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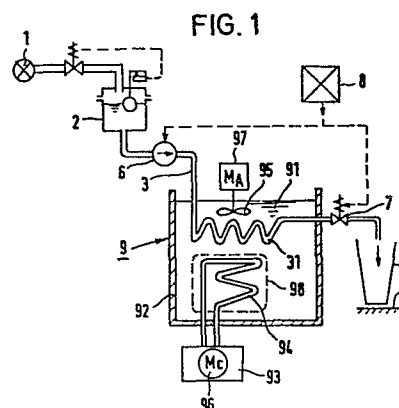
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Water-cooled heat-accumulating type drink cooling system.

In a water-cooled heat-accumulating type drink cooling system having a water tank (92) filled with water (91) and provided with a cooler (94) and a drink cooling coil (31) immersed in the water and an electric water agitator (95, 97) for cooling a drink flowing through said drink cooling coil (31), an agitator stopping means is provided, which stops said agitator (95, 97), when the temperature of the water (91) in said water tank (92) is decreased to a level in the neighbourhood of its freezing point. Hereby freezing of the drink within the drink cooling coil (31) may be prevented (Figure 1).



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Water-cooled heat-accumulating type drink cooling system

- This invention relates to a water-cooled heat-accumulating
- 5 type drink cooling system according to the first portion
of claim 1, as it is used in cup-type automatic vending ma-
chines for refreshing drinks and dispensers for cold water
or refreshing drinks.
- 10 There is a known water-cooled heat-accumulating type drink
cooling system of this kind, which has a cooling water tank
filled with water and provided in the water therein with a
cooler consisting of an evaporator for a refrigerator, a
15 drink cooling coil formed at an intermediate portion of a
drink supply pipe-line, and an electric water agitator, and
which is adapted to cool a drink flowing in the drink cooling
coil by operating the refrigerator with the water in the
tank, which serves as a heat transfer medium, stirred by the
electric agitator. In order to minimize the capacity of the
20 refrigerator used in this drink cooling system, a layer of
ice, which is a so-called ice bank is kept formed at all
times around the cooler disposed in the water tank. Accor-

- 2 -

1 dingly, even when the operation of the refrigerator is interrupted, the cooling water in the tank can be maintained at a low temperature owing to the heat accumulated in the ice bank. Such a method of momentarily increasing the drink
5 cooling capacity is widely utilized.

Fig. 1 is a schematic diagram of such a water-cooled heat-accumulating type drink cooling system as described above. Referring to Fig. 1, reference numeral 1 denotes a drinking
10 water source, such as city water, 2 a drinking water reservoir, 3 a drinking water supply pipe -line extended from the reservoir 2 and opened to a cup 5 placed on a vending stage 4, 6 a drinking water feed pump, 7 a drinking water supply valve provided at that portion of the pipe-line 3
15 which is close to a terminal end thereof, and 8 a drinking water supply control circuit. A drinking water cooling unit 9 consists of a cooling water tank 92 filled with water 91, a cooler 94 composed of an evaporator, which is disposed in the water in the tank 92, of a refrigerator 93, a
20 water agitator 95, and a drinking water cooling coil 31 formed at an intermediate portion of the pipe-line 3 and immersed in the water in the tank 92 in such a manner that the coil 31 is spaced from the cooler 94. Reference numeral 96 denotes a compressor motor of the refrigerator 93,
25 97 a drive motor for the agitator 95, and 98 an ice bank formed around the cooler 94. The drinking water is stored in the reservoir 2 at all times. When a drinking water supply signal is given, the supply valve 7 is opened, and the pump 6 is operated at the same time to allow the drink-
30 ing water cooled in the cooling coil 31 to be fed into the cup 5.

An operation control circuit for the compressor motor 96 and the drive motor 97 in the conventional drink cooling
35 system is shown in Fig. 2. Referring to Fig. 2, reference symbol TS_1 denotes a contact of a compressor control ther-

1 mostat connected in series to the compressor motor 96. A
temperature-sensitive portion of the contact TS_1 is provided
such that it is spaced from the cooler 94. When a layer
of ice formed around the cooler has grown into an ice bank
5 98 of a predetermined thickness, the temperature-sensitive
portion of the contact TS_1 is covered therewith, so that
the temperature of the ice is sensed by the temperature-
sensitive portion of the contact TS_1 . As a result, the con-
trol contact is opened to cause the compressor motor 96
10 to be stopped. When the ice bank 98 is melted with the
thickness thereof being decreased to a predetermined level,
the control contact is closed to allow the compressor mo-
tor 96 to be actuated again, so that the operation of the
refrigerator 93 is resumed. The above-mentioned thermostat
15 used as an operation control means for the compressor mo-
tor may be substituted by an electrode type ice sensor. In
the meantime, the drive motor 97 for the agitator is ope-
rated continuously while the drink cooling system is in
operation, for the purpose of improving a total heat trans-
20 fer coefficient. Accordingly, the water 91 in the tank 92
continues to be agitated.

When a drink supply instruction is given in this drink
cooling system operated in accordance with the above-de-
25 scribed conventional method, it often happens that the
drink does not flow out into the cup even if the pump 6
and supply valve 7 are operated normally. The results of
an investigation of the cause of this trouble show that
the flow of drink is blocked by small pieces of ice ga-
30 thered in narrow portions of the drink supply pipe-line 3
and inner portions of the supply valve 7. Further investi-
gations were conducted to clear up the cause of the occur-
rence of small pieces of ice on the assumption that the
drink is over-cooled and partly freezed for certain rea-
35 sons in the drink cooling coil 31 during a drink cooling
step. After all, it was discovered that the causes of the

1 occurrence of small pieces of ice reside in the following.

A time chart for an operation of the drink cooling system having the conventional circuit shown in Fig. 2 is shown
5 in Fig. 3. Temperature characteristic curves a, b in the drawing represent the temperature of the water in the tank 92 and the temperature of the surface of the cooler 94, respectively. As is clear from the temperature characteristic curve a, the water is once over-cooled to a negative temperature $T_0^{\circ}\text{C}$, which is lower than 0°C , i.e. a freezing point
10 of water, during an initial stage of the formation of ice bank on the surface of the cooler 94. In order to allow ice to be formed on the surface of the cooler 94, it is necessary in general that the water around the surface of the
15 cooler 94 be once over-cooled to a temperature below 0°C . At the moment ice is formed after the temperature of the water has been decreased to below 0°C , the temperature of the water becomes 0°C . Once a layer of ice is formed on the surface of the cooler, it then grows continuously in
20 the outward direction. Consequently, only the temperature of the surface of the cooler, which is covered with a layer of ice, is maintained at a low level due to the continuous operation of the refrigerator, and an over-cooling phenomenon does not occur in that part of the water in the
25 tank which is away from the surface of the cooler.

In a case where the agitator 95 is continuously operated as mentioned above to stir the water 91 in the tank 94 during the transition period in which ice begins to be formed
30 on the surface of the cooler 94, the temperature of the water in every part of the interior of the tank becomes substantially equal to that of the cooler 94. As a result, an over-cooling phenomenon occurs during an initial stage of formation of ice not only in the water 91 around the cooler
35 94 but also in the water 91 in the remaining portion of the interior of the tank 94. The over-cooling temperature $T_0^{\circ}\text{C}$

1 in such a case is approximately -0.5°C to -2.0°C , though
it varies depending upon the construction of the water tank,
the capacity of the refrigerator and the operational condi-
tion of the agitator. Accordingly, when such an over-cooling
5 phenomenon occurs with no drink supply instruction given, the
drink staying in the cooling coil 31, which is disposed in
a position sufficiently away from the cooler 94, is also
over-cooled to a temperature below a freezing point there-
of via the water 91, as a heat transfer medium, so that
10 small pieces of ice are formed in the cooling coil. When a
drink supply instruction is given at such time that small
pieces of ice occur in the cooling coil 31, the pieces of
ice flow with the drinking water in the pipe-line 3 to be
gathered in narrow portions thereof, for example, an inner
15 portion of the supply valve 7. As a result, the flow of
drinking water is blocked or the drinking water is not
supplied normally.

Since a drink feed rate in an automatic vending machine in
20 particular is set by controlling the opening time of the
supply valve 7, such a trouble as mentioned above would re-
sult in a sales trouble. The above description is referred
to the cooling and supplying of drinking water. When syrup
or other kinds of drinks are cooled and supplied, a simi-
25 lar over-cooling problem would occur.

The invention as claimed is intended to remedy these draw-
backs. It solves the problem of how to prevent a drink in
the cooling coil in the above-described drink cooling
30 system from being over-cooled during the formation of an
ice bank, and thereby to prevent small pieces of ice from
being formed in the cooling coil.

This problem is solved by the features of the characteri-
35 zing clause of claim 1.

In a drink cooling system described above, an agitator

1 stopping means is provided adapted to sense a decrease in
the temperature of the water in the tank to a level in the
neighbourhood of its freezing point during a step of cooling
the water for the purpose of forming a layer of ice on the
5 surface of the cooler by operating the cooler and agitator,
and stop at once the agitator which has been in operation,
which agitator stopping means consists of, for example, a
thermostat which has a control contact inserted in a drive
motor circuit for the agitator and which is adapted to open
10 the contact and stop the agitator at once when the tempera-
ture of the water in the tank has been decreased to a level
higher than and in the neighbourhood of its freezing point.

The advantages offered by the invention are that the opera-
15 tion of the agitator for use in stirring the water in the
tank is stopped when the temperature of the water is in
the neighbourhood of 0°C in an initial stage of formation
of a layer of ice around the cooler of the refrigerator.
Consequently, an over-cooling phenomenon occurs only in
20 an extremely limited, small space around the cooler, and
that portion of the water in the tank which is around
the drink cooling coil is not over-cooled to a temperature
below 0°C. As a result, no small ice pieces are formed in
the drink cooling coil. Therefore, the drink cooling system
25 according to the present invention is free from the drink
supply trouble encountered in a conventional drink cooling
system of this kind, and permits supplying a drink smooth-
ly.

30 Embodiments of the present invention will be described with
reference to the accompanying drawings.

Fig. 1 is a schematic diagram of a water-cooled heat-accu-
mulating drink cooling system;

35

Fig. 2 is a diagram of an operation control circuit in a

1 conventional drink cooling system of this kind;

Fig. 3 is a time chart of a cooling operation conducted by the operation control circuit shown in Fig. 2;

5

Fig. 4 is a diagram of an operation control circuit in a basic embodiment of the present invention;

Fig. 5 is a time chart of a cooling operation conducted by
10 the operation control circuit shown in Fig. 4;

Fig. 6 is a diagram of an operation control circuit in a first further embodiment of the present invention;

15 Fig. 7 illustrates the arrangement and principle of operations of thermostats used in the operation control circuit shown in Fig. 6;

Fig. 8 is a diagram of an operation control circuit in a
20 second further embodiment of the present invention;

Fig. 9 illustrates the construction and principle of operation of an electrode type sensor used in the operation control circuit shown in Fig. 8; and
25

Fig. 10 is a time chart of cooling operations conducted by the operation control circuits shown in Figs. 6 and 8.

30 Fig. 4 shows a basic operation control circuit of a system according to the present invention. In this operation control circuit as compared with the operation control circuit shown in Fig. 2, a contact TS_2 of an agitator stopping thermostat is inserted in a power source circuit for the drive
35 motor 97 for the agitator. A temperature-sensitive portion $S(TS_2)$ of the contact TS_2 for the thermostat is provided

- 1 such that it is sufficiently spaced from the cooler 94. The
thermostat is adapted to sense a decrease in the tempera-
ture of the water in the tank 91 to a positive level T_2 ,
which is in the neighbourhood of its freezing point of 0°C ,
5 during a step of cooling the water by operating the cooler
as shown in a time chart of operation thereof shown in
Fig. 5. When this temperature level T_2 is reached, the con-
tact TS_2 is opened at once.
- 10 When during a step of cooling the water 91 by operating the
cooler 94 for the purpose of forming an ice bank 98 on the
surface of the cooler, with the agitator also in an operated
state, the temperature of the water 91 in the tank 92 in the
drink cooling system provided with the above-described agi-
15 tator stopping means has decreased to the level $T_2^{\circ}\text{C}$, this
temperature is sensed by the temperature-sensitive portion
 $\text{S}(\text{TS}_2)$ of the contact TS_2 of the thermostat. As a result,
the contact TS_2 is opened and the drive motor 97 for the
agitator is stopped. When the motor 97 is stopped, the wa-
20 ter 91 stops being agitated, to become calm. Consequently,
an over-cooling phenomenon occurs only in a limited por-
tion of the water 91, i.e. that portion of the water 91
which is around the cooler 94. In fact, an over-cooling
phenomenon does not extend to the circumferential area of
25 the drink cooling coil 31, which is disposed in a position
away from the cooler 94, so that small pieces of ice do
not occur in the drinking water in the cooling coil. The
temperature characteristics of the water in this tank is
as shown in a curve a' in Fig. 5, whereas curve b' shows
30 the temperature characteristic of the surface of the cooler
94.

Another embodiment of the present invention constructed on
the basis of the basic circuit mentioned above will be
35 described.

1 An operation control circuit of this embodiment, which employs a thermostat as an ice formation sensor, is shown in Fig. 6. The circuit shown in Fig. 6 is provided, in addition to the contact TS_2 of the agitator stopping thermostat referred to in the previous description of the basic
5 circuit shown in Fig. 4, with a b contact TS_1' of the above-mentioned compressor motor control thermostat, a control contact TS_3 of an agitator re-starting thermostat and a control contact X of a relay RV which is operated in accordance with a drink supply instruction. These four control
10 contacts are connected together in parallel to form an OR-circuit, which is inserted in an agitator motor circuit.

Temperature-sensitive portions $S(TS_1)$, $S(TS_2)$, $S(TS_3)$ of
15 the contacts TS_1 , TS_2 , TS_3 of the above-mentioned thermostats are provided in alignment with one another with respect to the cooler 94.

In Fig. 7, in which the abscissa is taken in the direction
20 of the thickness of ice, and in which the ordinate is taken in the direction of negative temperature, characteristic curves designated by symbols c-g represent the distributions of temperature of the inner portion of a layer of ice. The solid curves c, d, e represent the distributions of temperature in the inner portion of a layer of ice with respect to
25 its thicknesses I, II, III formed around the cooler 94 with the refrigerator in operation. The broken curves f, g represent the distributions of temperature of the inner portion of the layer of ice with respect to its thicknesses II, III
30 formed around the cooler 94 with the refrigerator not in operation.

When a layer of ice of a small thickness is formed on the surface of the cooler 94 in a step of cooling the water in
35 the tank 92 to form an ice bank, the temperature of the surface of the cooler 94 is rapidly decreased to a negative

1 temperature T_3 , which is sensed by the temperature-sensitive
portion $S(TS_3)$, which is in contact with the surface of the
cooler 94, of the contact TS_3 of the agitator re-starting
thermostat. As a result, the control contact is closed to
5 allow the agitator 95, the operation of which has been
stopped by the contact TS_2 , to be started again. Since an
over-cooling phenomenon does not occur in the tank 92 for
the reasons previously given, after a layer of ice has once
formed around the cooler 94, the heat exchange efficiency
10 of the cooling water and drink cooling coil, i.e. the drink
cooling capacity of the drink cooling system can be in-
creased by re-starting the agitator 95 in the mentioned
manner. The thermostat contact TS_3 is adapted to be re-
opened at the temperature T_3' which is substantially equal
15 to 0°C . The difference between the temperatures T_3 , T_3'
constitutes a differential of the thermostat.

When the layer of ice formed on the surface of the cooler
94 has grown by a continuous operation of the cooler 94,
20 to attain a predetermined thickness III, an ambient tempe-
rature of the temperature-sensitive portion $S(TS_1)$ of the
thermostat contact TS_1 is decreased to T_1 . The thermostat
contact TS_1 sensing this temperature is actuated to stop
the compressor motor 96 and close the control contact TS_1'
25 of the motor circuit for the agitator (refer to Fig. 6).
When the ice is then gradually melted with its thickness
decreased to the level II, an ambient temperature T_1' is
sensed by the temperature-sensitive portion of the ther-
mostat TS_1 , so that the contact thereof is shifted to
30 allow the compressor motor 9 to be operated again.

In short, the operation of the freezer or refrigerator is
controlled by the thermostat contact TS_1 in such a manner
that the thickness of ice can be maintained between the le-
35 vels II, III unless the drink is supplied continuously to
cause great variations in load. When the compressor motor

1 96 is stopped, the refrigerant ceases to flow in the cooler
94, so that the temperature of the outer surface thereof
is increased to substantially 0°C.

5 The role of the relay contact X will now be described.

The relay RV is adapted to receive a drink supply instruc-
tion and close its control contact X. When the contact X
has thus been closed, the agitator 95 is operated. The
10 operation of the contact X is not restricted by the opera-
tional conditions for the other thermostats. In other words,
when a drink supply instruction is given even in a case
where the temperature of the cooling water is decreased to
a level in the neighbourhood of 0°C during the formation
15 of ice to cause the agitator to be stopped by the agitator
stopping thermostat contact TS₂, the agitator is operated
immediately in preference to the operation of the thermo-
stat contact TS₂. Even when an over-cooling phenomenon oc-
curs in the whole of the interior of the water tank by the
20 operation of the agitator, small pieces of ice are not
formed in the drink cooling coil 31 as long as a drink flows
in the drink supply pipe-line 3. The operation of the agi-
tator 95 even serves to improve the effect of heat exchange
between the drink cooling coil 31 and cooling water to al-
25 low the drink to be cooled in an excellent manner.

Fig. 10 is a time chart of an operation of the operation
control circuit shown in Fig. 6, which chart has been pre-
pared on the basis of the actions thereof described above.

30

As is clear from Fig. 10, when the temperature of the cool-
ing water has been decreased to a level in the neighbour-
hood of 0°C in an initial stage of formation of a layer of
ice on the surface of the cooler, the operation of the agi-
35 tator is stopped to prevent that portion of the water in
the tank which is around the drink cooling coil from being

1 over-cooled. Consequently, the drinking water is not over-
cooled as may be noted from the temperature characteristic
curve a' of the cooling water, so that small pieces of ice
can be prevented from being formed in the drink cooling
5 coil. Since the water in the tank is stirred by the agita-
tor to such an extent that an over-cooling phenomenon does
not occur in the whole of the interior of the tank, and in
a drink supply period during which the drinking water flows
in the drink cooling coil, a high total heat transfer coef-
10 ficient can be obtained, and also a high drink cooling ca-
pacity can be maintained.

Another embodiment of the present invention employing an
electrode type ice sensor as an ice formation detecting
15 means will be described with reference to Figs. 8 and 9.

Control contacts S_1 , S_2 shown in Fig. 8 play the same roles
as the control contacts designated by symbols TS_1 , TS_3 in
Fig. 6. The control contacts S_1 , S_2 are opened and closed by
20 an output signal from an electrode type ice sensor 10. The
ice sensor 10 consists of five electrodes designated by
symbols A-E and arranged on one side of the cooler 94 in
such a manner as shown in Fig. 9, and a detector circuit 12.
The electrodes A, B are reference electrodes constantly po-
25 sitioned in the water in the tank, and the electrodes C, D,
E are ice sensor electrodes disposed in positions corre-
sponding to the thicknesses III, II, I, respectively, of
ice to be formed. On the other hand, the detector circuit
12 consists of, for example, a bridge circuit for use in
30 comparing the resistance between the electrodes A-B and the
resistances between the electrodes A-C, A-D, A-E. The de-
tector circuit 12 is adapted to output a signal on the ba-
sis of the difference between the resistances measured
and compared in the above-mentioned manner.

35

The operation of the ice sensor 10 will be described in

1 detail.

As generally known, the specific resistance of water and that of ice differ from each other by a two-digit number. Accordingly, when no ice is formed on the surface of the cooler 94, the spaces between the electrodes A-B, A-E are occupied by water. In such a case, the resistances are in a balanced state, so that no signal is outputted from the circuit 12. On the other hand, when ice is formed to cover the electrode E therewith, the balance between the resistances between the electrodes A-B, A-E is lost, and the formation of ice is sensed by the ice sensor to output a signal therefrom to allow the control contact S_2 to be closed. Also, while the resistances between the electrodes A-B, A-C are in a balanced state, the control contact S_1 is closed, and the compressor motor 96 continues to be operated. When the layer of ice has grown to attain a thickness III to cause the balance of resistance to be lost, the control contact S_1 is opened, so that the compressor motor 96 is stopped.

When the ice is then melted with the thickness thereof decreased to the thickness II, the electrode D is exposed to water, so that the resistances between the electrodes A-B, A-D become balanced. As a result, the control contact S_1 is closed again to allow the operation of the compressor motor 96 to be resumed. The condition of formation of ice on the surface of the cooler 94 is thus sensed by the ice sensor, and the control contacts S_1 , S_2 permit controlling the operations of the compressor motor 96 and agitator motor 97 in a desired manner just as the control contacts TS_1 , TS_3 shown in Fig. 6. A time chart of the operation of the drink cooling system utilizing the above-described control method is substantially identical with that shown in Fig. 10. However, the control contact S_2 continues to be closed as shown in broken line m in Fig. 10

1 until the ice has been melted substantially completely,
with the agitator kept operated therewith as shown in broken line n in the same drawing.

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1. A water-cooled heat-accumulating type drink cooling system having a water tank (92) filled with water (91) and provided in the water therein with a cooler (94), a drink cooling coil (31) formed at an intermediate portion of a drink supply pipe-line (3), and an electric water agitator (95, 97), said cooler (94) being operated to cool the water (91) in said tank to form an ice bank (98) therearound and accumulate heat in the ice bank, a drink flowing through said drink cooling coil (31) being cooled with the cooling water (91) in said tank (92),
characterized by
an agitator stopping means (TS_2) which is adapted to sense, while said cooler (94) is operated, a decrease in the temperature of the water (91) in said tank (92) to a level (T_2) in the neighbourhood of its freezing point, and stop said agitator (95, 97) at once.
2. A system according to Claim 1, wherein said drink cooling system includes, in addition to said agitator stopping means (TS_2), an agitator re-starting means (TS_3 , S_2) which is adapted to sense the formation of an ice bank (98) and re-start said agitator (95, 97) the operation of which has been in an interrupted state.
3. A system according to any of the preceding claims, characterized by an agitator control means (RV, X) which is adapted to operate said agitator (95, 97) in accordance with a drink supplying instruction and in preference to an operation of said agitator stopping means (TS_2).

- 1 4. A system according to any of the preceding claims, characterized in that said agitator stopping means consists of a thermostat which has a temperature sensing
5 portion ($S(TS_2)$) capable of sensing the temperature of the water (91) in said tank (92), and a control contact (TS_2) provided in a drive motor circuit for said agitator (95, 97), and which is adapted to sense a decrease in the temperature of the water (91) in said tank (92) to
10 a level (T_2) not lower than and in the neighbourhood of 0°C and open said control contact (TS_2).
5. A system according to any of claims 2 to 4, characterized in that said agitator re-starting means consists of a thermostat which has a temperature sensing portion
15 ($S(TS_3)$) capable of sensing a surface temperature of said cooler (94), and a control contact (TS_3) provided in a drive motor circuit for said agitator (93, 97), and which is adapted to sense a decrease in the temperature of a surface of said cooler to a level low enough to
20 ascertain the formation of an ice bank (98) therearound and close said control contact.
6. A system according to any of claims 2 to 4, characterized in that said agitator re-starting means consists
25 of an electrode type ice sensor (10) which is composed of an electrode (E) provided in the vicinity of a surface of said cooler (94) and which is adapted to sense the formation of ice on the basis of a difference between a fixed electric resistance of water and that
30 of ice to output a signal, and a control contact (S_2) provided in a drive motor circuit for said agitator (95, 97) and adapted to be closed with an output signal from said ice sensor (10).

1 7. A system according to any of claims 3 to 6 characte-
rized in that said agitator control means consists of
a relay (RV) adapted to close in accordance with a
drink supplying instruction a control contact (X) pro-
5 vided in a drive motor circuit for said agitator (95, 97).

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FIG. 1

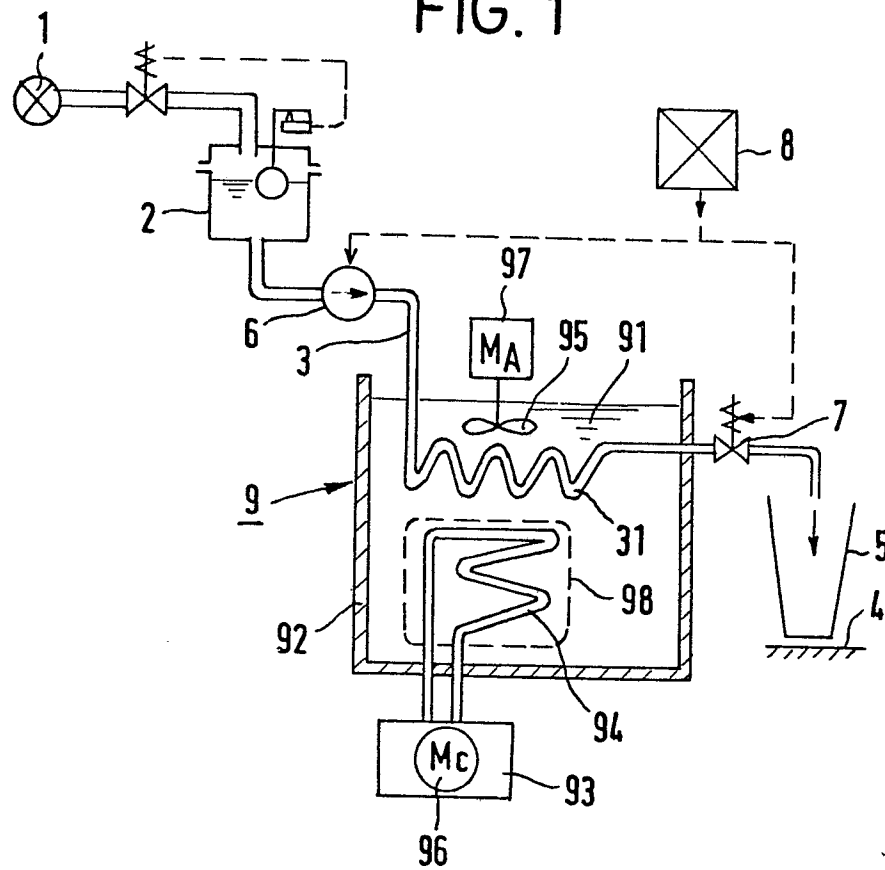


FIG. 3

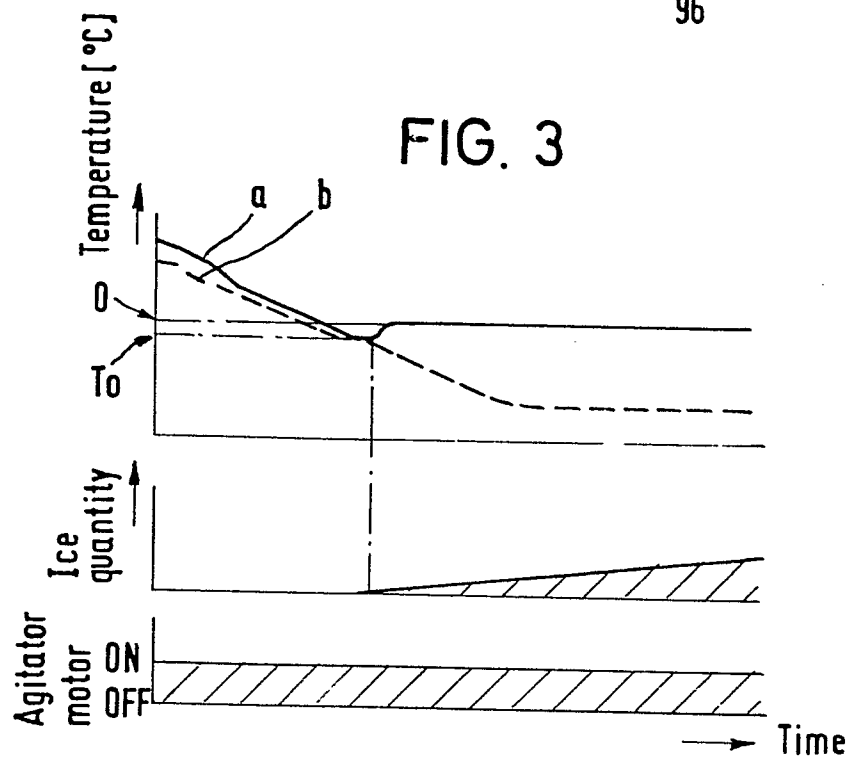
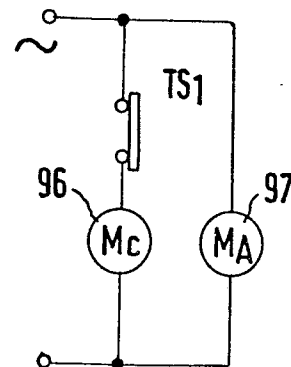


FIG. 2



2/4

FIG. 4

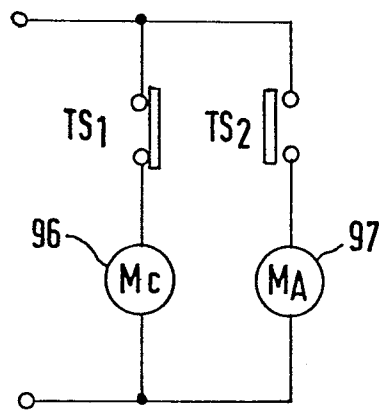


FIG. 5

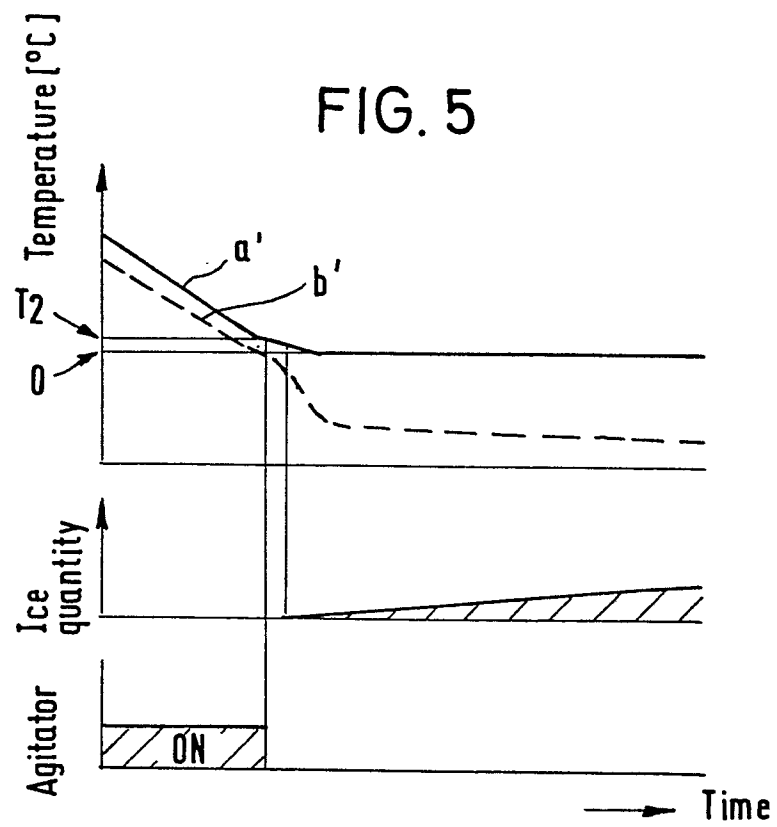


FIG. 6

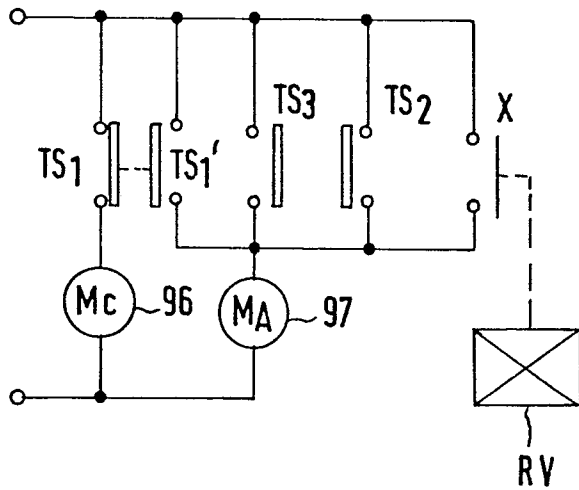


FIG. 7

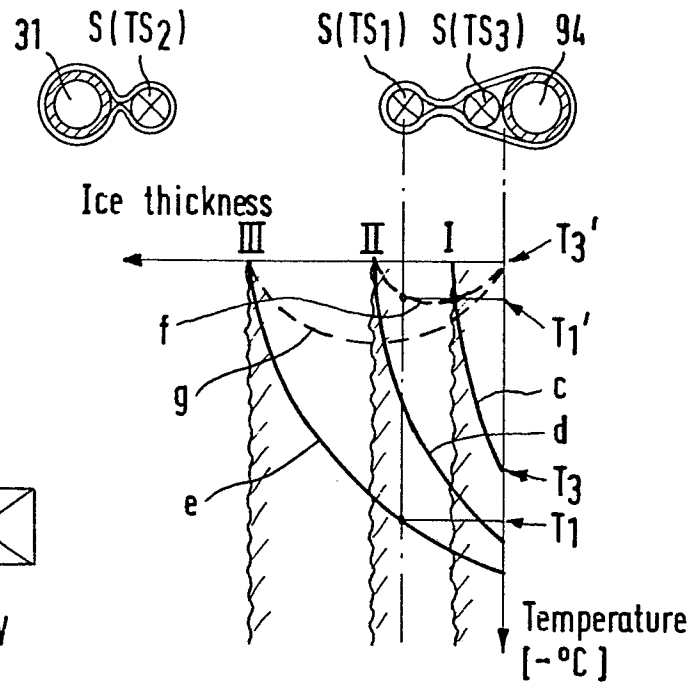


FIG. 8

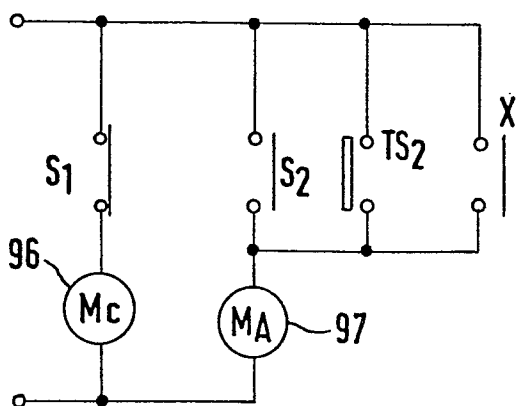


FIG. 9

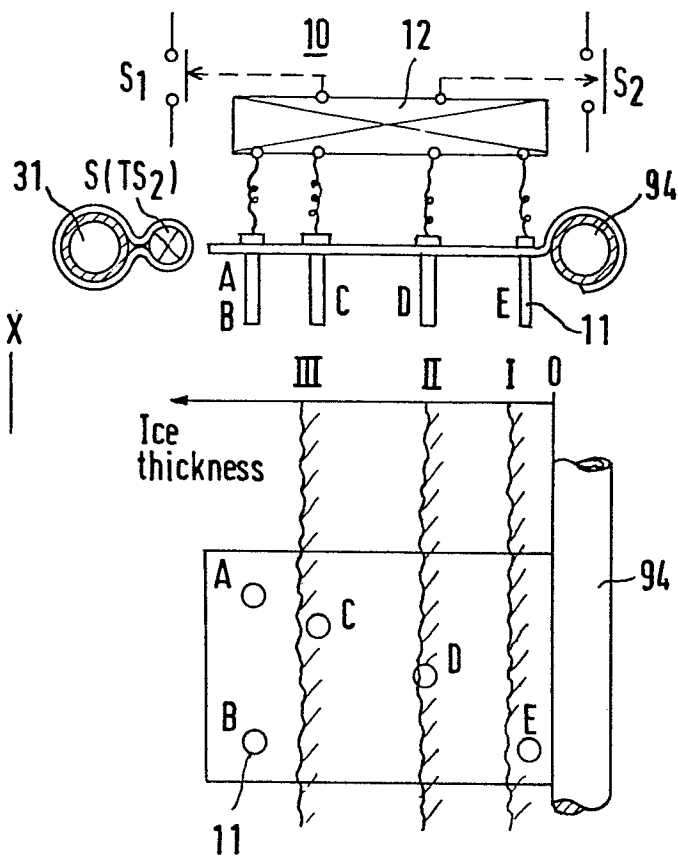
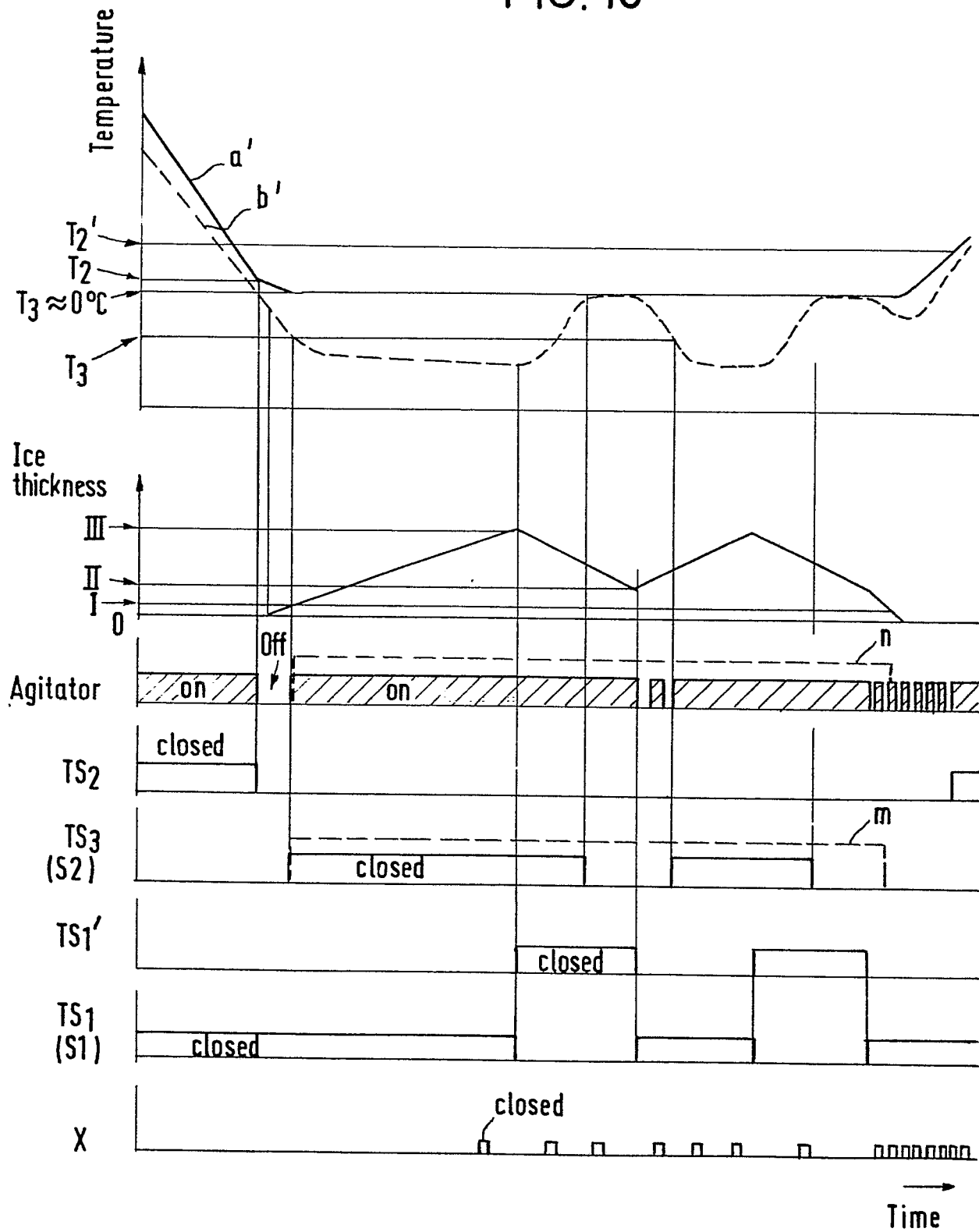


FIG. 10





European Patent
Office

EUROPEAN SEARCH REPORT

0065995

Application number

EP 81 10 4101

DOCUMENTS CONSIDERED TO BE RELEVANT			CLASSIFICATION OF THE APPLICATION (Int. Cl. 3)
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	
X/Y	<u>DE - C - 646 207</u> (BOSCH) * page 2, line 109 to page 4, line 114; figures 1-6 * ---	1,3	F 25 D 31/00 F 25 D 17/02 F 25 D 21/02
X	<u>US - A - 4 124 994</u> (CORNELIUS) * column 1, line 54 to column 3, line 38; figures 1-3 * ---	1	
Y	<u>GB - A - 929 955</u> (SNELWEGERFABRIEK OLLAND) * page 2, line 94 to page 3, line 66; figures 1 and 2 * ---	3	TECHNICAL FIELDS SEARCHED (Int.Cl. 3) F 25 D A 01 J
A	<u>DE - C - 684 559</u> (BOSCH) * page 2, line 64 to page 3, line 80; figures 1 and 2 * ---	1,3	
A	<u>GB - A - 1 380 688</u> (PAXMAN) * page 1, line 72 to page 2, line 77; figures 1-7 * ---	1,3	
A	<u>GB - A - 2 007 820</u> (MARSTON PAXMAN) * page 1, line 93 to page 2, line 1; figures 1 and 2 * ---	1,3	CATEGORY OF CITED DOCUMENTS
A	<u>US - A - 3 298 191</u> (BURKE) * column 3, line 17 to column 6, line 18; figures * ---	6	X: particularly relevant if taken alone Y: particularly relevant if combined with another document of the same category A: technological background O: non-written disclosure P: intermediate document T: theory or principle underlying the invention E: earlier patent document, but published on, or after the filing date D: document cited in the application L: document cited for other reasons
A	<u>US - A - 3 502 899</u> (JONES)		&: member of the same patent family, corresponding document
A The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 29.01.1982	Examiner BOETS

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