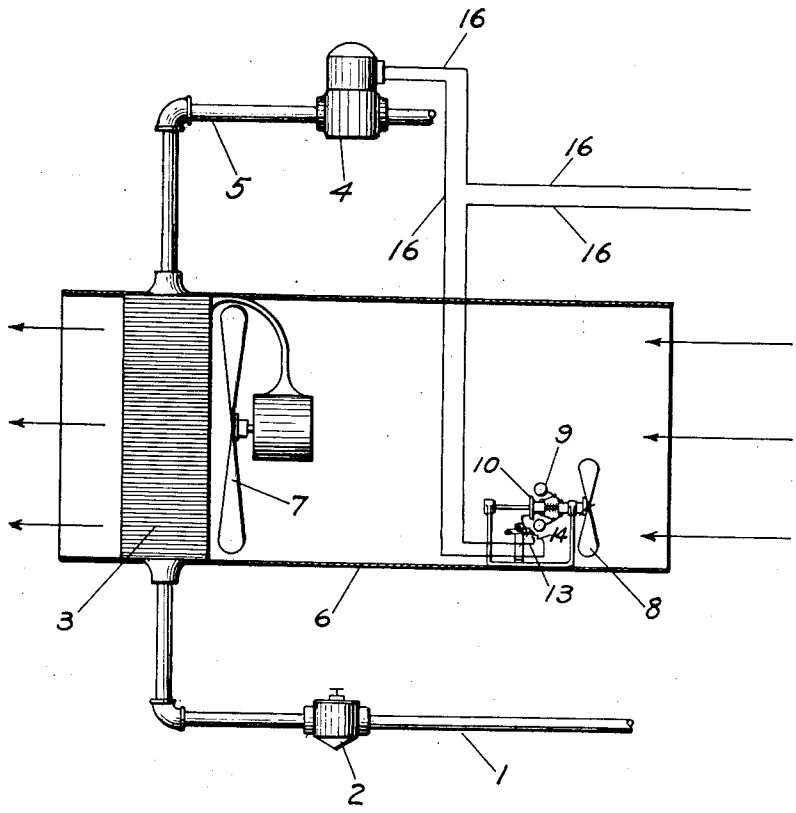

Figure 1.

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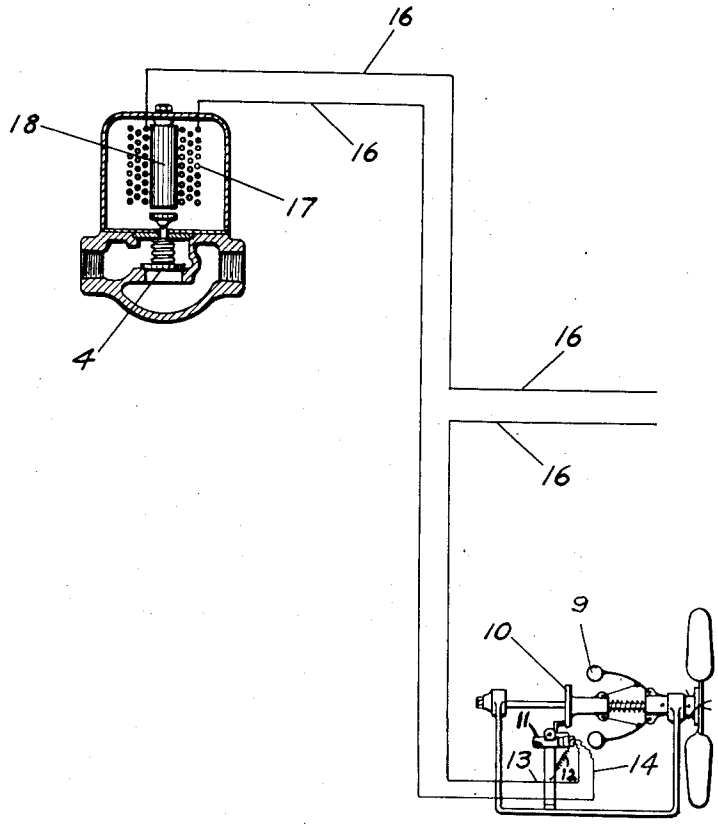

Figure 2.

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UNITED STATES PATENT OFFICE

1,984,053

AUTOMATICALLY-CONTROLLED REFRIGERATIVE SYSTEM

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Application July 7, 1930, Serial No. 465,908

8 Claims. (Cl. 62—2)

This invention relates to improvements in refrigerative systems. More especially it has to do with flow control of a refrigerant in accordance with the frost conditions of a heat exchanger in such a system.

As herein illustrated the system comprises a heat exchanger having conduits through which a suitable refrigerant flows and having between these conduits spaces through which fluid flows to be cooled. When the fluid is air containing moisture there is an accumulation of frost on the heat exchanger which if permitted to collect indefinitely would fill the said spaces and eventually prevent any flow of air through them. If, however, the flow of refrigerant is cut off before this accumulation becomes too great, the air which continues to flow through the spaces of the exchanger will melt the frost and thus restore the air-flow capacity of the system.

It is an object of this invention to provide a system in which the flow of the refrigerant is automatically controlled in accordance with the operation of the system, or more specifically in accordance with the frost conditions of the heat exchanger, to the end that undue accumulation of frost will not occur.

The accompanying drawings show somewhat diagrammatically a system embodying the invention but this is to be taken as merely illustrative of the principles involved and it is intended that the patent shall cover by suitable expression in the appended claims whatever features of patentable novelty exist in the invention disclosed.

In the drawings:

Figure 1 is a side view of the pertinent parts of a refrigerative system embodying the invention; and

Figure 2 is a somewhat enlarged view of the control means of Figure 1.

Referring more particularly to the drawings, pipe 1 represents a supply line leading from a suitable compressor and condenser (not shown) through the usual pressure regulating valve 2 and thence to the bottom of a heat exchange unit 3 having conduits through which the refrigerant passes to a return pipe 5 leading back to the compressor.

The unit 3 is preferably arranged within a casing 6 and there is provided means, such as the fan 7, for driving air through the unit and past the refrigerant conduits thereof. In the path of this air flow the invention contemplates the provision of means which will be responsive to changes in said air flow and thereby actuated to effect control of the refrigerant flow. The specific means shown comprise blades 8 mounted on a rotatable shaft having associated therewith a centrifugal governor 9. The terminal sleeve 10 of this governor is engaged by a pivotally mounted tube 11 having a suitably arranged spring 12 for maintaining the engagement (see Figure 2). This tube contains a charge of mercury which, in accordance with the position of the tube makes or breaks connection between the terminals 13 and 14 of an electric power circuit 16.

This circuit may lead to any suitable means for controlling the flow of refrigerant and is here shown as connected to the windings 17 of an electromagnet 18 which upon being energized effects the opening of a valve 4. This valve is located in the line through which the refrigerant flows being here shown connected to the return pipe 5.

The operation of the system is as follows. Assume the valve 4 to be open and refrigerant flowing through pipe 1, the unit 3 and return pipe 5. With the fan 7 in operation air will be forced through the casing 6 and unit 3 bathing the refrigerant filled conduits thereof. Heat is taken from the air and absorbed by the refrigerant. So long as the spaces of the unit are sufficiently open to permit a predetermined flow of air the valve 4 will remain open. This is due to the fact that the blades 8 are driven fast enough to cause the ball levers of the governor 9 to fly outward and thus position sleeve 10 so that the spring 12 will keep tube 11 in position where the mercury closes the gap between terminals 13 and 14. With the circuit 16 thus closed, the electromagnet 18 is energized and holds valve 4 off its seat.

The air, however, passing the refrigerant conduits almost invariably contains moisture and in time this will condense on the unit and form a film of frost. As this accumulation grows and reduces the size of the open spaces through the unit, the air flow is retarded and its velocity decreased. This will affect the speed of blades 8 and the governor 9 and in due time will so reduce this speed of rotation as to cause the sleeve 10 to tilt the tube 11 and bring about the opening of circuit 16. This causes de-energization of the magnet and allows valve 4 to seat and thus stop the flow of refrigerant. But the air flow through the unit continues, although at a reduced velocity, and as it passes over the frost, the latter is melted, some of it being entrained in the air while the most of it drains down the unit and flows away through a suitable drain (not shown).

As the frost disappears, or as the unit is thus defrosted, the air spaces are again freed and in

due course the air flow will become of sufficient velocity to again affect the blades 8 and governor 9 in such manner as to bring about the closure of circuit 16. This will cause valve 4 to be opened and the flow of refrigerant to reoccur. The foregoing cycle will be repeated indefinitely thus accomplishing the defrosting of the unit automatically in accordance with the regular operation of the system.

Having thus described my invention, what I claim is:

1. A refrigerative system comprising, in combination, a heat exchange unit in a refrigerant circuit; means in said circuit for controlling the flow of refrigerant; means for driving a current of air past said unit; means for directing the air to said driving means; and means in the path of said directed air on the approach side of said driving means actuated in accordance with variations in the velocity of said air for controlling the said first named means.

2. A refrigerative system comprising, in combination, a refrigerant circuit including a heat exchange unit having surfaces over which a current of air is adapted to pass; a valve in said circuit for controlling the flow of refrigerant therethrough; a fan arranged to drive air toward said surfaces; means for directing air to said fan; and means on the approach side of said fan affected by the velocity of the directed air for controlling the position of said valve.

3. A refrigerative system comprising, in combination, a refrigerant circuit including a heat exchange unit having surface over which a current of air is adapted to pass; means for moving said air; an electrically actuated valve in said circuit for controlling the flow of refrigerant therethrough; means for directing air to said moving means; a movable element in the path of said directed air; and means actuated by the movement of said element for controlling the electric circuit of said valve.

4. A refrigerative system comprising, in combination, a refrigerant circuit including a heat exchange unit having a multiplicity of surfaces; a valve for controlling the flow of refrigerant through the unit; a fan for causing an air current over said surfaces; means for directing air to said fan; and means arranged on the approach side of said fan in the path of said directed air and controlled by the said directed air for actuating said valve.

5. A refrigerative system comprising, in combination, a refrigerant circuit including a heat exchange unit having a multiplicity of surfaces; a valve for controlling the flow of refrigerant through the unit; a fan for causing air to move past said surfaces; means for directing air to said fan; and a movable element mounted in the path of said directed air on the approach side of said fan and actuated by variations in the flow of said directed air for controlling said valve.

6. In a refrigerative system, a heat exchange unit having a plurality of surfaces, said unit being adapted to receive a supply of refrigerant, a valve for controlling the flow of refrigerant through the unit, a fan for producing an air current over said surfaces, means directing air to said fan, a rotating fan mounted in the path of the directed air and adapted to be driven thereby, a switch controlled by variations in the speed of rotation of said rotating fan, and electric means controller by said switch for operating said valve.

7. In a refrigerative system, a heat exchange unit having a plurality of surfaces, said unit being adapted to receive refrigerant, an electrically actuated valve for controlling the flow of refrigerant through the unit, a conduit surrounding said unit, a force draft fan mounted in said conduit for forcing a current of air over said surfaces, a movable member mounted in said conduit in position to be variably moved due to the variation in velocity of the air current passing through said conduit, and an electrical connection between said movable member and said valve for closing said valve upon the velocity of the air current being reduced below a predetermined degree and opening said valve upon the velocity rising above a predetermined degree.

8. In a refrigerative system, a heat exchange unit having a plurality of surfaces, said unit being adapted to receive a supply of refrigerant, an electrically actuated valve for controlling the flow of refrigerant through the unit, a conduit surrounding said unit, a force draft fan mounted in said conduit for forcing a current of air over said surfaces, a rotary fan mounted in said conduit and operatively connected with said valve for closing the same when its rotation falls below a predetermined speed and opening said valve when its rotation exceeds a predetermind speed.

THOMAS W. CARRAWAY.