May 14, 1935. W. R. KITZMILLER 2,001,028

DEFROSTING SYSTEM

Filed Sept. 26, 1932 2 Sheets-Sheet 1

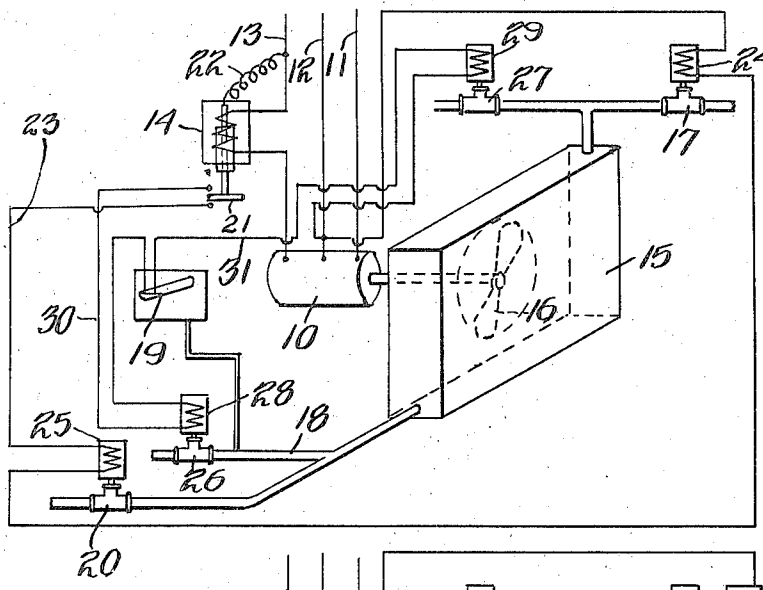


Fig. 1.

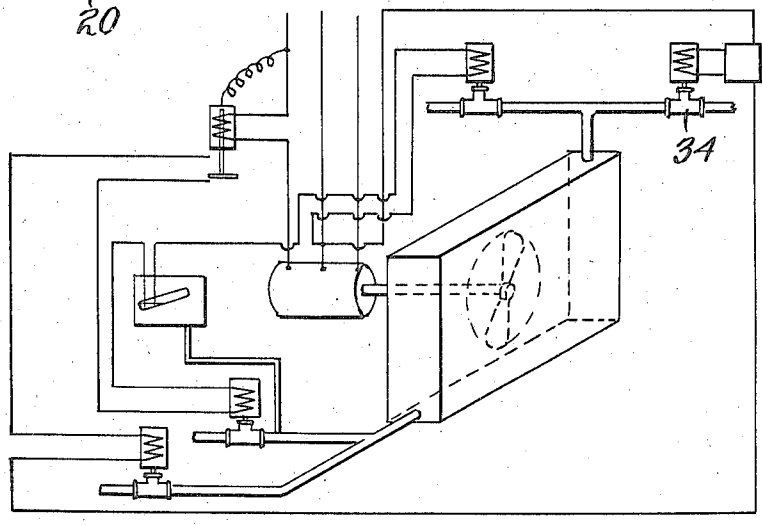


Fig. 2.

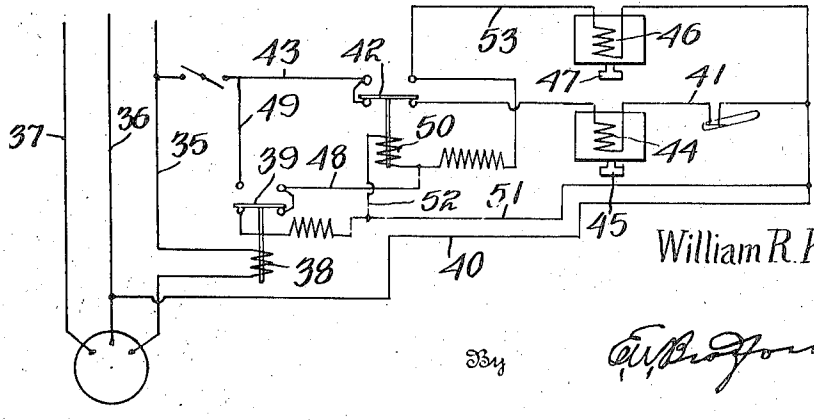


Fig. 3.

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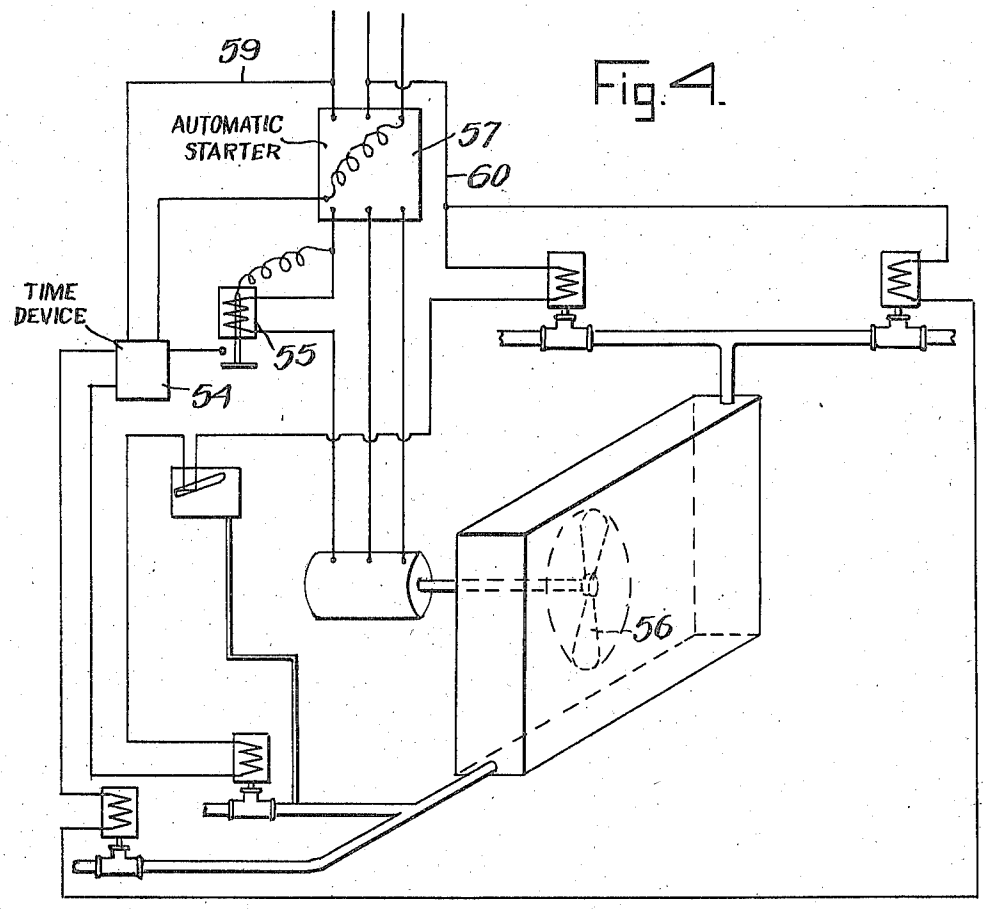
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Fig. 4.



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2,001,028

UNITED STATES PATENT OFFICE

2,001,028

DEFROSTING SYSTEM

William R. Kitzmiller, Waynesboro, Pa., assignor to Frick Company, Waynesboro, Pa., a corporation of Pennsylvania

Application September 26, 1932, Serial No. 634,947

9 Claims. (Cl. 62—4)

This invention relates to defrosting of coolers and while it may be adapted for any uses for which suited it is designed particularly with a view to its use in the cooling of air in a room or chamber. Due to the presence of moisture in a room or chamber a deposit of frost or ice forms on the evaporator or other cooler through which the air being cooled is circulated. This accumulation of frost greatly retards cooling of the air, since frost and ice are poor conductors of heat. Moreover the accumulation of frost may impede the passage of air through the cooler and thereby greatly reduce the efficiency of the device.

My invention therefore relates to improvements in means for automatically defrosting a cooler when the frost has accumulated to an objectionable degree.

The system is an improvement over that shown in my copending application Serial No. 561,800, filed September 8, 1931 for Defrosting systems.

Referring to the accompanying drawings, which are made a part hereof and on which similar reference characters indicate similar parts,

Figure 1 is a view in elevation of the preferred form of the invention with certain parts shown diagrammatically,

Figure 2, a view in elevation partly diagrammatic of a slightly different form of the invention,

Figure 3, a diagrammatic lay-out of an interlocked system which may be used with either of the two forms just described, and

Figure 4, a view in elevation partly diagrammatic of a slightly different form of the invention.

In the drawings numeral 10 indicates a motor which is operated by three phase current from lines 11, 12 and 13. The wire 13 is coiled about a solenoid 14 to provide a means for operating a switch 21 for a purpose which will later appear. The motor 10 operates a fan 16 for forcing air to be cooled through the evaporator or other cooler 15. The fan may be operated so as to force the air through the evaporator or to draw it through the evaporator as desired. The refrigerant which may be a cold brine or a volatile refrigerant is circulated through the evaporator or cooler and is drawn out through a valve 17 and passes to the suction of a compressor or pump not shown. Refrigerant to the evaporator passes through a valve 20. During normal operation the parts will be in the position shown in Figure 1 in which the valves 20 and 17 will be open so that refrigerant will freely circulate through the evaporator and the fan will operate to circulate air through the evaporator to cool the air. Under certain conditions the valve 20 may be omitted and any other suitable means provided for expansion or feeding of fluid to the cooler. This valve may be of the float type, automatic expansion valve, etc. When the evaporator has become coated with frost so as to impede the passage of air through the evaporator the load on the motor 10 will be affected and this change in load will energize coil 14 of switch 21, thereby opening the circuit from line 13 to line 12 through conductors 22 and 23 and solenoids 24 and 25, and close the circuit through conductors 22 and 30 and solenoids 28 and 29. This will de-energize solenoids 24 and 25 to close the valves 17 and 20. Valves 26 and 27 are arranged to open when solenoids 28 and 29 are energized by closing the circuit 30 and 31 with lines 12 and 13. When the valves 26 and 27 are opened warm fluid will be circulated through the evaporator 15. The evaporator will therefore be quickly defrosted. As soon as the frost has been removed from the evaporator coils the switch 21 will open circuit 22, 30 closing circuit through 22, 23, and this in turn will open valve 17 and valve 20 and close valves 26 and 27 so that the hot fluid will be cut off from the evaporator and the cold refrigerant will again circulate through the coils. The defrosting of the coils will require only a short time so that the temperature in the room will not be seriously affected during the few moments required to defrost the coils. The system therefore will operate automatically to maintain the coils relatively free of frost. If desired under certain conditions valve 27 may be omitted in which case the defrosting fluid can pass on to the compressor or pump through valve 17. It will be possible in some cases to operate without valve 20 and operate with a float control or other means of expansion in place of valve 20. These combinations will depend on the work being done and temperatures required. When operating with a direct expansion refrigerant, it will often be possible to simply use valve 17 and valve 26 for the defrosting cycle. The refrigerant will be expanded through valve 20 which may be of the float type or as explained above. When the unit 15 has become heavily frosted, electrical device 21 will be operated to break the circuit through conductor 23 and close the circuit through conductor 30, thus closing the valve 17 and closing circuit through lines 13, 30 and 31 thus opening valve 26.

The cut-out switch 19 is provided as a further feature of safety and is operated in response to

great temperature or pressure changes in the hot fluid which passes through the pipe 18 to the evaporator. When this fluid is too warm or pressure too high the switch 19 which is a pressure or thermostat switch will open and break the circuit through line 31. This will permit valve 26 to close. This safety feature also insures partial control of defrosting time since it would control the flow of warm fluid in some cases.

The arrangement shown in Figure 2 is similar to that shown in Figure 1 except that there is provided a time lag switch at 33. The time device 33 tends to hold the valve 34 closed a little beyond the regular defrosting period to insure the complete removal of snow and ice from the evaporator coils. In other words the electrical device 33 acts simply as a time lag in the opening of valve 34 to place the unit back into normal operation.

It may be necessary to provide means for insuring positive operation of the switch 21 in the event the electrical device should not hold the proper contact.

An interlocked system shown diagrammatically in Figure 3 provides for operating the switch 21 so that operation will be insured regardless of any interfering circumstances. In this interlocked system the wire 35 is connected in series through a coil 38 to operate the switch 39. During defrosting operation of the cooling system the switch 39 will be in the position shown in Figure 3 and the circuit will be closed from line 36 through wires 40, 41, switch 42 and wire 43 to the wire 35. This will energize solenoid 44 to open the valve 45 which controls the hot fluid to the evaporator. At the same time solenoid 46 will be de-energized so that the suction valve 47 from the evaporator will be closed. When the load on the motor 10 varies from a given standard due to loss of frost on the evaporator the switch 39 will be moved up to close circuit across lines 48 and 49.

The coil 50 will first be energized through lines 40, 51, 52, 48 and 49. This will raise switch 42 to close circuit from line 40 through line 53 to 43. This will energize solenoid 46 and open valve 47 to start evaporation of refrigerant. From the description given it will be apparent that the device may be arranged to operate within any predetermined load changes on the motor which operates the fan which change in load is due to an impeding of the passage of air through the evaporator coils.

The wiring hook-up illustrated in Figure 3 is generally known as a lock-up system and employs lock-up relays containing proper resistances to eliminate short circuits. This wiring can be used in various ways to secure practically the same results and may or may not employ the lock-up system.

The arrangement shown in Figure 4 is practically the same as those illustrated in Figures 1 and 2 except that there is provided a time switch 54 to operate the defrosting cycle rather than the electrical device 55. The relay or electrical device 55 will operate according to the frost on the cooler. Whenever the frost has built up to an objectionable point, the electrical device 55 will operate the time device 54 which will carry out the defrosting cycle and at the same time start and stop the fan 56, if desired, through an automatic starter 57. This would be necessary in rooms below freezing since the fan would draw freezing air over the melting frost and retard defrosting. The wiring hook-up will depend on the application and type of instrument employed. However, the connections 59 and 60 will be made ahead of the automatic starter 57 so that current is available to operate the timing device when the fan 56 is shut down.

It will be obvious to those skilled in the art that various changes may be made in my device without departing from the spirit of the invention and therefore I do not limit myself to what is shown in the drawings and described in the specification, but only as indicated by the appended claims.

Having thus fully described my said invention, what I claim as new and desire to secure by Letters Patent, is:

1. A device for defrosting a cooler comprising means for circulating refrigerant through the cooler, a fan adapted to circulate air over the cooler, a motor for operating said fan, the load on said motor varying as a result of the increase in the pressure head in the cooler when the cooler becomes heavily coated with frost, and means controlled by variation in the load on said motor for stopping circulation of refrigerant through the cooler and for causing the circulation of a warm fluid therethrough to hasten defrosting of the evaporator, substantially as set forth.

2. In a fluid cooling system of the kind described having an evaporator, valve means for controlling the flow of refrigerant through the evaporator, means for circulating the medium to be cooled through the evaporator, a motor for operating said means, means for controlling the said valve means in response to variations in the load on said motor due to impedance of the fluid being cooled due to a frosted condition of the evaporator, and means automatically operated upon closing of said valve means for circulating a warm fluid through the refrigerator to hasten the defrosting of the refrigerator when the flow of refrigerant has been stopped, substantially as set forth.

3. In a fluid cooling system of the kind described having a cooler, valve means for controlling the flow of refrigerant through the cooler, means for circulating the medium to be cooled through the cooler, a motor for operating said means, means for controlling the said valve means in response to variations in the load on said motor due to impedance of the fluid being cooled due to a frosted condition of the evaporator, means for circulating a warm fluid through the cooler to hasten the defrosting of the refrigerator when the flow of refrigerant has been stopped, and a time delay device for delaying reopening of the refrigerant control valve means for a short time after the load on the motor has returned to normal thereby insuring a complete defrosting of the cooler before the resumption of circulation of refrigerant fluid through the evaporator, substantially as set forth.

4. In a device of the kind described, a cooler having refrigerant lines connected thereto and valves for controlling the flow of refrigerant through said lines, a separate line also connected with the cooler having valves for controlling the flow of a warm fluid therethrough, means for circulating the medium to be cooled into contact with the cooler, a motor for operating said circulating means, means for controlling said switch subject to load on the motor due to a frosted condition of the cooler, said switch being in control of the valves for circulating refrigerant and for

circulating a warming fluid through the cooler, the warm fluid being circulated to remove the frost after the evaporator becomes objectionably coated with frost, substantially as set forth.

5. In a device of the kind described, a cooler having refrigerant lines connected thereto and valves for controlling the flow of refrigerant through said lines, a separate line also connected with the cooler having valves for controlling the flow of a warm fluid therethrough, means for circulating the medium to be cooled into contact with the cooler, a motor for operating said means, a switch controlled by the load on the motor due to a frosted condition of the cooler, said switch being in control of the valves for circulating refrigerant and for circulating a warming fluid through the cooler, the warm fluid being circulated to remove the frost after the evaporator becomes objectionably coated with frost, and a cut-out switch for stopping circulation of the warm fluid when the temperature of this fluid reaches a predetermined high degree, substantially as set forth.

6. A device for cooling air comprising a cooler, means for circulating refrigerant through the cooler, a fan for circulating air over the cooler, a motor for operating said fan, the load on said motor varying as a result of the increase in the pressure head through the cooler when the cooler becomes coated with ice or frost, means including a timing device for controlling circulation of refrigerant through the cooler, and means controlled by variation in the load on the motor for controlling the timing device.

7. A device of the kind described comprising an air cooler, means for circulating refrigerant through the cooler, valve means in control of said circulating means, a fan for circulating air over the cooler, a motor for operating said fan, the load on said motor varying as a result of the increase in the pressure head through the cooler when the cooler becomes coated with ice or frost, means controlled by variation in the load on the motor for operating said valve means, a timing device for controlling operation of the said valve means, and means automatically operable upon the stopping of circulation of refrigerant through the cooler for causing the circulation of a warm fluid therethrough to hasten defrosting.

8. In combination, a cooler, means for circulating refrigerant through the cooler, means for circulating the fluid to be cooled over the cooler, a motor for driving said last-mentioned means, the load on the motor varying as a result of the restriction of the fluid path when the cooler becomes coated with ice or frost, means for causing circulation of warm fluid through the refrigerant path in said cooler to defrost the cooler, and means for controlling the circulation of said warm fluid in response to the variation of load on the motor.

9. In combination, a cooler, means for circulating refrigerant through the cooler, means for circulating the fluid to be cooled over the cooler, a motor for driving said last-mentioned means, the load on the motor varying as a result of the restriction of the fluid path when the cooler becomes coated with ice or frost, means for causing circulation of warm fluid through the refrigerant path in said cooler to defrost the cooler, means for controlling the circulation of said warm fluid in response to the variation of load on the motor, and auxiliary control means for preventing warm fluid above a predetermined temperature or pressure from circulating through the cooler.

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