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SAFETY DEVICE FOR REFRIGERATION SYSTEMS

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Fig. 1.

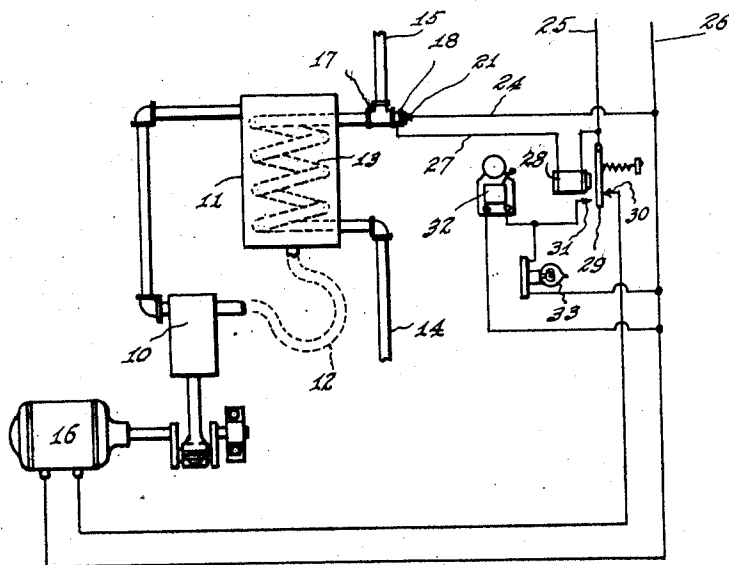
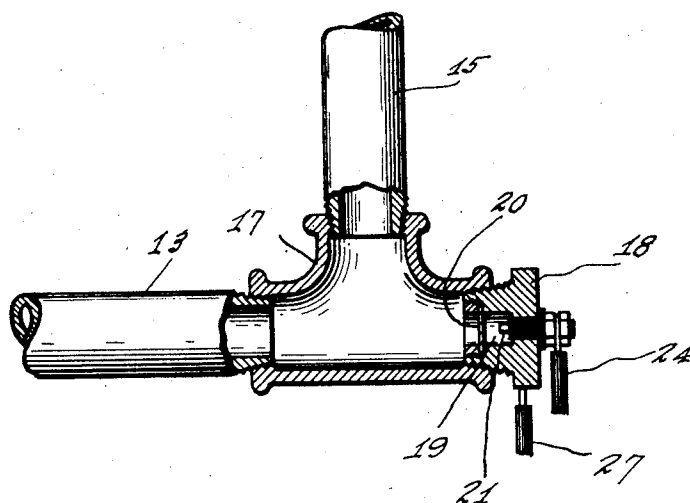


Fig. 2.



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SAFETY DEVICE FOR REFRIGERATION
SYSTEMS

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7 Claims. (Cl. 177—311)

In refrigerating systems where a refrigerant such as sulphur dioxide is cooled in a heat exchanger through which cooling water flows, damage frequently results from small leaks which permit communication between the refrigerant circuit and the cooling water system. When any such leak occurs the sulphur dioxide, being under relatively high pressure, escapes into the water system; but eventually, as the pressure in the refrigerant-circuit drops, some water finds its way into the refrigerant circuit, forms sulphurous acid with the sulphur dioxide, and may seriously corrode and otherwise damage the refrigeration apparatus.

It is the object of my invention to prevent the occurrence of damage as the result of any accident whereby the refrigerant comes into association with the cooling liquid. More specifically, it is my object to produce a device which can be readily attached to any existing refrigerating system and which will become operative upon acidification of the water at least to give notice of the dangerous condition and preferably to stop the operation of the refrigeration apparatus.

In carrying out my invention I provide a pair of electrodes insulated from each other and exposed within a chamber separated from the cooling water by a diaphragm which is subject to corrosion by the acid or other compound formed when the refrigerant combines with the cooling water. Should a leak occur whereby the refrigerant would enter the circulating water system, the resultant acid formed would dissolve such diaphragm and enter the electrode-containing chamber completing a circuit between the electrodes. Completion of that circuit can be availed of for performing any desired operation, such as actuating a warning signal or stopping the operation of the refrigerating apparatus.

The accompanying drawing illustrates my invention: Fig. 1 is a diagrammatic view showing apparatus embodying my invention associated with a refrigerating system, and Fig. 2 is a section on an enlarged scale through a portion of the apparatus shown in Fig. 1.

My invention is not concerned with any details of the refrigeration apparatus, which is indicated only diagrammatically in the drawing. Refrigeration apparatus of the compression type, which is indicated in the drawing but to which my invention is not limited, embodies a compressor 10 which compresses the refrigerant and delivers it to a cooler 11 from which the refrigerant passes through the remaining portion of the apparatus indicated diagrammatically by the dotted

lines 12 and back to the compressor. It is customary to cool the refrigerant in the cooler 11 by means of a cooling coil 13 having its ends connected respectively to a water supply pipe 14 and a discharge pipe 15. Some suitable source of power, such as an electric motor 16 is employed to drive the compressor 10.

A device embodying my invention is conveniently associated with apparatus such as has just been described at the point where the cooling coil 13 is connected to the discharge pipe 15. If such a location is desired, the connection to the cooling coil 13 of the discharge pipe 15 may be by means of an ordinary pipe T 17. In that opening of the T which is not connected to either of the pipes 13 and 15, I may mount the device embodying my invention.

As shown in the drawing, that opening of the T 17 which is not connected to the pipes 13 and 15 receives a plug 18 having an inwardly opening central chamber 19 closed by a relatively thin diaphragm 20 of some material which will be subject to the action of sulphurous acid. Within the chamber 19 I provide an electrode 21 which is suitably insulated from the body of the plug 18. The latter may be of metal and which may constitute the other electrode of the device.

It is obvious that various methods of utilizing the circuit completed between the electrode 21 and the body of the plug 18 may be availed of to secure the desired result. In the arrangement illustrated in the drawing, the electrode 21 is connected by a wire 24 to one of a pair of current-supply wires 25 and 26, and the body of the plug 18 is connected through a wire 27 and the winding of a relay 28 to the other of such current-supply wires. The relay 28 has a movable contact 29 and two fixed contacts 30 and 31, the former of which is engaged by the movable contact 29 when the relay is deenergized and the latter of which is engaged by the movable contact when the relay is energized.

The motor 16, which operates the compressor 10, may be connected to the current-supply wires 25 and 26 through the contacts 29 and 30, so that upon energization of the relay the supply of current to the motor 16 will be cut off. If desired, warning signals such as a bell 32 and a lamp 33 may be connected to the supply wires 25 and 26 through the contacts 29 and 31 so that both visible and audible indications will be given when the relay 28 is energized.

In the operation of apparatus in which my invention is embodied, the diaphragm 20 remains intact as long as the water flowing through the

pipes 14 and 15 and coil 13 is not acidified. However, should a leak occur in the cooling coil 13, the sulphur dioxide in the cooler 11 would enter the water system through the leak and would
 5 react with the water to form sulphurous acid. This acid would then act upon the diaphragm, disintegrate it, and enter the chamber 19 where, being an electrolyte, it would complete a circuit
 10 between the electrode 21 and the body of the plug 18 to energize the relay 28, shut off the supply of current to the motor 16, actuate the warning bell 32, and light the warning lamp 33.

As the principal parts of my invention can be embodied in the plug 18, it is a simple matter to
 15 incorporate the invention in any refrigeration apparatus. For use with systems in which sulphur dioxide is the refrigerant, the diaphragm 20 may be of zinc and 0.020 inch in thickness or even thinner.

20 I claim as my invention:

1. In combination, a fluid-conveying conduit, a heat-exchanger through which said conduit passes, said heat-exchanger containing a second and different fluid in contact with the
 25 exterior of said conduit, said conduit being provided with an opening in one wall, a closure member for said opening, said member being formed of material subject to corrosion by a mixture of said two fluids, a warning signal, and
 30 means actuated by the passage of a mixture of said two fluids through said opening for operating said warning signal.

2. In combination, a fluid-conveying conduit, a heat-exchanger through which said conduit
 35 passes, said heat-exchanger containing a second and different fluid in contact with the exterior of said conduit, said conduit being provided with an opening in one wall, a closure member for said opening, said member being formed of material
 40 subject to corrosion by a mixture of said two fluids, and mechanism actuated by the passage of a mixture of said two fluids through said opening for stopping operation of said fluid-circulating means.

3. In refrigeration apparatus having a heat-exchanger through which separately pass a refrigerant and a liquid which, when mixed, form an electrolyte, supply and discharge conduits for conveying the liquid to and from said heat-exchanger, means forming a chamber adapted to communicate with said discharge conduit, conducting means associated with said chamber-forming means and including an insulated electrode exposed within said chamber, a closure for
 55 normally preventing entrance of the liquid into said chamber from said discharge conduit, said closure being formed of material subject to corrosion by the action of a mixture of the refrigerant and the liquid, a source of electric current and an electrically operated warning signal connected together through said conducting means.
 60

4. In refrigeration apparatus having a heat-exchanger through which separately pass a refrigerant and a liquid which, when mixed, form

an electrolyte, supply and discharge conduits for conveying the liquid to and from said heat-exchanger, means forming a chamber adapted to communicate with said discharge conduit, conducting means associated with said chamber-forming means and including an insulated electrode exposed within said chamber, a closure for normally preventing entrance of the liquid into said chamber from said discharge conduit, said closure being formed of material subject to corrosion by the action of a mixture of the refrigerant and the liquid, a normally closed electro-magnetic switch openable when energized to stop operation of the refrigeration apparatus, and a source of electric current connected to the coil
 15 of said electro-magnetic switch through said conducting means.

5. In refrigeration apparatus having a heat-exchanger through which the refrigerant and the liquid separately pass, supply and discharge conduits for conveying the liquid to and from said heat-exchanger, means forming a chamber adapted to communicate with said discharge conduit, a closure for preventing communication between said chamber and said discharge conduit, said closure being formed of material subject to corrosion by the action of a mixture of said refrigerant and liquid, a warning signal, and means responsive to the presence in said chamber of a mixture of said refrigerant and liquid for actuating said warning signal.

6. In refrigeration apparatus having a heat-exchanger through which the refrigerant and the liquid separately pass, supply and discharge conduits for conveying the liquid to and from said heat-exchanger, means forming a chamber adapted to communicate with said discharge conduit, a closure for preventing communication between said chamber and said discharge conduit, said closure being formed of material subject to corrosion by the action of a mixture of said refrigerant and liquid, and means responsive to the presence in said chamber of a mixture of said refrigerant and liquid for stopping operation of the refrigeration apparatus.

7. In refrigeration apparatus having a heat-exchanger through which separately pass a refrigerant and a liquid which, when mixed, form an electrolyte, supply and discharge conduits for conveying the liquid to and from said heat-exchanger, means forming a chamber adapted to communicate with one of said conduits, conducting means associated with said chamber-forming means and including an insulated electrode, a closure for normally preventing communication between said chamber and the conduit with which it is associated, said closure being formed of a material subject to corrosion by the action of a mixture of the refrigerant and the liquid, a source of electric current, and an electro-responsive device connected to said current source through said conducting means.

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