

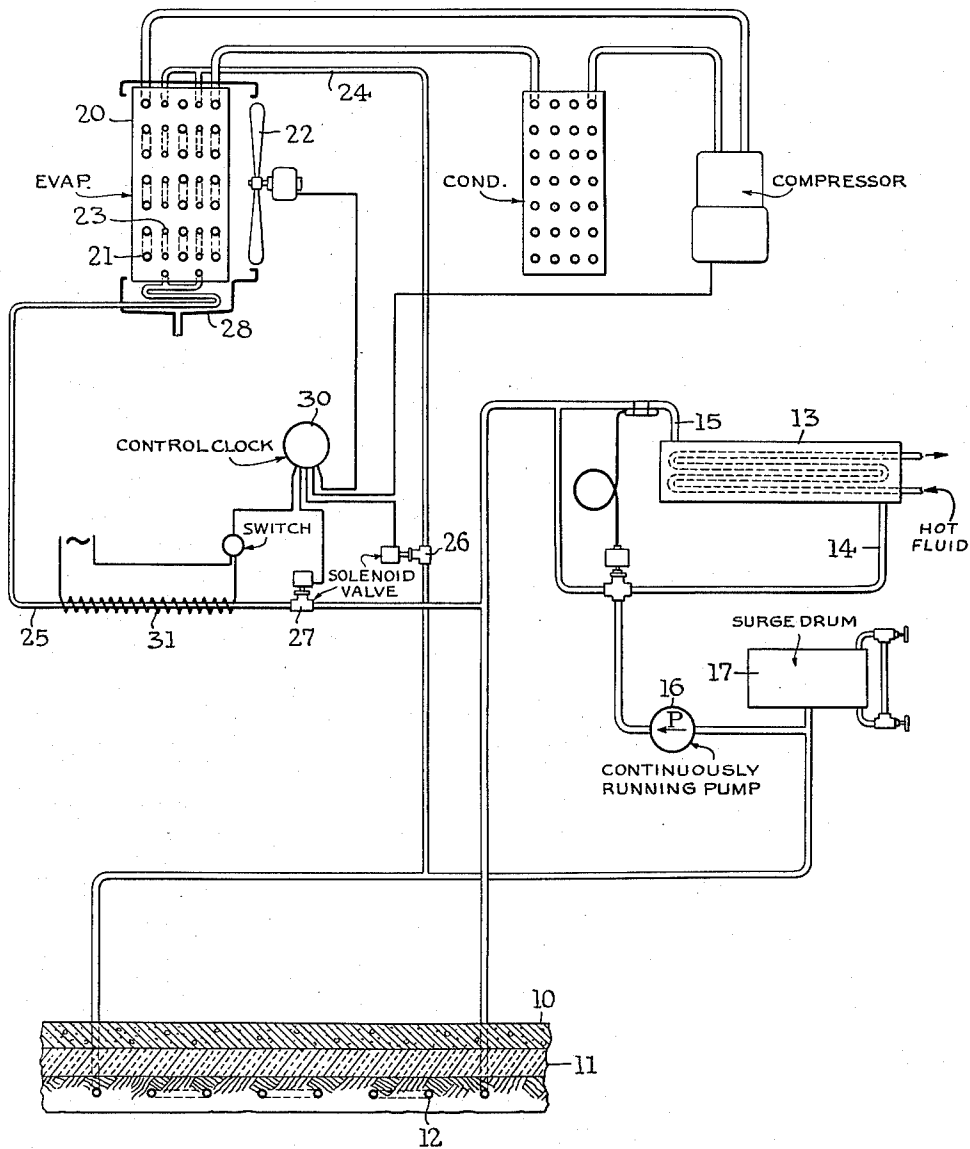
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AUTOMATIC DEFROSTING APPARATUS

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AUTOMATIC DEFROSTING APPARATUS

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4 Claims. (Cl. 62-155)

This invention relates to automatic defrosting systems for refrigeration apparatus, and more particularly to an automatic defrosting system for use on refrigeration apparatus in a cold storage warehouse.

In the construction of modern cold storage warehouses, it is now fairly common practice to install at the time that the warehouse is built some sort of heating means disposed beneath the insulated earth-laid floors of buildings of this kind. Such heating means serve to supply heat to the subjacent soil and thus prevent ice formation therein which would otherwise cause buckling and heaving of such floors as the ice build-up continues over a period of years. The applicant herein has been a pioneer in this phase of cold storage warehouse development and has also pioneered systems for remedying buckled and heaved floors in warehouses which have been in operation for a number of years, and which were not constructed with the above described heating means beneath their earth-laid floors. Another problem which occurs in cold storage warehouses is that of automatic defrosting of the evaporator coils without having to discontinue normal warehousing activity. Many systems for automatic defrosting have been proposed, and many enjoy substantial success. All of such systems in use at the present time suffer from any one of a number of drawbacks, principal among which is the need for separate apparatus for effecting the actual defrosting operation or special refrigerant connections in the case of hot gas defrosting which enable the refrigerant compressor to supply hot gas to the same evaporator conduits which are normally supplied with an expanding gas for cooling purposes.

It is the primary object of the present invention to provide refrigeration apparatus for a cold storage warehouse with automatic defrosting means which are as simple as possible, and which are entirely automatic in operation.

Other objects and advantages will be apparent from the following description read in conjunction with the attached sheet of drawings, in which the single figure shows in schematic form a preferred embodiment of the necessary heating and refrigerating apparatus to accomplish the objects of the present invention.

In general, the practice of the present invention is limited to a cold storage warehouse which includes a grid of fluid-carrying conduits disposed beneath the insulated earth-laid floor, and in which heated fluid is circulated continuously to supply heat to the subjacent soil. A circulating pump which runs continuously serves to circulate fluid in such a grid from a waste heat pickup exchanger. In order to effect automatic defrosting with apparatus of this type, it is herein proposed to use a second grid of fluid-carrying conduits which is disposed in direct heat exchange relation with the refrigerant carrying passages of the evaporator. This latter grid is connected, through means which include normally closed valves, to the heating grid positioned beneath the floor of the building. In order to effect actual defrosting, therefore, it is only necessary to stop

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the refrigerant compressor, and preferably the circulating fan, if any, which circulates the warehouse atmosphere over the evaporator, and at the same time open the valves between the floor heating grid and the evaporator heating grid so that circulation of the same heating fluid in heat exchange relation with the evaporator effects the necessary defrosting at periodic and predetermined time intervals.

Referring now to the drawing for a detailed description of the present invention, there is shown the upper or working surface of the earth-laid floor 10, the conventional layer of insulation 11 beneath the floor, and a grid 12 of fluid-carrying conduits disposed beneath the floor insulation. Circulation of heated fluid through this grid serves to supply sufficient heat to the subjacent soil to prevent ice formation therein. Subjacent soil as used herein is intended to be a generic expression meaning earth or fill such as crushed gravel or the like. It is now a known fact that regardless of the amount of insulation supplied beneath the floors of buildings of this kind, there is a gradual heat transfer through the floor which, over a period of years, will eventually result in sufficient ice formation in the subjacent soil to cause severe damage in buildings of this type.

A heat exchanger is shown diagrammatically at 13 and includes inlet and outlet connections 14 and 15, respectively, for connecting the heat exchanger to the subfloor heating grid. A pump 16 is connected to effect continuous circulation of fluid from the grid through the heat exchanger and return. A surge drum indicated at 17 and connected to the intake side of the pump assures an adequate supply of fluid for the purpose described.

The system as thus far described is entirely for the purpose of preventing ice formations in the subjacent soil.

An evaporator is shown schematically at 20 and conventionally includes a plurality of refrigerant carrying passageways or conduits 21. Also conventionally, a motor-driven fan 22 may be provided for circulating the warehouse atmosphere over the cooled evaporator surfaces. A second heating grid is shown at 23 in heat exchange relation with the refrigerant carrying passages of the evaporator. This grid is connected to the subfloor grid by means of a pair of conduits 24 and 25, each with a solenoid valve 26, 27 therein. These valves are normally closed to prevent the circulation of heated fluid during the time that the evaporator is performing its normal cooling function. When it is necessary to defrost the evaporator, it is then only necessary to open the solenoid valves, and shut down the refrigerant compressor and the air circulating fan. The pump 16 will then circulate the same fluid through the defrosting grid 23 as through the subfloor heating grid 12.

As the frost on the evaporator melts, it may be collected in a warmed drain pan 28 and conducted through the warmed drain to a point of disposal. As shown in the drawing, the source of heat for the drain pan is the same conduit 25 which conducts heated fluid to the defrosting grid.

The heat exchanger 13 may be of any conventional type, and as a heat source, it may utilize, for example, the water or coolant which is circulated over the condensers of the refrigeration system. Another possible source of heat for the heat exchanger would be an air pickup coil located, for example, in the compressor room of the warehouse. Obviously, however, the particular source of heat employed is not critical as regards practice of the present invention. The basic idea is to employ a single heated fluid which performs the double function of subjacent soil heating to prevent ice formation, and evaporator defrosting.

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Although the defrosting operation can, of course, be carried out manually at any desired time, it may be both practical and convenient to use a time controlled apparatus which will automatically start and stop the defrosting cycle. Such apparatus is schematically indicated on the drawing by the time clock 30. The time clock mechanism, of course, is connected to the various elements in the system, such as the solenoid valves 26 and 27, the evaporator fan 22, and the compressor which supplies the evaporator being defrosted.

In some cases, it may be necessary to provide a booster heater or the like which supplies heated fluid to the evaporator defrosting grid. Here again, the particular form of heater employed is unimportant. One practical embodiment would be an electric heater which is simply wrapped around one of the conduits as indicated in the drawing at 31. In the event that such apparatus is necessary, it will be understood that it is also under the control of the time apparatus and will begin its heating function simultaneously or substantially so with the circulation of fluid to the evaporator defrosting grid, when the solenoid valves are open and the compressor and air circulating fan are shut down.

From the foregoing, it will be apparent to those skilled in the art that there is herein shown and described a new and useful refrigeration apparatus which has primary utility in cold storage warehousing operations.

While the preferred embodiment has been herein shown and described, applicant is entitled to the benefit of a full range of equivalents within the scope of the appended claims.

I claim:

1. In combination: a refrigerated storage space including an insulated earth-laid floor; refrigeration apparatus for maintaining below freezing temperatures in said storage space, said apparatus including a conventional compressor, condenser and evaporator; a heating grid of fluid carrying conduits disposed beneath said insulated earth-laid floor; a source of heated fluid; pump means for continuously circulating said heated fluid through said heating grid to supply heat to the subjacent soil beneath said earth-laid floor; a defrosting grid of fluid carrying conduits disposed in direct heat exchange relation with the refrigerant carrying passages of said evaporator; fluid carrying means interconnecting said heating and defrosting grids, said means including normally closed electrically operated valves; and time controlled means electrically connected to said valves, and said refrigeration apparatus for periodically de-energizing said refrigeration apparatus and opening said valves to permit heated fluid from said source to defrost said evaporator, said means serving further to periodically reclose said valves and reenergize said refrigeration apparatus.

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2. The combination defined by claim 1 and including an electrically operated booster heater positioned in heat exchange relation to the fluid in said grids.

3. In combination: a refrigerated storage space including an insulated earth-laid floor; refrigeration apparatus for maintaining below-freezing temperatures in said storage space, said apparatus including a conventional compressor, condenser and evaporator; a heating grid of fluid-carrying conduits disposed beneath the insulated floor of said storage space; means including a pump for continuously circulating a heated fluid through said conduits to heat the subjacent soil; a defrosting grid of fluid-carrying conduits disposed in direct heat exchange relation with the refrigerant-carrying passages of said evaporator; means including normally closed valves connecting said heating and defrosting grids; and an electrical heater, normally inoperative, arranged in heat exchange relation with at least one of said fluid-carrying conduits; time controlled means connected to said heater, said valves and said compressor for periodically and at predetermined time intervals turning off said compressor, energizing said electrical heater, and opening said valves to cause circulation of the heated fluid from said heating grid through said defrosting conduits to effect defrosting of said evaporator, said time controlled means serving further to reclose said valves, restart said compressor and de-energize said electrical heater upon completion of the defrosting cycle.

4. In combination: a refrigerated storage space including an insulated earth-laid floor; refrigeration apparatus for maintaining below-freezing temperatures in said storage space, said apparatus including a conventional compressor, condenser and evaporator; a heating grid of fluid-carrying conduits disposed beneath the insulated floor of said storage space; means for circulating a heated fluid through said conduits to heat the subjacent soil; a drain pan arranged beneath said evaporator; a defrosting grid of fluid carrying conduits disposed in direct heat exchange relation to the refrigerant carrying passages of said evaporator and also in heat exchange relation with said drain pan; and means including normally closed valves connecting said heating and defrosting grids to regulate circulation of heated fluid from said heating grid through said defrosting conduits to effect defrosting of said evaporator.

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