Nov. 1, 1955 J. G. HAILEY 2,722,108

REFRIGERATION CONTROL SERVICE

Filed Sept. 21, 1953 2 Sheets-Sheet 1

Fig. 1

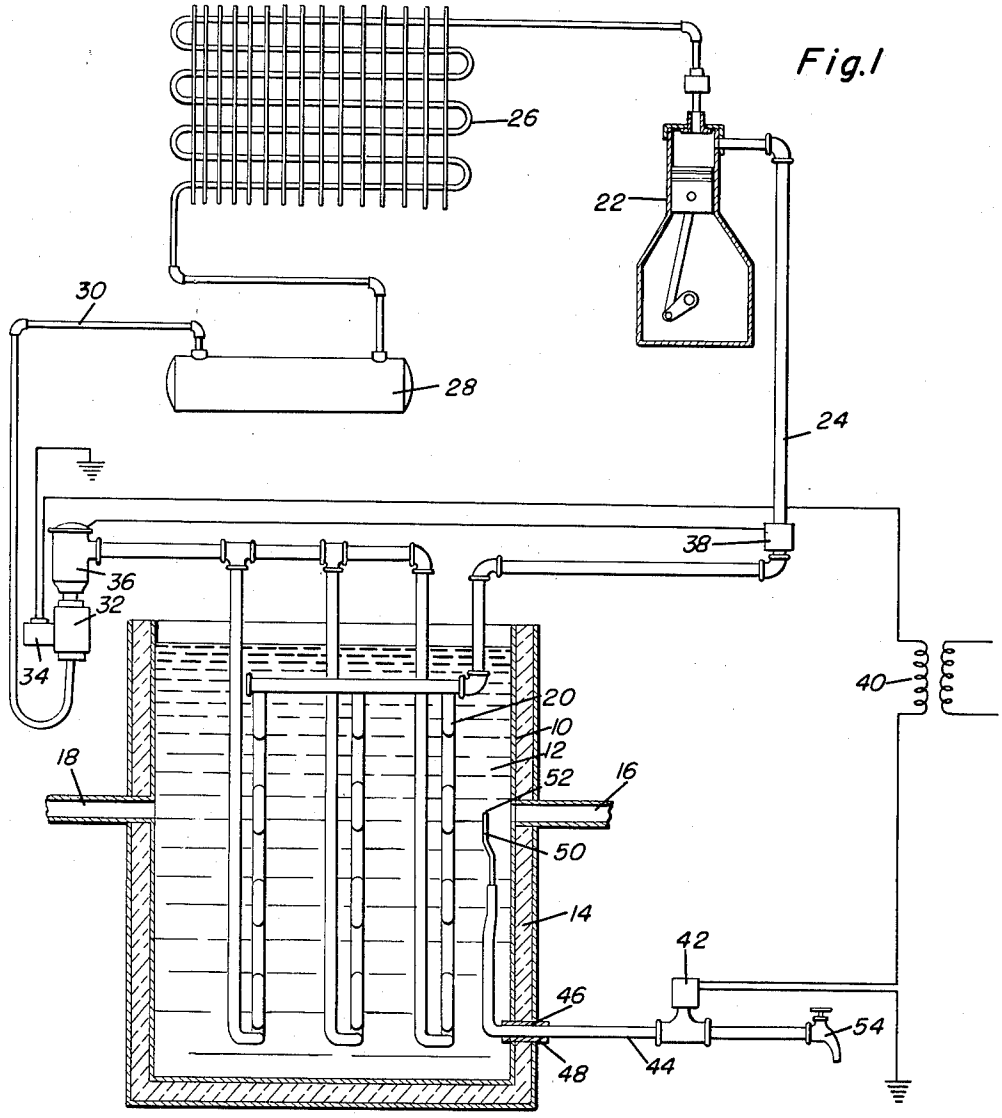
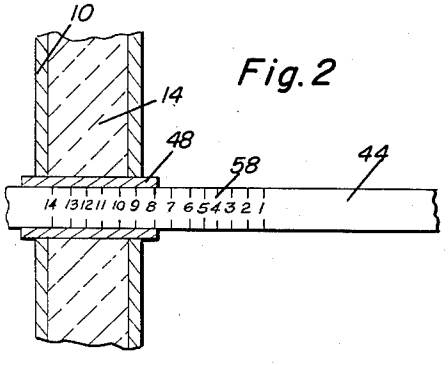


Fig. 2



James G. Hailey
INVENTOR.

BY Clarence A. O'Brien and Harvey B. Jacobson
Attorneys

Nov. 1, 1955 J. G. HAILEY 2,722,108

REFRIGERATION CONTROL SERVICE

Filed Sept. 21, 1953 2 Sheets-Sheet 2

Fig.3

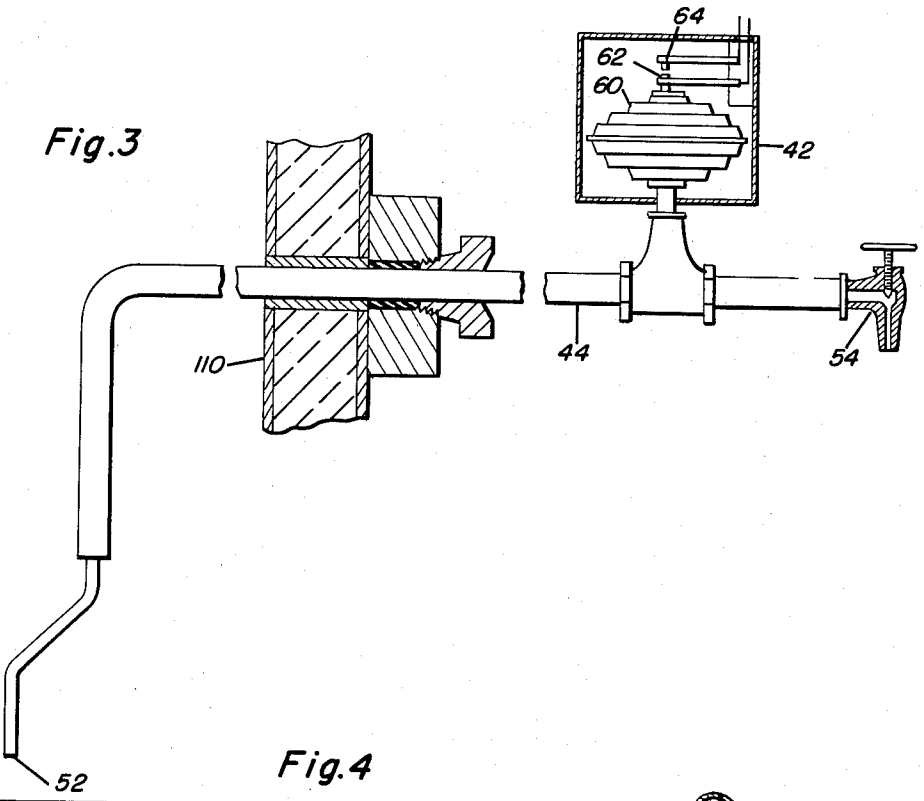
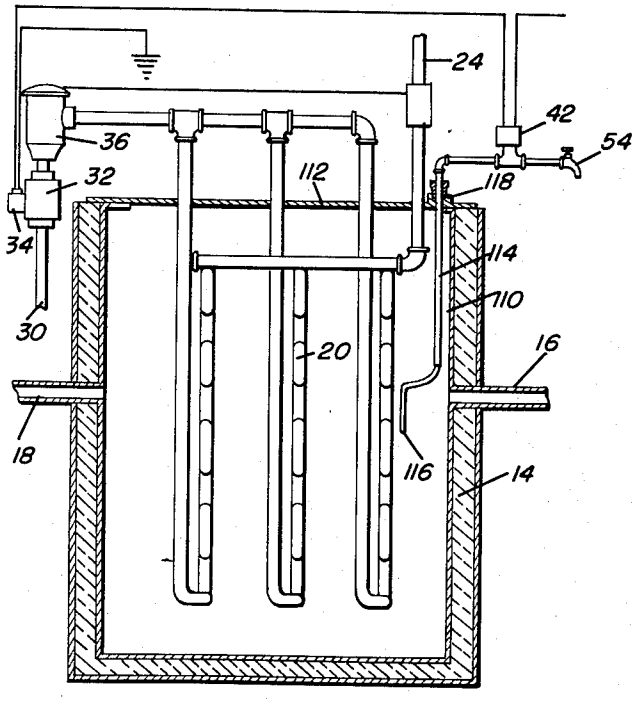


Fig.4



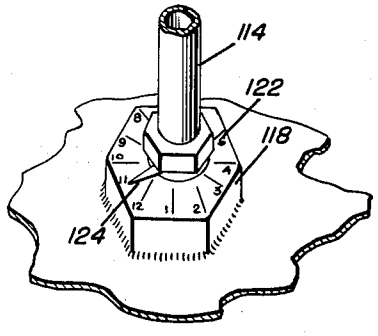


Fig. 5

James G. Hailey
INVENTOR.

BY Clarence A. O'Brien and Harvey B. Jacobson
Attorneys

United States Patent Office 2,722,108
Patented Nov. 1, 1955

2,722,108

REFRIGERATION CONTROL SERVICE

James G. Hailey, Dallas, Tex.

Application September 21, 1953, Serial No. 381,288

3 Claims. (Cl. 62—7)

This invention relates to a refrigeration control device and particularly to a device responsive to the accumulation of ice in a heat storage device for controlling the supply of refrigerant cooling coil therein.

In air conditioning systems it has heretofore been known to provide a heat exchanger in the form of a tank of water with a cooling coil therein and means to circulate the water to absorb heat from any desired medium. It is customary to provide these devices with a capacity equal to the average capacity of the cooling system and store energy in the water tank by means of an accumulation of ice therein so that during peak loads on the cooling system the ice may be melted to supply the necessary energy to the cooling system and during off loads on the cooling system the ice will be accumulated to store the energy necessary to meet the peak.

In the utilization of such energy-storing means it is necessary to provide some means responsive to the thickness of the ice to shut off the accumulation thereof so that the tank does not become ice-bound whereby the circulation may be impeded so that cooling will not take place; this will also prevent damage of the equipment by an excess accumulation of ice.

The present invention provides a control system utilizing a solenoid operated valve for controlling the flow of compressed refrigerant to the cooling coil and a bleeder or drip tube connected into the water container and having an opening at a spaced distance from the refrigerating coil so that the accumulation of a predetermined amount of ice thereon will stop the aperture of the bleeder tube and prevent the flow of water from the container thereinto. A pressure responsive switch is then responsive to the pressure within the bleeder tube and a control valve controls the flow of water therethrough so that when the ice closes the intake aperture the pressure on the tube will fall and cause the switch to deenergize the solenoid valve.

It is accordingly an object of the invention to provide an improved heat exchanger.

A further object of the invention is to provide a heat exchanger having energy storing means with a control system.

A further object of the invention is to provide a control system for an energy storing device.

A further object of the invention is to provide a bleeder tube having control means associated therewith for controlling the accumulation of ice in a container.

Other objects and many of the attendant advantages of the present invention will be apparent from the following detailed description taken in conjunction with the accompanying drawings in which:

Figure 1 is a schematic illustration of a heat exchanger, energy storing system, provided with a control device according to the invention;

Figure 2 is an enlarged detail view of an indicator for the control device;

Figure 3 is an elevational view of a modified control device;

Figure 4 is a schematic showing of a closed heat exchanger with the modified control device installed; and

Figure 5 is a perspective view of an indicator for use with a modified controller.

In the exemplification according to the invention, a container **10** contains a quantity of water **12** and is provided with suitable insulation **14**. A circulating conduit **16** and **18** draws water out of the tank **10** and passes it through a suitable cooling system and returns it thereto. A plurality of cooling coils **20** are passed in the fluid in the tank **10** and a compressor **22** is connected to the cooling coils by a suction line **24** so that the evaporated refrigerant in the coils **20** will be drawn off and compressed and the compressed refrigerant will be delivered to a condenser **26** and to a receiver tank **28** from whence it will be delivered through a conduit **30** to a refrigerant valve **32** which is provided with a solenoid operating coil **34** and also with a thermostatic refrigerant valve **36** responsive to a thermostat **38** connected with the suction line **24** so that refrigerant may be circulated when the valves **36** and **38** are open.

The controller for the solenoid valve **32** comprises a source of energy such as a transformer **40**. The energy flowing through the transformer **40** is controlled by a pressure responsive switch **42** which is responsive to the pressure on a bleeder line **44** which extends through an aperture **46** in the side of a container **10** and is provided with a suitable stuffing gland **48** for preventing the loss of water thereon. The upper end of the bleeder tube **44** is provided with a feeder tube **50** having an aperture **52** at the top end thereof; the tube **50** being offset so that the aperture **52** is in predetermined proximity to the cooling coil **20**. A release or controller valve **54** is placed on the outer end of a bleeder tube **44** and controls the flow of water therethrough. This valve which is manually adjustable provides a permanently operating positively acting pressure relieving means for the tube, which produces a predetermined drop of the hydraulic pressure within the tube, and relieves pressure when the opening **52** is closed. For simplicity of illustration, the valve **54** is shown as the usual spigot type valve although obviously any type of valve or controlled aperture may be used. The bleeder tube **44** is preferably slidably received in the packing **48** so that the aperture **52** may be adjusted toward or away from the coil **20**. In order to readily determine the adjustment of the aperture **52** indicia **58** may be placed on the tube **44** so that the adjustment of the aperture **52** may be readily determined.

Pressure switch **42** is preferably of a type provided with a Sylphon type bellows **60** carrying a movable contact **62** for cooperation with a fixed contact **64** so that the release of pressure in the bellows **60** will cause the contact **62** to be separated from contact **64** and deenergize the solenoid **34** so that the solenoid valve **32** will be closed.

In the exemplification according to Figure 4, a tank **110** is provided with a top **112** so that the water in the tank **16** is maintained under suitable pressure. A bleeder line **114** is placed inside of the container **110** and is provided with an aperture **116** with the bleeder line **114** passing through a packing gland **118**. The bleeder tube **114** may be rotated in the gland **118** to move the aperture **116** toward or away from the refrigerating coil **20**. The gland **118** may be provided with indicia **122** and a pointer **124** may be placed on the bleeder tube **114** so that the exact adjustment of the aperture **116** may be readily ascertained.

In the operation of the device according to the invention, the presence of unfrozen water at the aperture **52** or **116** will cause the tubes **44** or **114** to be filled with water and the valve **54** will control the rate of flow

therethrough and the valve **54** is set at a less rate of flow than is permitted by the apertures **52** or **116** so that a pressure would be built up in the bleeder tubes **44** or **115** so that the switches **42** will be actuated by the pressure in the bleeder tubes **44** or **114** to close the circuit and cause the solenoid **34** to open the valve **32** so that refrigerant may flow through the expansion coils **20**. During any period of reduced demand for heat exchange the coils **20** will build up ice thereon so that the energy will be available for the next peak demand. If the ice builds up to a point where the ice covers the apertures **52** or **116** the water will cease flowing into the bleeder tubes and the valve **54** will reduce the pressure therein so that the pressure switches **42** will deenergize the solenoids **34** and close the valves **32** to prevent further flow of refrigerant through the coils **20** and the accession of ice on the coils **20**.

For the purpose of exemplification, particular embodiments of the invention have been shown and described according to the best present understanding thereof. However, it will be apparent to those skilled in the art that various changes and modifications may be made in the construction and arrangements of the parts thereof without departing from the true spirit of the invention.

What is claimed as new is as follows:

1. For use in a heat exchanger having a solenoid valve controlling the flow of refrigerant to a refrigerating element which stores energy by producing a coating of ice on the refrigerating element, a controller comprising a conduit provided with permanently operating positively acting pressure controlling and relieving means having an opening in proximity to the refrigerating element, said opening adapted to be closed by a predetermined thickness of ice on said element, a pressure switch responsive to the pressure in said conduit, a relief valve connected to said conduit, and circuit means including said pressure switch adapted to energize said solenoid valve, means for adjusting the position of said opening with respect to said refrigerating element, and indicating means indicating the position of said opening.

2. In a heat exchanger and energy storage system having a water filled container with a cooling coil immersed

in the water and means for supplying condensed refrigerant to said cooling coil, a control device comprising a solenoid valve controlling the flow of refrigerant to said cooling coil, a trickle tube mounted in said container and extending through the wall of said container, said tube having an opening in the container in spaced relation to said cooling coil, and being provided with permanently operating manually adjustable positive pressure controlling and relieving means a valve controlling the flow of water through said tube, a pressure switch responsive to the pressure in said tube, circuit means including said pressure switch for energizing said solenoid valve, and means for adjusting said tube in said container to vary the distance of said opening from said cooling coil.

3. In a heat exchanger and energy storage system having a water filled container with a cooling coil immersed in the water and means for supplying condensed refrigerant to said cooling coil, a control device comprising a solenoid valve controlling the flow of refrigerant to said cooling coil, a trickle tube mounted in said container and extending through the wall of said container, and provided with permanently operating manually adjustable positive pressure control and relieving means said tube having an opening in the container in spaced relation to said cooling coil, a valve controlling the flow of water through said tube, a pressure switch responsive to the pressure in said tube, and circuit means including said pressure switch for energizing said solenoid valve, a sliding connection between said tube and said container for varying the relation of said opening to said cooling coil, and indicia for indicatng the adjustment.

References Cited in the file of this patent

UNITED STATES PATENTS

1,937,698	Hoffman	Dec. 5, 1933
2,512,066	Linfor	June 20, 1950
2,561,437	Cobb	July 24, 1951
2,593,874	Grandia	Apr. 22, 1952
2,633,004	Leeson	Mar. 31, 1953
2,674,101	Calling	Apr. 6, 1954