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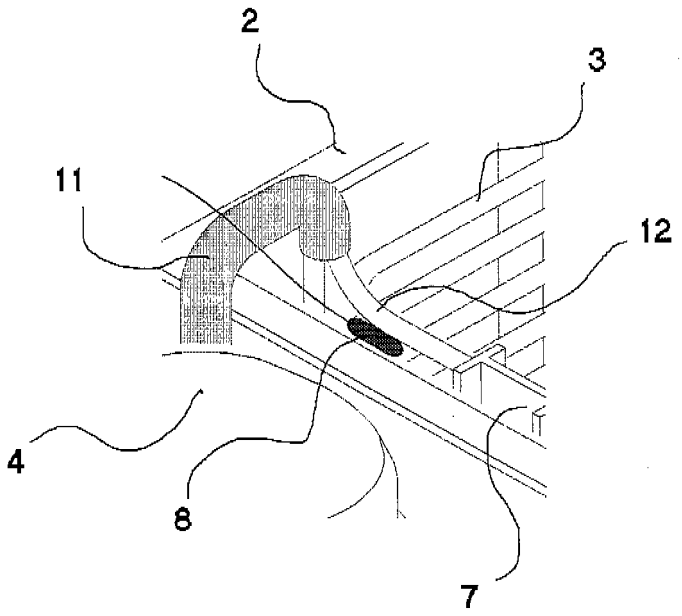
(54) An equipment for refrigerating beverages

(57) Equipment for beverage refrigeration of the type comprising at least one refrigerator device (1), provided with at least one cooling fluid circulating evaporator (3), for refrigerating a heat transfer liquid contained in at least one tank (2) wherein is disposed part of a supplying circuit for such beverages, the evaporator (3) of above mentioned refrigerator device (1) being connected to the tank (2), as well as means (8, 9) for temperature regulation of heat transfer liquid. Such regulation means comprise at least one temperature detecting sensor (8) and at least one operation controller (9) of the refrigerator device (1). Advantageously, the evaporator comprises at least part (12) of a duct for the cooling fluid in heat transfer relationship with a surrounding fluid only, the temperature detecting sensor (8) being constrained in contact to such a part (12) of a duct for cooling fluid in heat transfer relationship with a surrounding fluid only.

FIGURE 2



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Description

[0001] The present invention refers to a beverage refrigeration equipment comprising a refrigerator device of the type provided with at least one evaporator for refrigerating a heat transfer liquid contained in a tank wherein is disposed part of a beverage supply circuit.

[0002] It is prior art maintaining the beverage / beverages cooled in a related supplying and broaching circuit, by an equipment comprising a refrigerator device, generally of the vapour - compression type, which coil evaporator is disposed in heat transfer relationship with a defined part of the beverage supplying circuit, e. g., by one or more ducts for passing the beverages, or by storage reservoirs, or by other housings for such beverages. Such a heat transfer relationship is normally realized by a liquid contained in a suitable tank, disposed for housing either the said evaporator coil and the ducts or the supplying circuit housings of the beverages to be cooled.

[0003] The temperature reached by the beverage passage duct, or by the housings, within the (heat transfer liquid) bath in the aforementioned tank, must be carefully controlled and, in this connection, is known art how to regulate the refrigerator device such that the heat transfer liquid contained in the tank, usually water, is cooled to an extent such as to generate an ice layer, having a predefined thickness around the evaporator coil. Indeed this ice layer performs the heat accumulating function to cooperate in keeping the more fixed the bath temperature is possible. This way, the heat transfer liquid thermal conditions within the tank are maintained approximately fixed, to a temperature next to the solidification temperature of the same heat transfer liquid, and the thermodynamic conditions of the beverage are maintained approximately fixed as well.

[0004] To avoid an excessive or insufficient ice formation around the evaporator in the tank - in this case called ice bank - and / or nevertheless to maintain the desired beverage temperature fixed, and thereby of the heat transfer liquid, is know how to use automatic means for regulating the heat transfer liquid temperature including at least a temperature detecting sensor for the heat transfer liquid and / or the beverage conduits, functionally connected to a automatic operation controller (e. g. a thermostat) of the refrigerator device.

[0005] The refrigerator device regulation, operated by automatic means for regulating the temperature, must be especially accurate, because a heat transfer liquid temperature excessively low might cool too much the beverage to be delivered, with possible glaciation thereof within the supplying conduits, whereas a too high temperature might involve an insufficient beverage cooling, with consequent less broached beverage quality of the taste being perceived by user.

[0006] Such carefulness is particularly important in such a case when the beverage to be chilled is beer, or any other beverage with alcoholic content, which is usually cooled to a temperature below 6 °C (normally between 2 °C to 5 °C) by using a ice bank, which tank is filled with water only. It is however growing the practice of serving beer at a temperature next to 0 °C (normally between - 2°C to + 2 °C) by using an ice bank, which tank contains a low concentration mixture of water and glycol. In this case, also little temperature variations of the heat transfer liquid will cause undesirable thermal beer conditions determining a deterioration of the broached beer taste.

[0007] The automatic means for controlling the ice bank temperature of the known art provide for disposing one or more temperature sensors, e.g. thermistors, within the containment tank of the heat transfer liquid to detect instantly the temperature thereof, and thereby to transmit this detection, or a related signal thereto, to the refrigerator device controller.

[0008] For instance, the European Application EP-A-0 315 439 in the name of THE COCA COLA CO. describes a ice bank, of the type above mentioned, wherein a thermistor connected to a controller of the refrigerator device operation is disposed within a tank containing the heat transfer liquid, in a location nearby the evaporator coil of the same refrigerator device. The thermistor location might be regulated by the operator during the operation of the ice bank, such a way that the thermistor is placed adequately far from the ice layer creating around the evaporator coil itself.

[0009] Such a solution does not allow an exact temperature control of the heat transfer liquid, because while the equipment is operating there are several convective flows at different temperatures inside the heat transfer liquid, due, for instance, to the interaction with the beverage flow within the supplying circuit portion disposed in the equipment tank and / or to the interaction with the environment temperature surrounding the tank, which might determine false detections of the temperature by the thermistor (or other thermometric sensor), with consequent inaccurate regulation of the refrigerator device.

[0010] The US patent n°. 2,459,337 in the name of RANEY, although non relating to a beverage supplying circuit, describes a ice bank for refrigerating beverages in single housings, wherein such housings are fitted in a tank containing a heat transfer liquid that is cooled by a suitable refrigerator device evaporator. The RANEY patent provides that the temperature regulation in the tank is realized by an automatic controller of the same refrigerator device, functionally connected to two temperature sensors. More particularly, the solution described in US 2,459,337 teaches to constrain the temperature sensor directly to the coil evaporator, which is in turn attached on a plate extending to the whole depth and width of the tank.

[0011] The RANEY's device arrangement is such that the temperature being recorded by the aforementioned sensor constrained to the evaporator - as well described, on the other hand, in the same RANEY patent - is the temperature reached by the plate itself; temperature that might be, for the remarkable spatial extent of the plate,

quite different either from the cooling fluid temperature circulating in the refrigerator device evaporator, since the plate is in heat transfer relationship with a wide surface of the liquid contained in the tank, and from the temperature acquired by the same heat transfer liquid in the tank.

[0012] The Applicant noticed that when using water and glycol mixtures as heat transfer liquids in the mixtures used to obtain lower freezing temperatures in the tank of the aforementioned refrigerator device, such detections are quite inaccurate, mainly when on the refrigerator device evaporator is generated a ice layer not allowing an accurate adjustment of the bath temperature within the tank.

[0013] It is therefore an object of the present invention to realize a beverage refrigerator equipment as the one mentioned before allowing an accurate adjustment of the heat transfer liquid temperature in the tank, when this is composed of water and glycol mixture too.

[0014] An other object of the present invention is to provide a beverage refrigerator equipment allowing an accurate detection, direct or not, of the temperature obtained by the heat transfer liquid collocated in the tank of the same refrigerator equipment.

[0015] These and other objects are obtained by the beverage refrigerator equipment according to the first independent claim and further dependent claims, and by the method for regulating the heat transfer temperature within the tank of a beverage refrigerator equipment according to the twelfth independent claim and the subsequent claims dependent therefrom.

[0016] The equipment for beverage refrigeration, according to the present invention, comprises at least one refrigerator device, provided with at least one cooling fluid circulating evaporator, for refrigerating a heat transfer liquid contained in at least one tank, wherein is disposed part of a supplying circuit for the beverages, such evaporator being connected to the equipment tank, as well as means for temperature regulation of heat transfer liquid. Such means for temperature regulation comprise at least one temperature detecting sensor and at least one operation controller of the refrigerator device. Advantageously, said evaporator comprises at least one duct part for the cooling fluid, preferably belonging to a coil, that is in heat transfer relationship with only a fluid surrounding thereto, for example the said heat transfer liquid and / or the surrounding environment air, and the said temperature detecting sensor is constrained, in close contact, to that duct part of evaporator situated in heat transfer relationship with the surrounding fluid only.

[0017] Such a solution, as the Applicant could verify in practice, is disclosed to be very effective in determining the temperature of the liquid bath in the tank, although indirect, and as a result in regulating the related temperature.

[0018] Disposing the temperature sensor, e. g. a thermistor, in contact with a coil portion or other circulation duct part of the evaporator cooling fluid, at first surrounded by the heat transfer liquid and / or the environment air exclusively, allows indeed to detect the temperature of the cooling fluid itself within the coil with a reduced margin for error, substantially the temperature not suffering from thermodynamic changes which the bath is submitted to, and being closely related to the mean temperature reached by the heat transfer liquid in the tank. Moreover, in particular in the case of ice layer formation over the evaporator coil portion to which is constrained the temperature sensor, basically the latter is thermally insulated from the remaining heat transfer liquid, and therefore it might detect the temperature of the cooling fluid within the coil more accurately.

[0019] According to a preferred aspect of the present invention, the sensor is preferably situated next to or at the cooling fluid outlet section of the evaporator, the outlet section being situated at the open surface of the heat transfer liquid in the refrigerator equipment tank.

[0020] According to another aspect of the present invention, it is provided a method for the regulation of the temperature of a heat transfer liquid contained in a beverage refrigerator equipment tank, of the type comprising a refrigerator device provided with at least one cooling fluid circulating evaporator connected to said tank. Such a method comprises the steps of:

a) directly or indirectly detecting the temperature of the said heat transfer liquid;
b) controlling one or more operating parameters of said refrigerator device based on temperature values of the heat transfer liquid detected in preceding step a).

[0021] Advantageously, the method of the present invention provides that in step a) of detecting the heat transfer liquid temperature, the temperature of the cooling fluid within the refrigerator device evaporator is to be substantially detected.

[0022] Such a detection, that could be in principle obtained also by dipping a thermometric probe in a duct length for the evaporator cooling fluid, is disclosed to be not much sensible to changes, even if local, of the thermodynamic conditions of the heat transfer liquid in the refrigerator equipment tank, and the measure is thereby optimal for carrying out an exact regulation of the refrigerator equipment itself, substantially to maintain fixed the temperature of the beverages passing through this thank.

[0023] For purposes of illustrations and not limitative, a preferred embodiment of the present invention will be provided with reference to the accompanying drawings, in which:

Figure 1 is an exploded exemplificative view of a beverage refrigerator equipment, according to a preferred embodiment of the present invention;
Figure 2 is an expanded view of an equipment detail of figure 1.

[0024] Relating generally to the figures, the particular

embodiment of the beverage refrigerator equipment herein described, according to the present invention, comprises a refrigerator device 1, of the kind provided with a cooling fluid circulating evaporator 3, that is disposed to cool a heat transfer liquid in the tank 2, within there is also part of the refrigeration circuit for the beverages, in itself known in the art.

[0025] More particularly, the refrigerator device 1 herein illustrated is of the vapour - compression type (having reverse thermodynamic cycle), wherein a cooling fluid, that is susceptible to change phase during the cycle, is alternatively subjected to compression and expansion (isenthalpic lamination), having two intermediate phases for heat transferring and absorbing, respectively. Thereby such a refrigerator device 1 is composed of a compressor 4, a condenser 6, wherein the heat transferring to environment takes place, being forced by a fan 5, a isenthalpic lamination valve (not shown) and an evaporator 3, formed by a suitable metallic coil, wherein the heat absorbing from outside takes place.

[0026] Substantially this evaporator coil 3, in the equipment herein illustrated, is shaped as cylindrical helix and is constrained to the inner wall of the tank 2 by the bracket 7. It is to be observed that this evaporator arrangement 3 is only illustrative and any other arrangement allowing it to be connected to this tank 2, in a heat transfer relationship, or better directly or not to the heat transfer liquid, is anyway comprised in the protection scope of this patent right.

[0027] As mentioned, in the tank 2 is located part of a beverage supplying circuit, of which can be seen a connection 10 only, e. g. composed of ducts or housings (reservoirs) for the beverages themselves. This part of a beverage supplying circuit situated in the tank 2 is thereby cooled by the refrigerator device 1, due to the evaporator 3, through interposing a heat transfer liquid contained in the same tank 2, having the goal not only to make effective and homogeneous the heat transferring from the beverages to the same evaporator 3, but also to substantially maintain the thermodynamic condition stable within the tank 2.

[0028] This heat transfer liquid might be water only, or a mixture of water and other substances for lowering its solidification temperature, or any other liquid with suitable thermal inertia and predefined solidification temperature.

[0029] When such equipment is used with a beer supplying circuit, which broaching temperature is critic, this heat transfer liquid is preferably comprised of a water and glycol mixture.

[0030] The beverage refrigerator equipment herein illustrated, according to a particular aspect of the present invention, comprises also means 8, 9 for regulating the temperature reached by the aforementioned heat transfer liquid, comprising at least one temperature sensor 8, e. g. made up of a thermo - resistance or thermistor, and a respective controller 9 (thermostat) of the refrigerator device 1 operations, preferably working on the compressor 4 in the particular device 1 herein illustrated.

[0031] According to the known art, the thermostat 9, based on temperature readings made by the sensor 8, adjusts the operation of the compressor 4, by activating or deactivating it in case of the detected temperature is higher or lower to the predefined one, respectively.

[0032] Advantageously, according to the present invention, the sensor 8 is located in close contact to a portion 12 of an evaporator duct 3, the portion 12 being in heat transfer relationship only with a fluid surrounding thereto, that is preferably with the heat transfer liquid in the tank 2 only, or with the environment air around the same tank 2.

[0033] More particularly, the sensor 8 is attached, in the particular embodiment of the invention herein illustrated, on a coil length of evaporator 3, that is surrounded by the heat transfer liquid only in the tank 2 and not being in heat transfer relationship with other members, e.g. the tank inner walls 2 or the brackets 7.

[0034] This way, as mentioned, it is possible to detect very precisely, although indirectly, the temperature reached by the cooling fluid evolving within the evaporator 3, and this measurement, substantially being not affected by local or extemporary thermodynamic conditions of the heat transfer liquid in the tank 2 during the operation of the refrigerator device of the present invention, is disclosed to be particularly useful for controlling the refrigerator device 1 functionalities, thanks to the thermostat 9.

[0035] Although not herein illustrated, it has to be noticed that attaching the sensor 8 to the evaporator 3 might be also carried out at a part of a duct for the cooling fluid of the same evaporator 3 that is placed outside the tank, such a way to be surrounded by the environment air only. Moreover, this sensor might be situated not outside the coil only, but also inside thereof.

[0036] However, in the characteristic embodiment of the invention herein illustrated, the sensor 8 is specifically attached to an ending length 12 of the evaporator coil 3, substantially at the cooling fluid outlet section from the same evaporator 3 and just before the thermally insulating sheath 11, beneath the heat transfer liquid open surface in the tank 2. This way, while the refrigerator equipment is operating, the formation of a ice layer over the outer surface of the evaporator coil 3 cooperates in even further insulating the sensor 8 from the thermal conditions of the remaining heat transfer liquid in the tank 2, allowing a even more accurate detection of the heat transfer temperature in the evaporator 3.

[0037] It is to be noted that such a precision in detecting the cooling fluid temperature in the evaporator 3 causes a relevant high precision in adjusting the operation of the refrigerator device 1, and thereby in maintaining accurate and fixed thermal conditions in the tank 2. Such a fixed thermal conditions are particularly important in case of the beverage to be delivered is beer and consequently the heat transfer liquid in the tank 2 is made of a water and glycol mixture.

[0038] Indeed, in case of using water and glycol as

heat transfer liquid in the tank 2, the formation of a ice layer around the evaporator 3 in the tank 2 (although at a temperature below 0 °C due to the glycol presence), with functionality of "cold " accumulating, causes thermal fluctuations in the water and glycol mixture still in the liquid phase, rendering an accurate and exact detection of the bath temperature very difficult. Then to such an inaccuracy corresponds to an non optimal operation of the refrigerator device 1, and consequently high fluctuations in the temperature reached by the heat transfer liquid in the tank itself 2.

[0039] With the above described beverage refrigerator equipment such drawback is substantially worked out by implementing the method below, according to the present invention, for adjusting the heat transfer liquid temperature that is contained in a tank 2 of a beverage refrigerator equipment, thanks to a refrigerator device 1 of the type above, comprising the step of:

a) continuously detecting, directly or not, the heat transfer liquid temperature in the tank 2;
b) continuously controlling one or more operation parameters of the refrigerator device 1, based on temperature values of the heat transfer liquid detected in preceding step a);

wherein this step a) of detecting the heat transfer liquid temperature occurs - indirectly - through substantial detection of the cooling fluid temperature circulating in the evaporator 3 of the above mentioned refrigerator device 1.

[0040] According to a particular aspect of this method, the cooling fluid temperature is detected in proximity of at least part 12 of a duct for the cooling fluid (the duct could belong to a metallic coil) of the evaporator 3, in heat transfer relationship with a surrounding fluid only, and such a detection might preferably be determined in proximity to or at the cooling fluid outlet section from the evaporator itself 3.

[0041] Thanks to implementing such a method with the refrigerator equipment, according to the above particular aspect of the present invention, the Applicant could notice the continuously maintaining of the optimal thermal conditions for broaching beer using a water and glycol bath at 5 ° BRIX and regulating the thermostat 9 thereby to maintain the temperature - detected by the sensor 8 - at -6 °C. Using these operative parameters, as the matter of fact, the Applicant observed the formation of an ice layer surrounding the evaporator coil 3 having a thickness of about 40 mm and a bath temperature substantially fixed and equal to -2 °C (i.e. of the heat transfer liquid in the tank 2), this temperature being optimal for broaching beer.

Claims

1. Equipment for beverage refrigeration of the type comprising at least one refrigerator device (1), provided with at least one cooling fluid circulating evaporator (3), for refrigerating a heat transfer liquid contained in at least one tank (2) wherein is disposed part of a supplying circuit for said beverages, the evaporator (3) of said at least one refrigerator device (1) being connected to at least one tank (2), as well as means (8, 9) for temperature regulation of said heat transfer liquid, said means for temperature regulation comprising at least one temperature detecting sensor (8) and at least one operation controller (9) of said at least one refrigerator device (1), **characterized in that** said evaporator comprises at least part (12) of a duct for said cooling fluid in heat transfer relationship with a surrounding fluid only, said at least one temperature detecting sensor (8) being constrained to said at least one part (12) of a duct for said cooling fluid in heat transfer relationship with a surrounding fluid only.

2. Equipment according to claim 1, wherein said refrigerator device comprises at least one compressor (4), **characterized in that** said controller (9) adjusts said compressor (4) operations of said at least one refrigerator device (1).

3. Equipment according to any one of the claims 1 or 2, wherein said evaporator (3) is placed, at least partly, within said at least one tank (2).

4. Equipment according to any one of the preceding claims, wherein said evaporator (3) comprises at least one metallic coil and said at least part (12) of said duct in heat transfer relationship with a surrounding fluid only belongs to at least one metallic coil.

5. Equipment according to any one of the preceding claims, **characterized in that** said at least duct part (12) of said evaporator (3) to which said at least one sensor (8) is contact constrained, is in heat transfer relationship with said heat transfer liquid within the tank (2) and / or with the air of the environment surrounding said tank (2).

6. Equipment according to any one of the preceding claims, **characterized in that** said at least duct part (12) of said evaporator (3) to which said at least one sensor (8) is contact constrained, is situated in proximity of or at the cooling fluid outlet section from the evaporator.

7. Equipment according to any one of the preceding claims, **characterized in that** said at least duct part (12) of said evaporator (3) to which said at least one sensor (8) is contact constrained is situated at the heat transfer liquid open surface within said tank (2).

8. Equipment according to any one of the preceding claims, **characterized in that** said at least one temperature detecting sensor (8) comprises a thermistor or a thermal resistance.

9. Equipment according to any one of the preceding claims, **characterized in that** said heat transfer liquid is a mixture comprising water and glycol.

10. Equipment according to claim 9, **characterized in that** said water and glycol mixture is at 5° BRIX.

11. Equipment according to any one of the preceding claims, **characterized in that** said beverages comprise beer.

12. Method for temperature regulating of a heat transfer liquid contained in a tank (2) of a beverage refrigeration equipment, said equipment comprising a refrigerator device (1) provided with at least one cooling fluid circulating evaporator (3) connected to said tank (2), the method comprising the step of:

    a) directly or indirectly detecting the temperature of said heat transfer liquid;
    b) controlling one or more working parameters of said refrigerator device (1) based on temperature values of the heat transfer liquid detected in preceding step a);

    characterized in that in said step a) of detecting the heat transfer liquid temperature, the temperature of the cooling fluid circulating in said evaporator (3) of said refrigerator device (1) is substantially detected.

13. Method according to claims 12, **characterized in that** said cooling fluid temperature is detected in proximity of at least a cooling fluid duct part (12) of said evaporator (3) in heat transfer relationship with a surrounding fluid only.

14. Method according to claim 12 or 13, **characterized in that** said cooling fluid temperature is detected in proximity or at the cooling fluid outlet section of said evaporator (3).

FIGURE 1

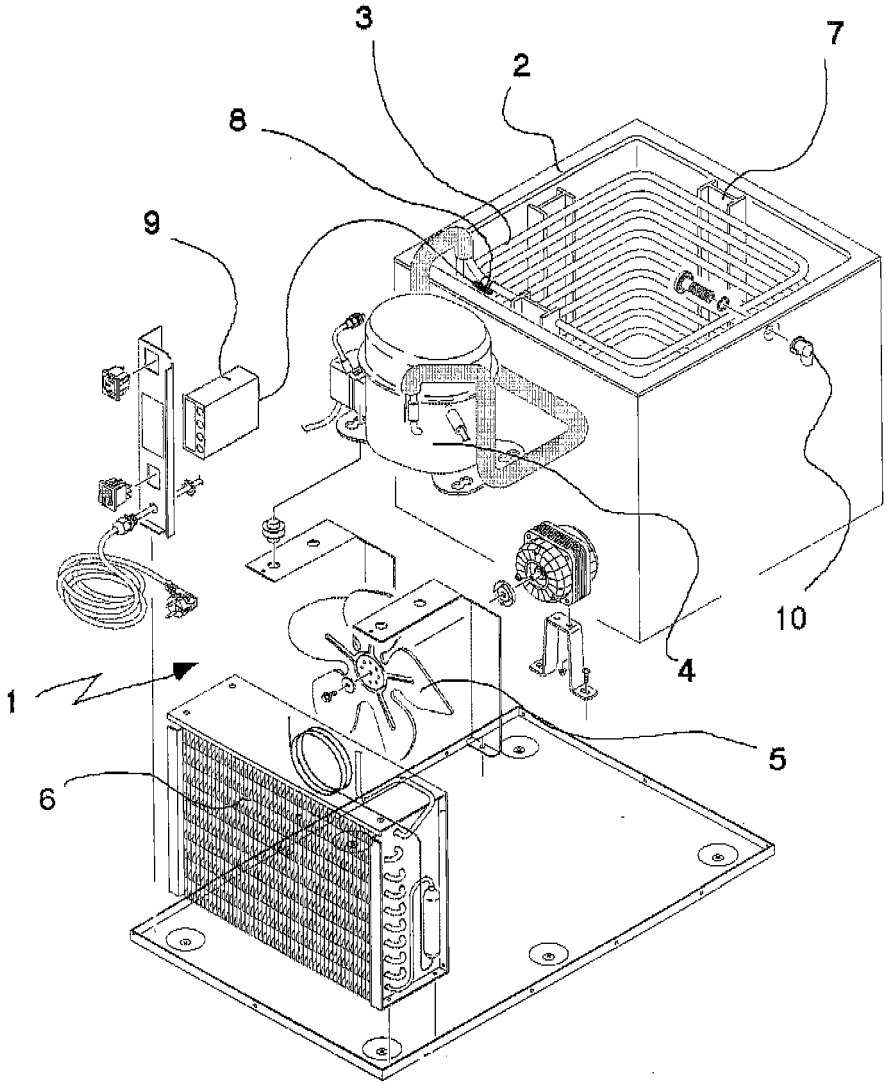
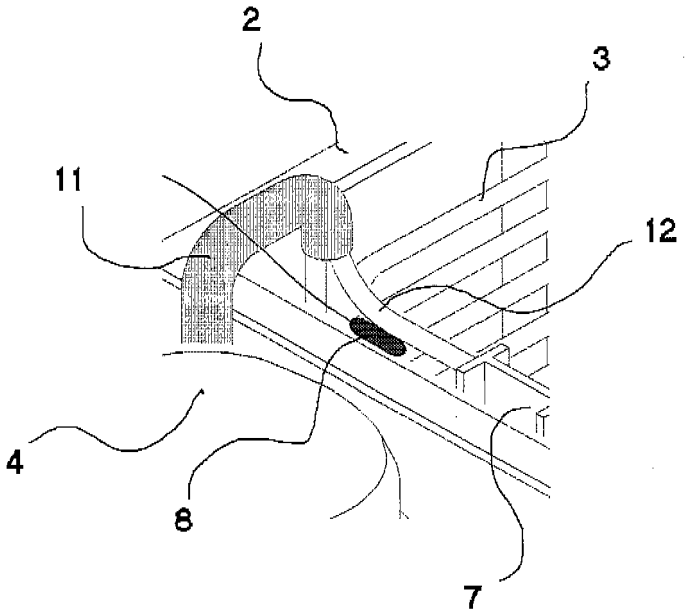


FIGURE 2



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EUROPEAN SEARCH REPORT

Application Number
EP 07 42 5549

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	GB 2 059 038 A (PAXMAN N E) 15 April 1981 (1981-04-15) * the whole document *	1-5,7,9, 12,13	INV. F25D31/00
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X,D	US 2 459 337 A (RANEY ESTEL C) 18 January 1949 (1949-01-18)	12	
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TECHNICAL FIELDS SEARCHED (IPC)

F25D
B67D

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	10 January 2008	Jessen, Flemming

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

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- US 2459337 A, RANEY **[0010] [0010]**