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(54) Household appliance for the supplying of cooled water or other beverage and relative operation method

(57) Household appliance (1) for the supplying of cooled water or other beverage having a tank (4) communicating directly with a source (8) supplying the beverage at above atmospheric pressure; means (5) for controlling the outflow of the water or other beverage from the tank (4); a cooling assembly (9) for cooling the beverage inside the tank (4); and a control unit (10) for controlling the cooling assembly (9) to bring the beverage inside the tank (4) to, and maintain it at, a reference temperature below or equal to the freezing temperature (T_0) of the beverage; the household appliance (1) also having freezing control means (13) for assisting irregular, non-homogeneous crystallization of the beverage to obtain a semisolid frozen drink mixture.

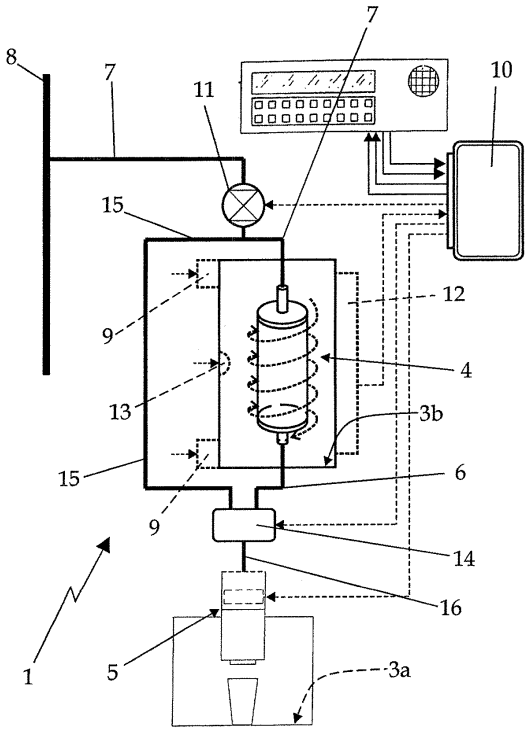

Fig. 3

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Description

[0001] The present invention relates to a household appliance for the supplying of cooled water or other beverage and to the relative operation method.

[0002] More specifically, the present invention relates to a household cooled-drink dispenser integrated in a refrigerator to which the following description refers purely by way of example.

[0003] As is known, household refrigerators have been marketed for some years now in which the door has a built-in cooled-water dispenser, which substantially comprises a tank for storing water or any other beverage to be dispensed; a cooling assembly for bringing the water inside the tank to, and maintaining it at, a predetermined reference temperature above the freezing temperature (i.e. 0°C) of water and normally ranging between 8°C and 15°C; and a metering valve located at a drink dispensing recess formed in the outer surface of the refrigerator door. The valve is connected to the bottom of the tank by a connecting pipe, and is designed to only allow controlled outflow of water from the tank to the drink dispensing recess underneath when the recess is engaged by a glass or other container to receive the water.

[0004] Unfortunately, integrating the cooled-drink dispenser inside the door of the refrigerator reduces the capacity of the tank and performance of the cooling assembly, thus seriously affecting operation of the dispenser.

[0005] The cooled-drink dispenser in fact can only dispense the water or any other beverage at the desired temperature after the tank has been filled by the user with the desired beverage, and after the cooling assembly has brought the beverage inside the tank to the set reference temperature.

[0006] In addition to the above operating drawbacks, the inside of the tank is an ideal receptacle for mould and bacteria, with all the risks this involves in the event the cooled-drink dispenser is only used sporadically, and the beverage is allowed to stagnate inside the tank for long periods of time.

[0007] It is an object of the present invention to provide a cooled-drink dispenser for refrigerators, designed to eliminate the aforementioned drawbacks.

[0008] According to the present invention, there is provided a household appliance for the supplying of cooled water or other beverage as claimed in Claim 1 and preferably, though not necessarily, in any one of the dependent Claims.

[0009] According to the present invention, there is also provided a cooled-drink dispenser featuring a household appliance for the supplying of cooled water or other beverage as claimed in Claim 1 and preferably, though not necessarily, in any one of the dependent Claims.

[0010] A non-limiting embodiment of the present invention will be described by way of example with reference to the accompanying drawings, in which:

Figure 1 shows a view in perspective of a household refrigerator featuring a cooled-drink dispenser in accordance with the teachings of the present invention;

Figure 2 shows, schematically, the cooled-drink dispenser integrated in the Figure 1 refrigerator;

Figure 3 shows, schematically, a variation of the cooled-drink dispenser shown schematically in Figure 2.

[0011] With reference to Figures 1 and 2, number 1 indicates as a whole a household appliance for the supplying of cooled water or other beverage which can be used preferably, though not necessarily, as cooled-drink dispenser.

[0012] More in details, in the example shown the household appliance 1 for the supplying of cooled water or other beverage is integrated in a cooled-drink dispenser 1 which in turn is integrated in a household refrigerator 2, preferably, though not necessarily, inside its door 3.

[0013] The household appliance 1 for the supplying of cooled water or other beverage, i.e. the cooled-drink dispenser 1, substantially comprises a tank 4 for temporarily storing water or any other beverage to be dispensed; and a metering valve 5 which, in the example shown, is located at a drink dispensing recess 3a formed in the outer surface of door 3 of refrigerator 2, is connected to tank 4 by a connecting pipe 6, and is designed to only permit controlled outflow of water or any other beverage from tank 4 to recess 3a when recess 3a is engaged by a glass or other container to receive the water.

[0014] Unlike known solutions, tank 4 is defined by an airtight container 4 housed, in the example shown, inside a compartment 3b formed in door 3 of refrigerator 2, above recess 3a, and the household appliance 1 or cooled-drink dispenser 1 also comprises a second connecting pipe 7 permanently connecting tank 4 to a source 8 of pressurized water or other beverage so as that tank 4 is always completely filled with water and does not contain air; a cooling assembly 9 which, on command, cools the liquid inside tank 4; and an electronic central control unit 10 which controls cooling assembly 9 on the basis of signals from a temperature sensor (not shown) for determining the temperature of the liquid inside tank 4, so as to bring the water or other beverage inside tank 4 to, and maintain it at, a reference temperature below or equal to the freezing temperature T_0 (i.e. 0°C) of water or other beverage.

[0015] More specifically, source 8 supplies water or any other beverage continuously at above atmospheric pressure, and the household appliance 1 or cooled-drink dispenser 1 preferably, though not necessarily, also comprises an on-off valve 11 located along connecting pipe 7, upstream from tank 4, and which, on command, isolates tank 4 from source 8 to cut off flow of water or other beverage.

[0016] In the example shown, source 8 is defined by the drinking water circuit of the building in which refrigerator 2 is located.

[0017] Tank 4 is advantageously defined by a variable-capacity, airtight container 4.

[0018] In the example shown, tank 4 is defined by a tubular body made of elastically deformable material and closed hermetically at both ends by two caps of rigid material to form a variable-volume closed container. The two caps are connected to the two connecting pipes 6 and 7 to allow water to flow from source 8 to metering valve 5 via the whole of tank 4.

[0019] In an alternative embodiment, tank 4 may be defined by a hermetically closed rigid container of constant internal volume and housing a closed capsule or container made of elastically deformable material and filled with gas.

[0020] In the example shown, cooling assembly 9 comprises a number of electric fans 9 which, on command, circulate, inside compartment 3b housing tank 4, a stream of cold air at a temperature below temperature T_0 and/or a stream of hot air at a temperature above temperature T_0; and electronic central control unit 10 controls fans 9 to alternate and/or mix the two air streams to bring the liquid inside tank 4 to, and maintain it at, around freezing temperature T_0. The stream of cold air may come from the freezer compartment of refrigerator 2 storing frozen food requiring a temperature of -25°C to -20°C, and the stream of hot air may come from the fresh-food compartment of refrigerator 2 storing fresh food requiring a temperature of 2°C to 8°C.

[0021] Fans 9 may obviously be replaced by a conventional heat-pump refrigeration circuit in which the evaporator is housed inside compartment 3b, close to tank 4, or by other refrigeration means.

[0022] With reference to Figure 2, the household appliance 1 or cooled-drink dispenser 1 also comprises a sensor 12 for determining and communicating to electronic central control unit 10 the amount of solid-state water or other beverage contained at all times inside tank 4; and means for preventing the formation of a single block of frozen liquid occupying the whole volume of tank 4 so as to obtain a biphasic (liquid state plus solid state) frozen liquid mixture, and preferably for assisting irregular, nonhomogeneous crystallization of the liquid inside tank 4, so as to obtain a semisolid, high-viscosity, frozen liquid mixture.

[0023] More specifically, the household appliance 1 or cooled-drink dispenser 1 comprises a freezing process control device 13 designed to force the liquid freezing inside tank 4 to crystallize irregularly and nonhomogeneously into a semisolid, high-viscosity mixture or slurry.

[0024] In the example shown, freezing process control device 13 is defined by an ultrasonic-frequency vibration emitter 13 positioned close to tank 4, and which, under the control of electronic central control unit 10, breaks up the ice or crystallized beverage formed in tank 4 to obtain said semisolid, high-viscosity mixture of frozen water or other beverage.

[0025] As an alternative to vibration emitter 13, the formation of a block of ice or frozen beverage inside tank 4 may also be prevented by cyclically and locally heating areas of tank 4 under the control of electronic central control unit 10, e.g. by means of a number of appropriately controlled resistors arranged inside the tank, to prevent the ice or frozen beverage crystals from adhering permanently to and forming layers on the walls of the tank.

[0026] In an alternative embodiment, tank 4 may obviously also be designed and/or cooled to restrict the formation of ice or frozen beverage crystals to certain predetermined points on the wall of the tank. In which case, freezing process control device 13 may be defined by an electrically operated propeller or stirring body housed inside tank 4 to keep the liquid inside the tank moving and detach the ice or frozen beverage crystals from the wall as they are formed.

[0027] Operation of the household appliance 1 or cooled-drink dispenser 1 will now be described, assuming on-off valve 11 is fully open to connect tank 4 directly to source 8 and to fill tank 4 completely with water from source 8. The temperature of the water supplied buy source 8 is obviously greater than the temperature of water or other beverage coming out of household appliance 1 or cooled-drink dispenser 1.

[0028] In actual use, electronic central control unit 10 controls cooling assembly 9 to bring the liquid inside tank 4 rapidly to below the freezing temperature T_0 of water and so freeze the liquid, and controls vibration emitter 13 (i.e. the means for preventing the formation of a block of frozen liquid inside tank 4) to force the water or other beverage freezing inside tank 4 to crystallize irregularly and nonhomogeneously into a biphasic or semisolid, high-viscosity, frozen drink mixture or slurry.

[0029] By means of sensor 12, electronic central control unit 10 continuously controls the percentage of water that has passed from the liquid state to the solid or semisolid frozen water mixture state inside tank 4, and controls cooling assembly 9 so that the percentage of water in the solid or semisolid mixture state does not exceed a predetermined maximum threshold ranging between 50% and 90% of the maximum capacity of tank 4, so as to ensure free circulation of the water at all times inside tank 4.

[0030] The household appliance 1 or cooled-drink dispenser 1 is ready to dispense cooled water as soon as a sufficient amount of solid or semisolid frozen water mixture is produced inside tank 4.

[0031] Insertion of a glass inside recess 3a in door 3 opens metering valve 5 to allow the water in tank 4 to flow along connecting pipe 6 into the glass.

[0032] Tank 4 being connected directly to pressurized-water source 8, the outflow of cooled water from tank 4 along connecting pipe 6 is accompanied by a simultaneous inflow into tank 4 of an equal amount of water at ambient temperature from source 8. Inside tank 4, the water at ambient temperature from source 8 mixes with and partly melts the solid or semisolid frozen water mixture to form cooled water at a temperature of 8°C to 15°C

(i.e. at a temperature below ambient temperature), which flows immediately along connecting pipe 6 into the glass.

[0033] By appropriately regulating ambient-temperature water flow into tank 4 (which can be done by electronic central control unit 10 appropriately controlling on-off valve 11) and the amount of solid or semisolid frozen water mixture inside tank 4, cooled water at a temperature of 8°C to 15°C can be obtained inside tank 4 for immediate supply along connecting pipe 6 into the glass.

[0034] Cooled-drink dispenser 1 in the form of the household appliance 1 obviously has numerous advantages. Above all, it provides for dispensing a quantity of cooled water, at a temperature ranging between 8°C and 15°C, much greater than the nominal capacity of tank 4, by using the solid or semisolid frozen water mixture as a thermal flywheel to rapidly cool the water from source 8.

[0035] The fact that tank 4 is always filled completely with water at a temperature of substantially 0°C considerably reduces the growth-rate of mould and bacteria.

[0036] Clearly, changes may be made to the household appliance 1 as described herein without, however, departing from the scope of the present invention.

[0037] For example, with reference to Figure 3, the household appliance 1 or cooled-drink dispenser 1 may comprise, downstream from tank 4, an electrically operated hydraulic mixer 14 for mixing the cooled water flowing out of tank 4 along connecting pipe 6 with the ambient-temperature water from source 8.

[0038] More specifically, hydraulic mixer 14 is a three-way mixer having a first inlet connected to tank 4 by connecting pipe 6; a second inlet connected to connecting pipe 7, upstream from tank 4 and downstream from on-off valve 11, by a bypass pipe 15; and one outlet connected to metering valve 5 by a connecting pipe 16.

[0039] In this variation, electronic central control unit 10 controls hydraulic mixer 14 on the basis of signals from a temperature sensor for determining the temperature of the water supply to metering valve 5, so as to adjust the temperature of the water supplied to metering valve 5 by appropriately mixing the cooled water from tank 4 with the ambient-temperature water directly from source 8.

[0040] Obviously in an other embodiment the household appliance 1 described above may have other uses. For example it can be used for cooling down the water in entrance to a traditional icemaker. In that case metering valve 5 is replaced by a traditional electrically controlled throttle valve or on-off valve located just before the icemaker so as to control the outflow of the water from tank 4 to the icemaker.

Claims

1. Household appliance (1) for the supplying of cooled water or other beverage comprising a tank (4) for temporarily storing the water or other beverage, means (5) for controlling the outflow of the water or other beverage from the tank (4), a cooling assembly (9) for cooling the water or other beverage inside said tank (4), and a control unit (10) for controlling said cooling assembly (9) to bring the water or other beverage inside the tank (4) to, and maintain it at, a predetermined reference temperature;
the household appliance (1) being **characterized in that** said tank (4) communicates with a source (8) supplying said water or other beverage at a pressure higher than atmospheric pressure, and **in that** said control unit (10) controls said cooling assembly (9) to bring the water or other beverage inside said tank (4) to, and maintain it at, a reference temperature below or equal to the freezing temperature (T_0) of said water or other beverage, so as to freeze the water or other beverage; the household appliance (1) also comprising freezing control means (13) for preventing the formation of a single block of frozen liquid occupying the whole volume of said tank (4) so as to obtain a biphasic frozen water or beverage mixture.

2. A household appliance as claimed in Claim 1, **characterized in that** said freezing control means (13) are able to assist an irregular, nonhomogeneous crystallization of said water or other beverage to obtain a semisolid frozen water or beverage mixture.

3. A household appliance as claimed in Claim 1 or 2, **characterized in that** said tank (4) is a closed, variable-capacity container (4).

4. A household appliance as claimed in any one of the foregoing Claims, **characterized by** also comprising an on-off valve (11) interposed between the tank (4) and said source (8); said on-off valve (11), on command, isolating said tank (4) from said source (8) to cut off flow of the beverage.

5. A household appliance as claimed in any one of the foregoing Claims, **characterized by** also comprising a hydraulic mixer (14) having two inlets connected respectively to said tank (4) and to said source (8), and one outlet connected said means (5) for controlling the outflow of the water or other beverage from the tank (4); said hydraulic mixer (14), on command, being able of mixing the cooled water or other beverage from the tank (4) with the ambient-temperature water or other beverage from said source (8), and feeding the resulting mixture to said means (5) for controlling the outflow of the water or other beverage.

6. A household appliance as claimed in any one of the foregoing Claims, **characterized in that** said freezing control means (13) comprise a predetermined-frequency vibration emitter (13) positioned close to the tank (4), and which breaks up the frozen water

or beverage clusters formed inside the tank (4), to obtain said semisolid frozen drink mixture.

7. A household appliance as claimed in any one of Claims 1 to 5, **characterized in that** said freezing control means (13) comprise means for keeping the water or other beverage inside the tank (4) moving at all times.

8. A household appliance as claimed in any one of the foregoing Claims, **characterized in that** said source (8) is defined by the drinking water circuit of the building in which the household appliance (1) is located.

9. A cooled-drink dispenser (1) **characterized by** comprising a household appliance (1) as claimed in any one of Claims 1 to 8, wherein said means (5) for controlling the outflow of the water or other beverage from the tank (4) comprises a metering valve (5) connected to the tank (4) and designed to permit controlled outflow of the water or other beverage from the tank (4) into a container positioned temporarily at the metering valve (5).

10. A household refrigerator, **characterized by** comprising a cooled-drink dispenser (1) as claimed in Claim 9.

11. A refrigerator as claimed in Claim 10, **characterized by** comprising a door (3), and in that said cooled-drink dispenser (1) is located on said door (3).

12. Operating method of a household appliance (1) for the supplying of cooled water or other beverage **characterized by** comprising the steps of:

- cooling down inside a tank (4) a given quantity of water or other beverage below its freezing temperature (T_0) so as to freeze it, while controlling the crystallization process to obtain a biphasic frozen water or other beverage mixture;
- mixing, inside said tank (4), said biphasic frozen water or other beverage mixture with water or other beverage at a higher temperature to partly melt said semisolid frozen water or other beverage mixture; and
- supplying the liquid-state cooled water or other beverage resulting from melting the biphasic frozen water or other beverage mixture inside said tank (4).

13. Operating method as claimed in Claim 12, wherein said tank (4) communicates with a source (8) supplying said water or other beverage at a pressure higher than atmospheric pressure.

14. Operating method as claimed in Claim 12 or 13, wherein said biphasic frozen water or other beverage mixture is a semisolid frozen water or other beverage mixture resulting from an irregular, nonhomogeneous crystallization of said water or other beverage.

15. Operating method as claimed in Claim 12, 13 or 14, wherein the household appliance (1) is a cooled-drink dispenser (1) and the phase of supplying the liquid-state cooled water or other beverage resulting from melting the biphasic frozen water or other beverage mixture consist in dispensing into a glass or other container the liquid-state water or other beverage resulting from melting the biphasic frozen water or other beverage mixture inside the tank (4).

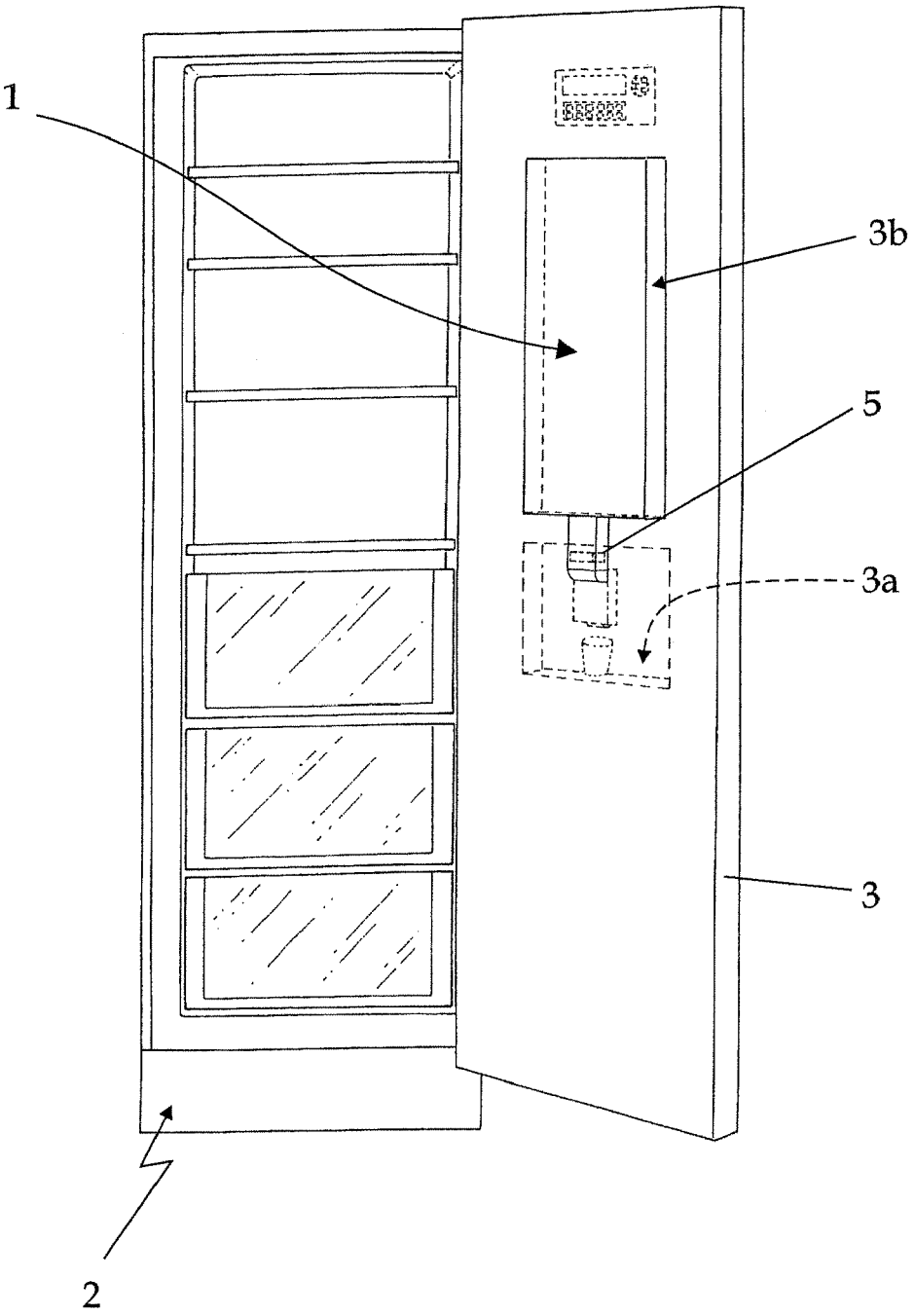

Fig. 1

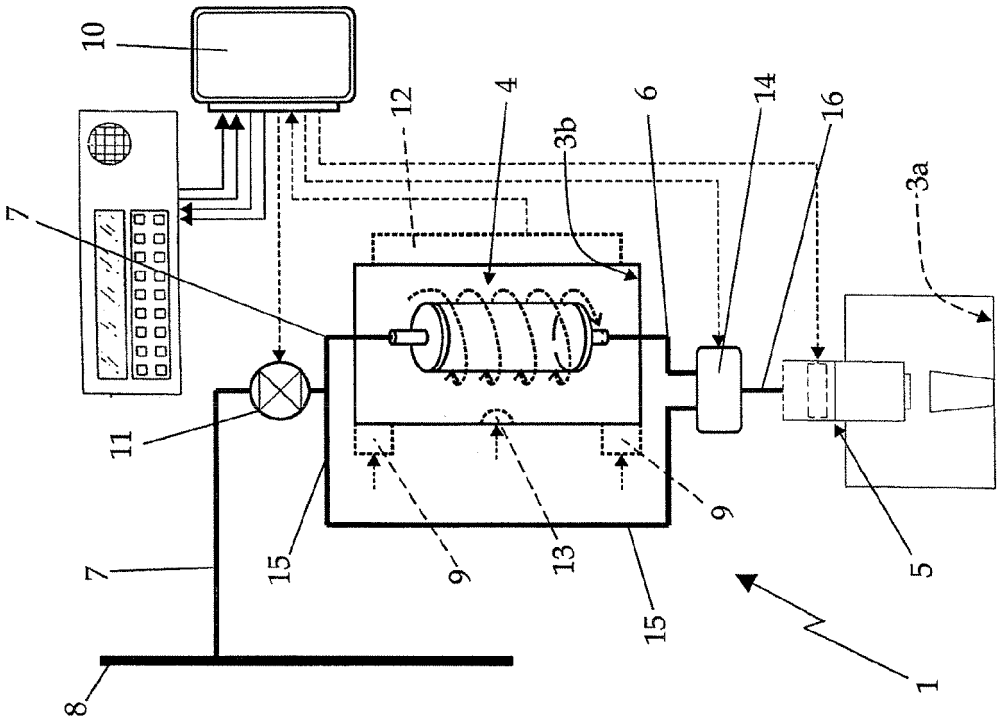

Fig. 3

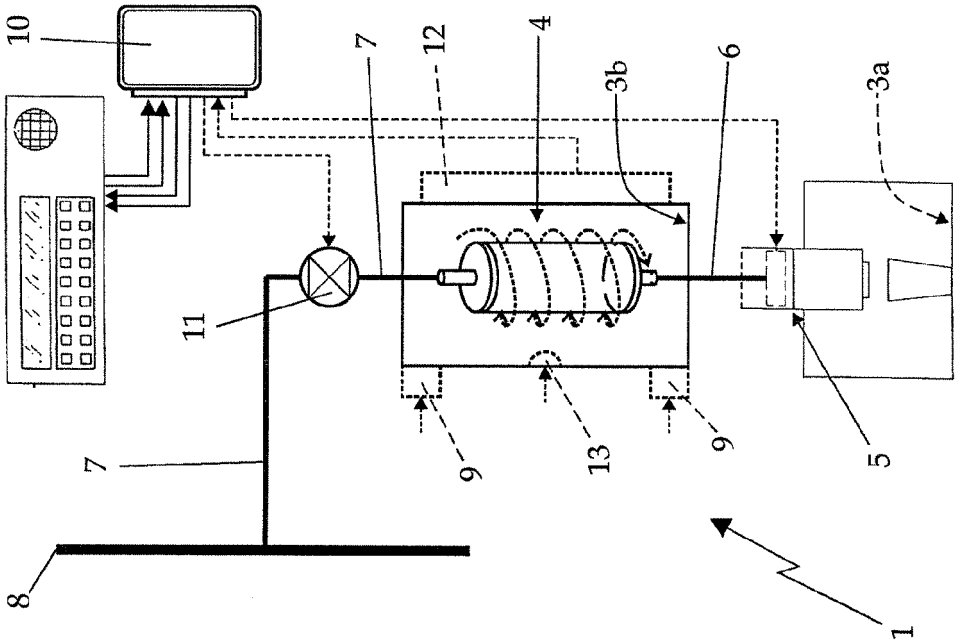

Fig. 2

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	27 February 2007	CORREIA DOS REIS, I

CATEGORY OF CITED DOCUMENTS

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EUROPEAN SEARCH REPORT

Application Number
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