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REFRIGERATING PLANT

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Fig.1

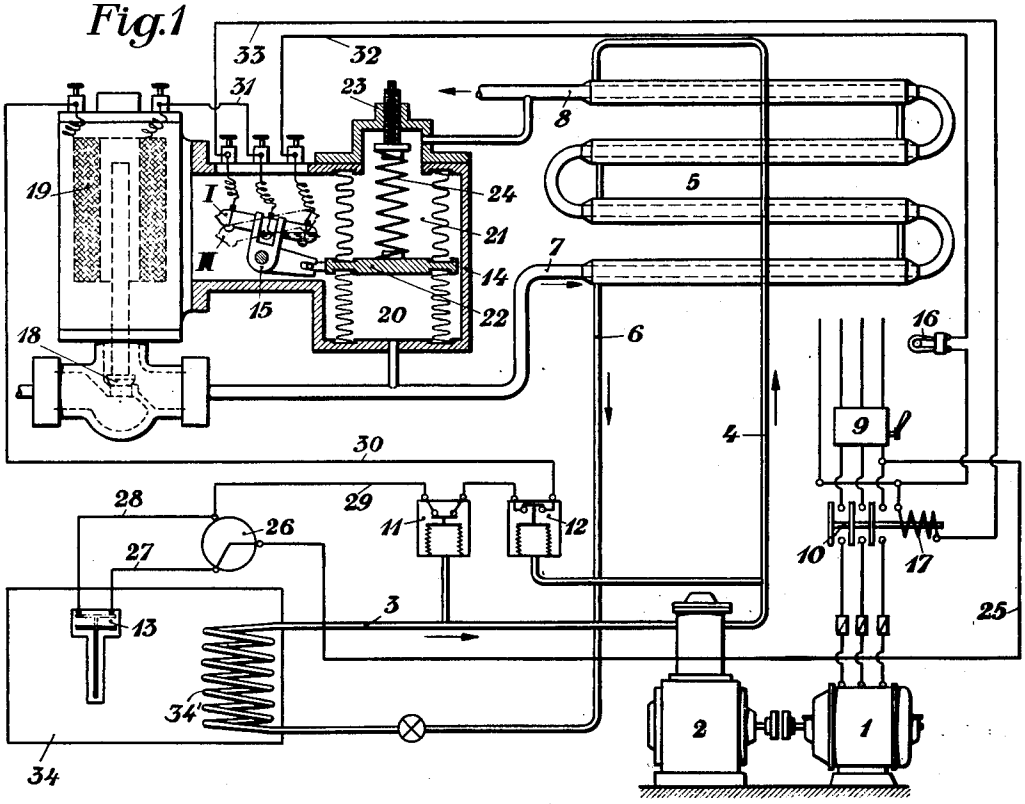
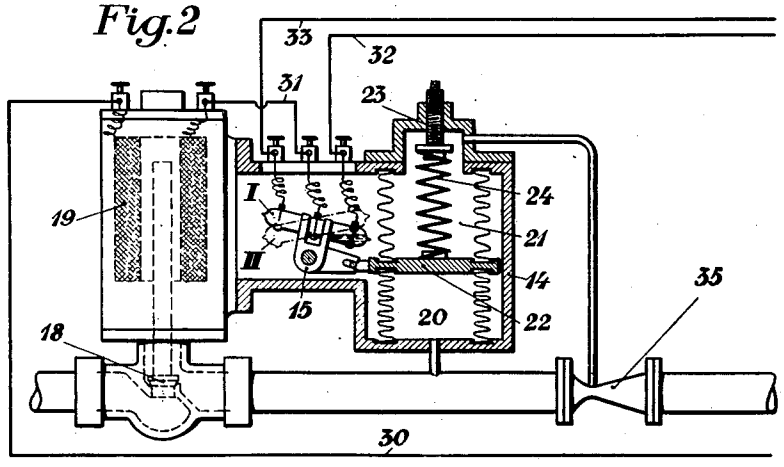


Fig.2



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REFRIGERATING PLANT

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5 Claims. (Cl. 62—4)

This invention relates to refrigerating plants of the kind including a compressor, evaporator and condenser.

Refrigerating plants are sometimes started and stopped by opening and closing a valve for regulating the cooling water supply to the condenser, means such for example as an auxiliary electrical circuit being closed at the same time as the valve is actuated, so that the compressor is started. When automatic operation is employed the cooling water regulating valve is sometimes actuated by a thermostat or pressostat. In arrangements of this type, however, if when the regulating valve has been opened, the supply of cooling water wholly or partly fails due, for example, to wrong manipulation or trouble in the water supply system, the pressure within the condenser will rise to such a high value that if a pressostat is employed the condenser pressure may be equal to or above the maximum pressure within the range of the pressostat, with the result that the motor driving the compressor will be stopped.

The transmission of heat to the surrounding air which takes place even when the supply of cooling water to the condenser has ceased tends to result in intermittent starting and stopping of the compressor and such intermittent operation is liable to cause injurious effects on the compressor without being accompanied by any appreciable cold production. If, with a view to preventing such intermittent operation, the pressostat is made non-reversible so that restarting the compressor has to be effected by hand, a stoppage in the case of a plant which is not continually supervised may continue even when the cooling water supply to the condenser has been resumed, with consequent risk of damage to goods which have to be cooled. The present invention has for its object to overcome the above difficulties.

To this end according to the present invention the machine for driving the compressor is controlled in accordance with the difference between the pressure at two points in the cooling water circuit of the condenser, whereby the compressor is operated when such pressure difference exists, or is stopped when such pressure difference ceases to exist, but the compressor cannot be started when such pressure difference does not exist.

Conveniently the machine for driving the compressor is controlled by a differentially operated regulating device actuated in accordance with the difference between the pressures at two points in the cooling circuit of the condenser. The differentially operated regulating device may be connected directly across the cooling water circuit with same unaltered or it may be connected to the cooling circuit of the condenser with one of the two points of connection being a Venturi throat arranged in the cooling circuit, and the other point being as before, i. e. a point of unrestricted cross-section.

The differentially operated regulating device may comprise two expansible chambers separated by an intermediate wall or plate with one chamber communicating with the condenser cooling circuit at a point adjacent to the high hydrostatic pressure or inlet part, whilst the other chamber communicates with the cooling circuit at a point nearer to the outlet or low hydrostatic pressure part, an adjustable loading spring acting on the intermediate wall in opposition to the pressure within that chamber which communicates with the high pressure part of the circuit.

In the accompanying drawing, Fig. 1 illustrates a construction according to the invention diagrammatically and by way of example.

Fig. 2 shows a modification in which a Venturi throat is inserted in the cooling medium circuit.

In the construction shown in Fig. 1, a motor 1 drives a compressor 2 which draws refrigerant from a suction pipe 3 and delivers it, after compression, through a delivery pipe 4 to a condenser 5. The refrigerant passes from the condenser 5 through a pipe 6 to the evaporator 34'. For cooling the refrigerant, cooling medium is supplied to the condenser 5 through a feed pipe 7, the cooling medium after passing through the condenser being discharged or returned to the cooling medium circuit through a discharge pipe 8.

The plant derives power from electric mains through a main switch 9, and a cut-out 10 is provided for automatically switching the motor 1 in and out of operation, the power supply to the motor being controlled as hereinafter described by two pressostats 11 and 12, a thermostat 13, and a differentially operated regulating device 14 adapted to control a tilting switch 15. The pressostat 11 operates in accordance with the pressure in the suction pipe 3 whilst the pressostat 12 operates in accordance with the pressure in the delivery pipe 4. The switch 15 is associated with a signal lamp 16 and a trip coil 17 for operating the cut-out 10, a valve 18 operated by a solenoid 19 being provided for con-

trolling the supply of cooling medium through the feed pipe 7.

The differentially operated regulating device 14 comprises two expansible chambers 20, 21, separated by a wall or plate 22 which is acted upon by a compression spring 24 the effective force of which can be adjusted by means of a stud 23, the plate 22 being operatively connected as shown through a bell-crank lever to the tilting switch 15. The chamber 20 communicates with the feed pipe 7 whilst the chamber 21 communicates with the discharge pipe 8. One conductor of the power supply is connected by a conductor 25 to a change-over switch 26 one terminal of which is connected through a conductor 27 to the thermostat 13 whose second terminal is connected by a conductor 28 to a third terminal on the changeover switch 26. A conductor 29 connects the last named terminal of the switch 26 to the pressostat 11 which is connected in series with the pressostat 12 whose second terminal is connected by a conductor 30 to the solenoid 19. The second terminal of the solenoid 19 is connected to one of the three terminals of the tilting switch 15, the other two terminals being connected by conductors 32 and 33 respectively through the signal lamp 16 and trip coil 17 to the neutral conductor of the power supply.

When the main switch 9 has been closed the plant will be rendered operative so that it will automatically start and stop as hereinafter described. When the temperature of the chamber 34 to be cooled (such, for example, as a cold storage chamber or brine bath) reaches the maximum permissible value the thermostat 13 will operate to connect the conductors 27 and 28 together. Under normal pressure conditions in the circuit of the refrigerant the pressostats 11 and 12 will maintain the connection between the conductors 29 and 30 so that the solenoid 19 will be energized and the valve 18 opened. When the tilting switch 15 is in the position I shown in full lines the central contact connected to the solenoid 19 through the conductor 31 will be connected to the righthand contact so that the electric circuit will be closed through the signal lamp 16.

With normal supply of cooling medium to the condenser however the pressure in the feed pipe 7 and chamber 20 will exceed the pressure in the chamber 21 whereby the plate 22 will be raised against the action of the spring 24 so that the switch 15 will be tilted from the position I to the position II, shown dotted. The central terminal of the switch 15 instead of being connected to the righthand contact will thus be connected to the left-hand contact. Current will now flow through the conductor 33 and trip coil 17 whereby the cut-out 10 will be closed and the motor 1 thus set in operation to cause the compressor to pump refrigerant to the condenser.

In the event of the cooling water supply failing in spite of the valve 18 having been opened the hydrostatic pressure in the chambers 20 and 21 will be equalized so that the tilting switch 15 will remain in the position I and the cut-out 10 will not be closed so that the motor 1 cannot be started. Further, the signal lamp 16 will remain illuminated and thereby indicate that the water supply is faulty.

If, during normal operation, the temperature within the cooling chamber 34 falls to the minimum permissible value the thermostat 13 will operate to break contact between the conductors 27 and 28, thereby deenergising the solenoid 19 and also the trip coil 17. The valve 18 will therefore close and the cut-out 10 will disconnect the motor 1 from the power supply. When the valve 18 has been closed the hydrostatic pressure within the pipes 7 and 8 and therefore in the chambers 20 and 21 will be equalized so that the spring 24 will move the plate 22 downwards thereby tilting the switch 15 into the position I shown in full lines.

Similarly, when the pressure in the suction pipe 3 falls exceptionally low due, for example, to this pipe becoming partially or wholly obstructed the pressostat 11 will open the electric circuit. Again, should the condenser pressure, i. e. the pressure in the delivery pipe 4, rise too high due, for example, to a closed valve the electric circuit will be opened by the pressostat 12. By turning the change-over switch 26 so that the conductor 25, instead of being connected to the conductor 27, is connected to the conductor 29 the thermostat 13 will be cut out of circuit and automatic starting and stopping of the motor 1 will take place under the control of the pressostats 11 and 12 and of the differentially operated regulating device 14.

Instead of connecting the differentially operated regulating device 14 across the cooling medium circuit of the condenser 5 as above described, according to Fig. 2, a Venturi throat 35 may be arranged in the cooling circuit and the differentially operated regulating device actuated in according with the difference between the pressure at the throat and the pressure at a point further forward in the direction of flow of the cooling medium. The chamber 21 communicates with the Venturi throat, whilst the chamber 20 communicates with the cooling circuit at a point therein further forward in the direction of flow of the cooling medium.

If desired, the tilting switch instead of having three contacts may be furnished with only two. The signal lamp 16 may then be connected directly to the solenoid 19 and a separate resistance inserted in series with the lamp. With this arrangement when the tilting switch 15 is in the position I shown in the drawing there would be no connection between the two contacts of the tilting switch, and when this switch is in the position II its contacts would be bridged so that the trip coil 17 would be energized, only a small current flowing through the signal lamp 16 so that this remains, in effect, inoperative.

It will be understood that instead of the differentially operated regulating device above described, any other suitable type of regulator may be employed. It will also be understood that the word "circuit", as used in the appended claims, includes not only a closed system through which the cooling water from the condenser circulates, but also a cooling water supply wherein the water, after passing through the condenser, is discharged to waste.

I claim:

1. In a refrigerating plant the combination with a motor, of a compressor driven by this motor, a condenser, an evaporator, a refrigerant circuit adapted to lead the refrigerant through the compressor, the condenser and the evaporator, a cooling medium circuit adapted to supply the cooling medium to the condenser, and means by which the motor for driving the compressor may be controlled in accordance with the

difference between the pressures at two points in said cooling medium circuit of the condenser.

2. In a refrigerating plant the combination with a motor, of a compressor driven by this motor, a condenser, an evaporator, a refrigerant circuit adapted to lead the refrigerant through the compressor, the condenser and the evaporator, a cooling medium circuit adapted to supply the cooling medium to the condenser, and a differentially operated regulating device by which the motor for driving the compressor may be controlled in accordance with the difference between the pressures at two points in said cooling medium circuit of the condenser.

3. In a refrigerating plant as claimed in claim 2, the use of a differentially operated regulating device connected across the cooling medium circuit of the condenser.

4. In a refrigerating plant as claimed in claim 2, the use of a differentially operated regulating device comprising two expansible chambers separated by an intermediate wall, with one chamber communicating with the condenser cooling circuit at a point adjacent to the high hydrostatic pressure or inlet part whilst the other chamber communicates with that cooling circuit at a point nearer to the outlet or low hydrostatic pressure part, an adjustable loading spring acting on the intermediate wall in opposition to the pressure within that chamber which communicates with the high pressure part of the circuit.

5. In a refrigerating plant as claimed in claim 2, the use of a differentially operated regulating device connected to a Venturi throat which is arranged in the cooling medium circuit of the condenser and also to said circuit at a point of relatively unrestricted cross section thereof.

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