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(71) Applicant: **CASTEL MAC S.p.A.**
Via del Lavoro, 9
I-31033 Castelfranco Veneto (Treviso)(IT)

(72) Inventor: **Portelli, Paolo**
Via D'Acquisto 7
I-31021 Mogliano Veneto (Treviso)(IT)

(74) Representative: **Mittler, Enrico et al**
c/o Marchi & Mittler s.r.l. Viale Lombardia, 20
I-20131 Milano(IT)

(54) Electronic device for controlling condensation in a refrigerating circuit of an ice-making machine.

(57) The device comprises a probe (7) suitable for taking the temperature of the condenser (2, 3) and an electronic control circuit (6) that receives from the probe (7) a signal related to the temperature of the condenser (2, 3) and when a given temperature level is reached it operates a cooling device (4, 5) and stops it when the temperature falls below a given minimum level. It also stops the machine until normal operating conditions are restored when the temperature exceeds a given maximum emergency value.

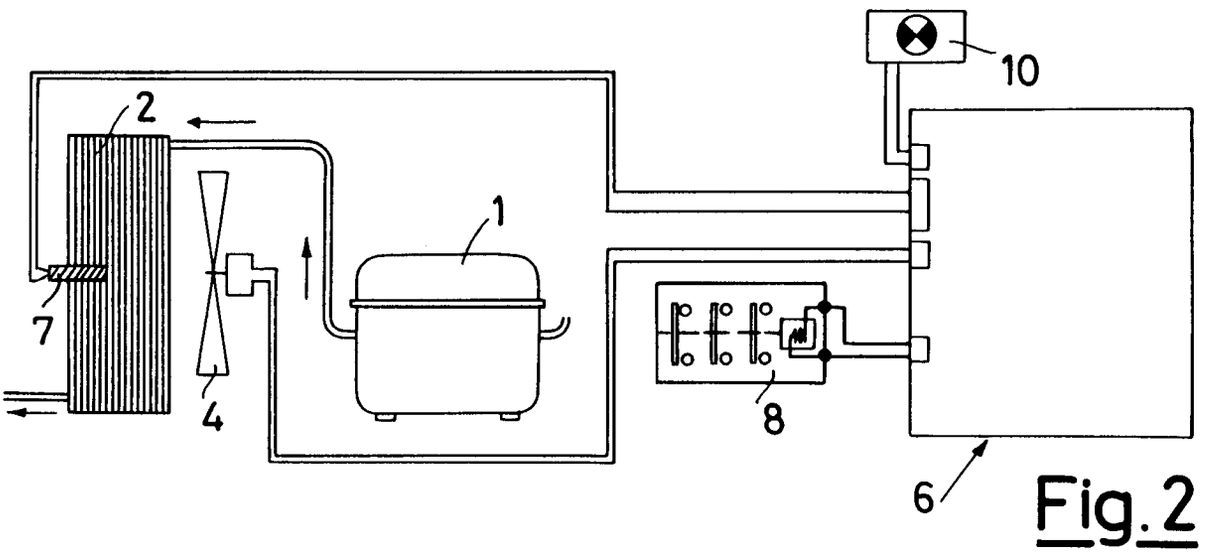

Fig.2

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The present invention relates to an electronic device for controlling condensation in a refrigerating circuit of an ice-making machine.

According to the known art a machine for making ice chips comprises essentially a freezing chamber supplied with water from a hydraulic circuit and a refrigerating circuit formed by a compressor for the compression of a fluid in the gaseous state (generally a chloro-fluoro carbide), an air- or water-circulation condenser where the fluid pumped by the compressor is cooled until it liquefies, a lamination member (valve capillary) for supplying the liquid and an evaporator where its expansion takes place with the withdrawal of heat from the external environment. The refrigerating circuit's evaporator is associated with the freezing chamber for transforming into ice the water present in it. A screw rotating inside the chamber conveys the ice as it is formed toward a delivery mouth in the proximity of a container for collecting the ice.

During the operation of the machine it is important that the temperature of the condenser, and thus the pressure inside it, be maintained within a given range of values and in any case below a maximum value (emergency value).

Such control, according to the known art is carried out through a pair of moving mechanical members such as servo pressure switches. The use of such control systems involves re-starting the machine as soon as normal pressure conditions have been restored in the condenser without waiting for a length of time sufficient for the compressor to cool down.

The object of the present invention is to overcome the mentioned drawbacks with a device for controlling condensation wherein the detection of the temperature and thus of the pressure is made with a static member and the machine is re-started after a time interval such as to allow the restoration of normal operating conditions of all the refrigerating circuit's components.

According to the invention such object is attained with an electronic device for controlling condensation in a refrigerating circuit of an ice-making machine, characterized in that it comprises a probe suitable for taking the temperature of the condenser and an electronic control circuit that receives from said probe a signal related to the temperature of the condenser and causes the operation and stoppage of a device for cooling the condenser and so as to maintain the temperature of the same within a given range of values, as well as to cause the machine to stop if a maximum emergency temperature is exceeded and until normal temperature conditions have been restored.

In this way, in addition to maintaining the correct condensation value, it is possible to stop the machine and to avoid that its operation with the condenser at high temperature should jeopardize the life of the machine itself.

The use of the electronic circuit also allows the machine to be re-started with a given delay after normal temperature conditions have been restored so as to allow the compressor to cool down.

The features of the present invention shall be made more evident by an embodiment illustrated as a non-limiting example in the enclosed drawings, wherein:

Fig. 1 shows a diagrammatic view of an ice-making machine;

Fig. 2 shows the principle diagramme of a device for controlling condensation with an air-cooling device;

Fig. 3 shows the principle diagramme of a device for controlling condensation with a water-cooling device;

Fig. 4 is a functional block diagramme of the electronic control circuit included in the devices illustrated in Fig.s 2 and 3.

With reference to Fig. 1, there is shown a machine for making ice chips that comprises a freezing chamber 21 supplied with water from a hydraulic circuit 22, an evaporator 23 of a refrigerating circuit 27 associated with the chamber 21 for cooling and consequently transforming into ice the water in the chamber 21, a motorized screw 24 made to rotate inside the chamber 21 for conveying the ice as it is formed toward a delivery mouth 25 in the proximity of a container for collecting the ice, not shown, and a motorization unit 26 of the screw 25.

As illustrated in Fig. 2, in addition to the evaporator 23, the refrigerating circuit 27 comprises a compressor 1 for the compression of a fluid in the gaseous state such as, say, a chloro-fluoro carbide, an air-cooled condenser 2 where the fluid pumped by the compressor 1 is cooled until it liquefies, a device for cooling the condenser 2, such as a fan 4, a lamination member 36 (Fig. 1) for the passage of the fluid to the evaporator 23.

With the condenser 2 there is associated a temperature control probe 7, in turn connected to an electronic circuit 6 for controlling the condensation temperature.

There is also a power unit 8 which drives the different operational members of the machine.

With reference to Fig. 4, the electronic control circuit 6 comprises a comparator 9 across an input of which there is applied a temperature signal from the probe 7, that is compared with a reference voltage present across its other input.

In cascade to the comparator 9 there is a microprocessor 12, which comprises an input register 13 for the temporary storage of the values at the output from the comparator 9, a RAM memory 15 in which the digital values from the register 13

are stored, an EPROM memory 16 in which the program data indicative of the emergency temperature inside the condenser have previously been stored, a central processing unit 14 suitable for operating the comparison between the digital values in the RAM memory 15 and in the EPROM 16, an output register 17 for storing the result of the comparison made by the unit 14. Inside the microprocessor 12 there is also a timer 33 which has the object of delaying by a pre-determined length of time the re-activation of the machine when the correct temperature conditions inside the condenser 2 have been restored. To the output from the microprocessor 14 there are connected an optical signal unit 10 and a power circuit 18 suitable for operating the machine's power unit 8. To the output of the comparator 9 there is also connected a power circuit 19 of the cooling device, in particular of the fan 4, illustrated in Fig. 2.

As illustrated in Fig. 3, in a water-cooling cycle the cooling device can be a hydraulic circuit controlled by a solenoid valve 5 suitable for supplying water through the condenser 3.

With reference to the drawings, the operation of the device according to the present invention is as follows.

The hydraulic circuit 22 supplies water to the freezing chamber 21 for its transformation into ice thanks to the evaporator 23. The screw 24, made to rotate by the motorization unit 26, pushes the ice as it is formed towards the delivery mouth 25. From the delivery mouth 25 the ice is moved through the conduit 28 into a collection container, not shown.

As long as the temperature taken by the probe 7 inside the condenser 2 is below a maximum emergency level, the signal received by the comparator 9 passes to the microprocessor 12 and is introduced into the input register 13 to be than made to pass into the RAM 15 to be compared by the processing unit 14 with the program dara previously stored in the EPROM 16. The result of the comparison is stored in the output register 17 and in such case it is an enabling signal for the machine's operation, transmitted to it through the power circuits 18, 8.

As soon as the temperature taken by the probe reaches a given pre-set level, the signal through the comparator 9 causes through the power circuit 19 the activation of the cooling device 4, 5. In the case of an air-cooled device this is translated into the operation of the fan 4 located in the proximity of the condenser 2, in the case of a water-cooled device in the opening of the solenoid valve 5 for supplying cooling water to the condenser itself.

Should the temperature taken by the probe 7 in the condenser 2 rise above a maximum emergency value, the signal transmitted to the comparator 9 causes through the microprocessor 12, and thus through the power unit 18 and the power circuit 8, the stoppage of the machine, as well as the switching on of the luminous device 10.

Le us now suppose that the signal taken by the probe 7 falls again below the maximum level. Such signal, after its passage through and appropriate comparison in the comparator 9, passes in the microprocessor 12, in the input register 13 and in the RAM 15. The result of the comparison with the program data stored in the EPROM 16 generates a signal that activates the timer 33 which, after a given length of time, causes the machine to restart.

Claims

1. Electronic device for controlling condensation in a refrigerating circuit of an ice-making machine, characterized in that it comprises a probe (7) suitable for taking the temperature of the condenser (2, 3) and an electronic control circuit (6) that receives from said probe (7) a signal related to the temperature of the condenser (2, 3) and causes the operation and stoppage of a device (4, 5) for cooling the condenser (2, 3) and so as to maintain the temperature of the same within a given range of values, as well as to cause the machine to stop if a maximum emergency temperature is exceeded and until normal temperature conditions have been restored.

2. Device according to claim 1, characterised in that said cooling device is a fan (4).

3. Device according to claim 1, characterised in that said cooling device is a hydraulic circuit controlled by a solenoid valve (5).

4. Device according to claim 1, characterised in that said electronic control circuit (6) comprises a comparator (9) across an input of which there is applied a temperature signal from the probe (7), that is compared with a reference voltage present across its other input.

5. Device according to claim 4, characterised in that in cascade to the comparator (9) there is a microprocessor (12) suitable for checking the condition corresponding to the emergency temperature in the condenser (2, 3) having been exceeded and to drive power circuits (8, 18) for stopping the machine's operation.

6. Device according to claim 5, characterised in that the microprocessor (12) comprises an in-

put register (13) for the temporary storage of the digital signals at the output from the comparator (9), RAM (15) and EPROM (16) memories for storing said digital and program data signals, respectively, related to the temperature of the condenser (2, 3), a processing unit (14) suitable for making the comparison between said digital signals and said program data and an output register (17) for storing the result of said comparison.

7. Device according to claim 5, characterised in that said microprocessor (12) is provided with a timer (33) which can be activated when the temperature inside the condenser (2, 3) falls below said emergency temperature and suitable for operating after a set time the reactivation of the machine's operation.

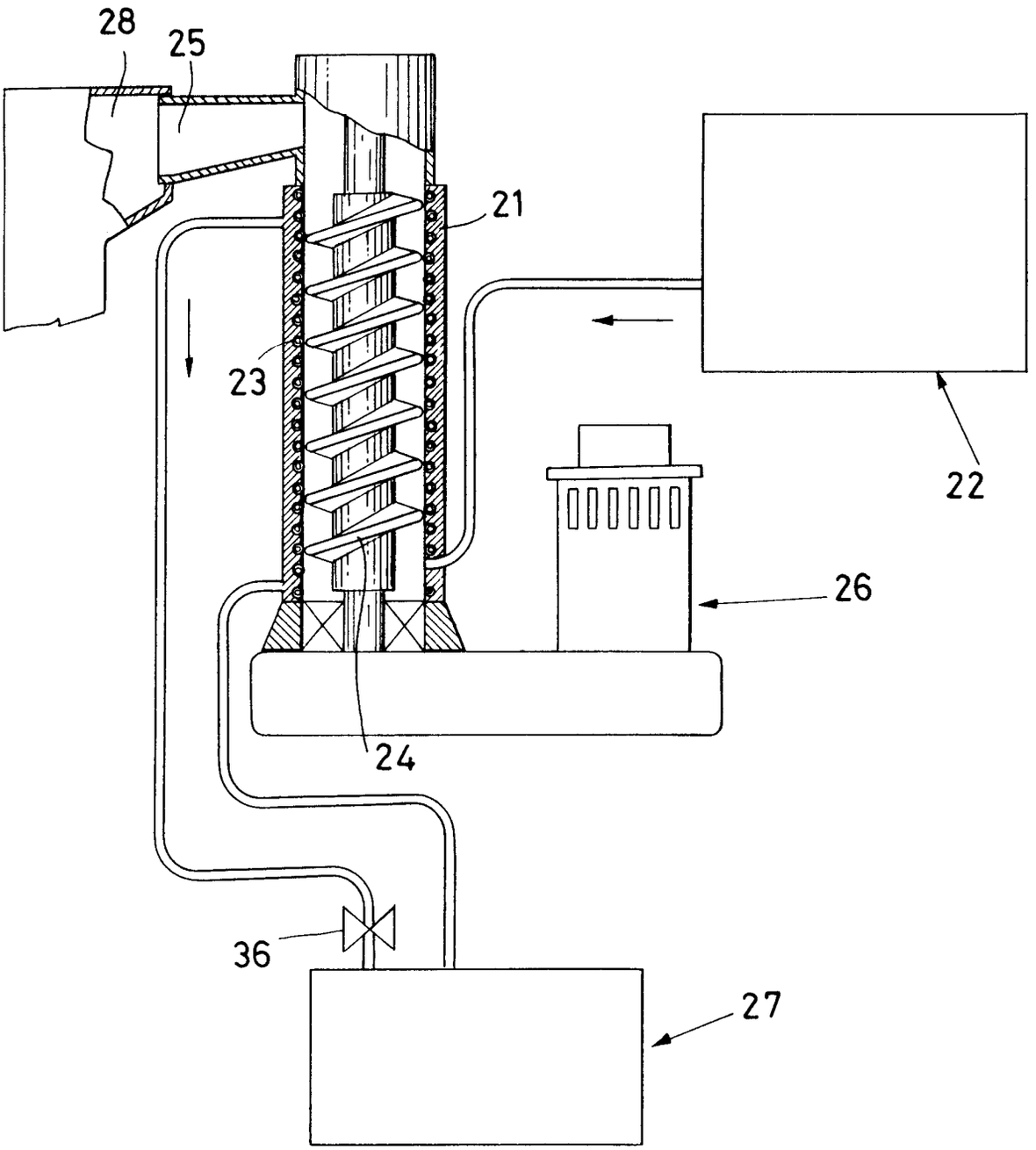

Fig.1

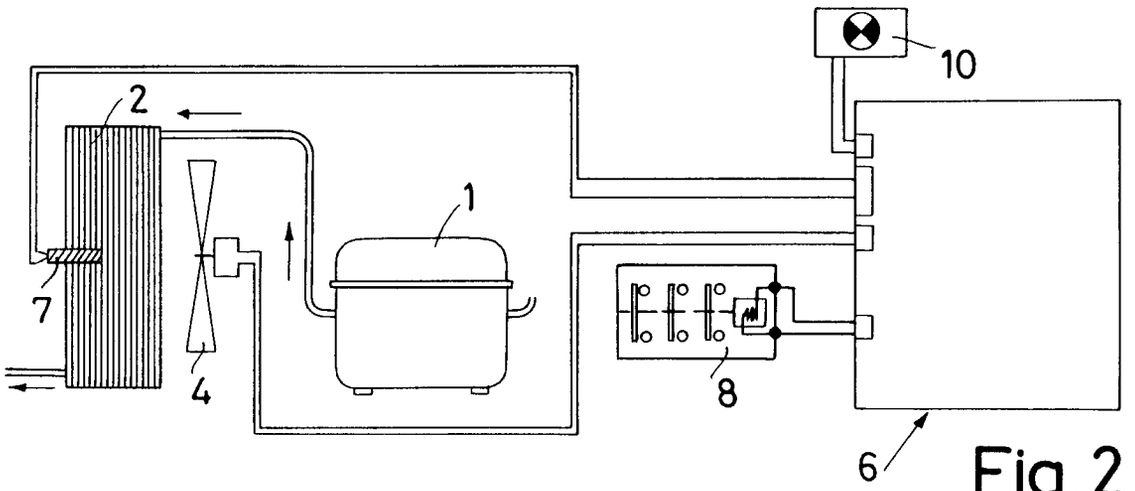

Fig.2

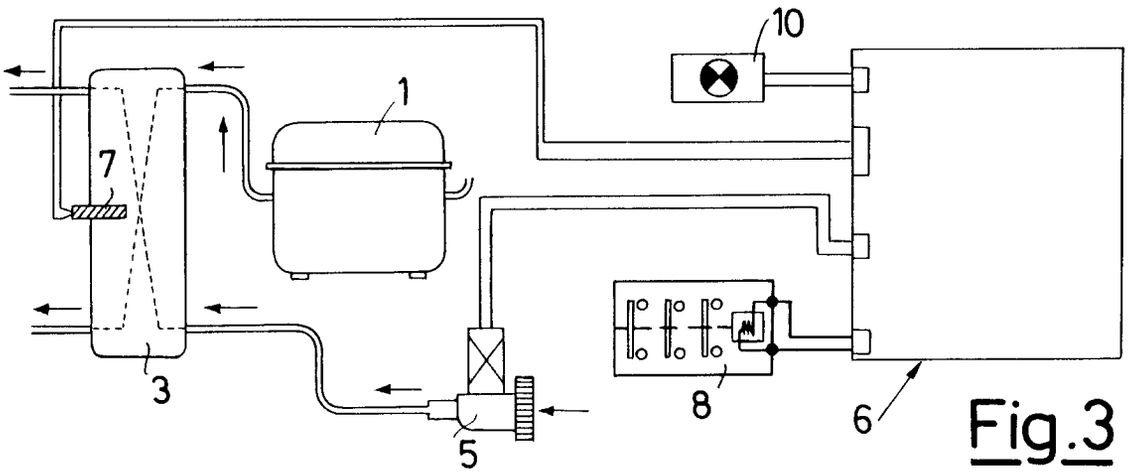

Fig.3

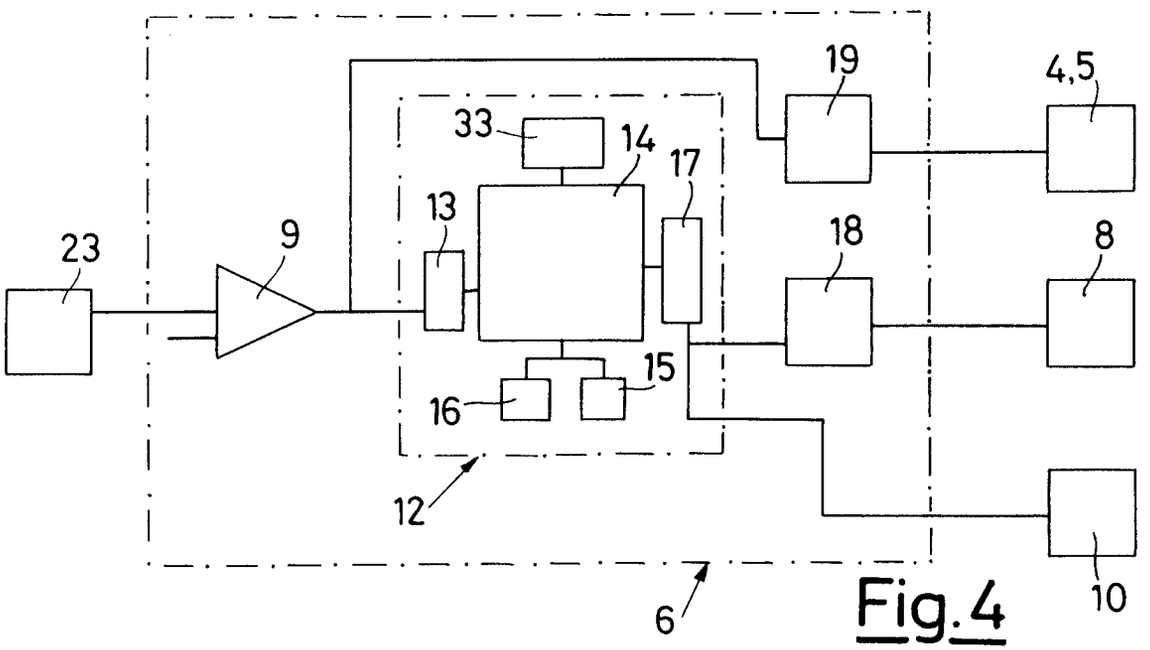

Fig.4

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EUROPEAN SEARCH REPORT

Application Number

EP 91 20 2185

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
Y	US-A-4 498 308 (PHILLIPS)	1,2	F25B49/02
A	* column 3, line 22 - column 6, line 49; figures 1-3 *	4	// F25C1/14
Y	DE-A-1 912 613 (SÜDDEUTSCHE KÜHLERFABRIK JULIUS FR. BEHR) * page 3, paragraph 2 - page 5, paragraph 2; figure 1 *	1,2	
A	US-A-3 366 167 (DAPPER) * column 2, line 40 - column 5, line 17; figures 1-3 *	1,2	
A	US-A-3 415 071 (KOMPELIEN) * column 2, line 3 - column 5, line 59; figures 1-2 *	1,2	
A	US-A-4 075 865 (WILLS) * column 2, line 37 - column 7, line 32; figure 1 *	1,2	
A	US-A-2 688 849 (ANDREWS) * column 1, line 30 - column 3, line 8; figure 1 *	1,3	TECHNICAL FIELDS SEARCHED (Int. Cl.5)
A	US-A-2 318 891 (SIDELL) * page 2, left column, line 38 - page 6, left column, line 62; figures 1-16 *	1,3	F25B F25C
A	US-A-4 944 160 (MALONE)		
A	US-A-4 325 223 (CANTLEY)		
A	US-A-4 193 781 (VOGEL)		

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	20 DECEMBER 1991	BOETS A.F.J.

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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