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(54) **Household appliance for the controlled supplying of cooled water or other beverage, and relative operating method**

(57) A household appliance (1) for the controlled supplying of cooled water or other beverage, and having a beverage container (9) to store a given amount of drinkable water or other beverage; a beverage container cooling system (4, 8) for cooling the drinkable water or other beverage stored in the beverage container (9); and an electronic central control unit (19) which calculates the estimated temperature (T_2) of the cooled drinkable water or other beverage currently stored in the beverage container (9), on the basis of a mathematical model describing the cooling capacity of the environment (4, 8) surrounding the beverage container (9).

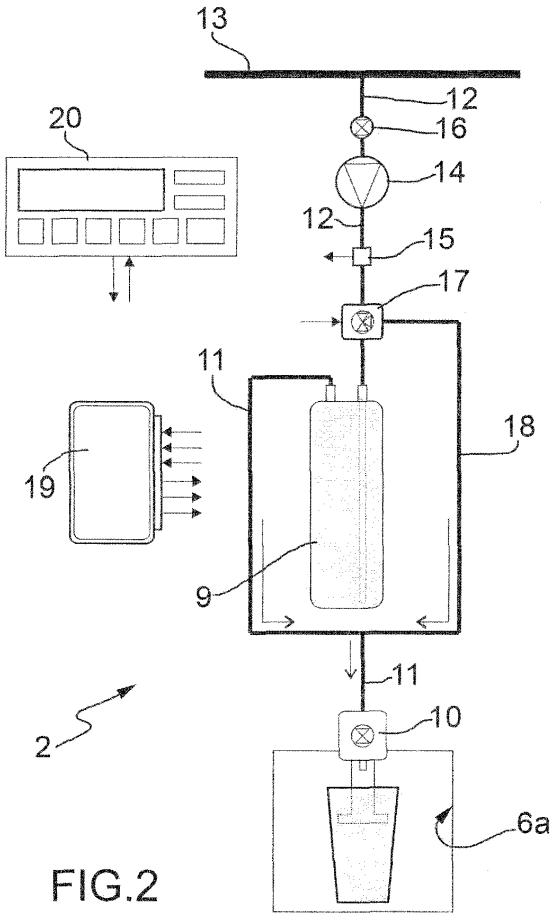

FIG.2

EP 2 093 529 A1

Description

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

[0002] More specifically, the present invention relates to a home refrigerator with an integrated cooled-drink dispenser for the controlled supplying of cooled water or other beverage at a given temperature, to which the following description refers purely by way of example.

[0003] As is known, some home refrigerator models have a cooled-drink dispenser built into the door to dispense, on command, cooled water at a temperature normally ranging between +5°C and +13°C.

[0004] More specifically, the cooled-drink dispenser generally comprises a tank filled manually by the user with the water or other beverage to be dispensed; and a draw valve located in a recess formed in the outer surface of the refrigerator door. The recess is designed to house a drinkable glass or similar container, and the draw valve is connected to the bottom of the tank by a connecting pipe, and is designed to only permit controlled outflow of the water or other beverage from the tank into the beverage dispensing recess underneath, when the recess is engaged by a drinkable glass or other container to receive the beverage.

[0005] Depending on where it is located inside the refrigerator, the tank may be cooled by the cold air circulating inside the refrigerated compartment of the refrigerator, or by an auxiliary heat exchanger integrated in the heat-pump cooling circuit of the refrigerator.

[0006] Obviously, in the first solution, the temperature of the water in the tank depends directly on the temperature maintained inside the refrigerated compartment by the cooling circuit of the refrigerator; whereas, in the second solution, the cooling circuit of the refrigerator is capable of maintaining the tank at a predetermined reference temperature, regardless and independently of the temperature maintained inside the refrigerated compartment/s of the refrigerator.

[0007] To better satisfy user requirements, in the second solution, the cooling circuit of the cooled-drink dispenser may operate to maintain the tank at a given reference temperature user-selectable manually from a control panel on the refrigerator door.

[0008] Unfortunately, in the second solution, the cooled-drink dispenser can only cater to the water temperature preference of one user, because the amount of water stored in the refrigerated tank (usually 2 or 3 litres) takes a long time to change temperature. Moreover, the cooling circuit of the cooled-drink dispenser fails to provide for rapidly increasing the temperature of the water stored in the tank, in the event the next user desires water at a slightly higher temperature than that set by the previous user.

[0009] It is an object of the present invention to provide a home refrigerator with a cooled-drink dispenser designed to eliminate the aforementioned drawbacks.

[0010] According to the present invention, there is provided a household appliance for the controlled supplying of cooled water or other beverage as claimed in Claim 1 and preferably, though not necessarily, in any one of the dependent Claims.

[0011] According to the present invention, there is also provided a method of operating a household appliance for the controlled supplying of cooled water or other beverage.

[0012] 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, with semitransparent parts and parts removed for clarity, of the top portion of a home refrigerator in accordance with the teachings of the present invention;

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

Figures 3 and 4 show two temperature charts illustrating operation of the cooled-drink dispenser integrated in the Figure 1 refrigerator;

Figure 5 shows schematically a first variation of the Figure 1 cooled-drink dispenser;

Figure 6 shows schematically a second variation of the Figure 1 cooled-drink dispenser.

[0013] With reference to Figure 1, number 1 indicates as a whole a household appliance for the controlled supplying of cooled water or other beverage.

[0014] More specifically, in the example shown household appliance 1 is a home refrigerator 1 incorporating a cooled-drink dispenser 2 for controlled supply of cooled drinkable water or other beverage at a given temperature above 0°C and preferably, though not necessarily, ranging between +5°C and +20°C.

[0015] With reference to figure 1, in the example shown, refrigerator 1 comprises a rigid, self-supporting, substantially parallelepiped-shaped casing 3 having two superimposed refrigerated inner compartments 4 and 5, each of which is lined with thermally insulating material and communicates with the outside through a respective access opening formed in the vertical front wall of casing 3.

[0016] Refrigerator 1 also comprises two doors 6 and 7 hinged, one over the other, to the vertical front wall of casing

3 to rotate, about a preferably, though not necessarily, common vertical axis, to and from a closed position, in which each rests against the vertical front wall of casing 3 to close the access opening to, and hermetically seal from the outside, a respective refrigerated compartment 4, 5.

[0017] With reference to Figure 1, refrigerator 1 also comprises a heat-pump cooling circuit 8 (shown partly in Figure 1) which transfers heat from one fluid to another by exploiting the changes in state of an intermediate gas refrigerant subjected to a closed thermodynamic cycle, and which is designed to bring each refrigerated compartment 4, 5 to, and keep it at, a respective predetermined reference temperature normally lower than the outside temperature.

[0018] The reference temperature is user-selectable within a predetermined temperature range.

[0019] More specifically, in the example shown, heat-pump cooling circuit 8 is designed to keep refrigerated compartment 4 (i.e. the top compartment of the refrigerator) at a reference temperature ranging between +1°C and +10°C and preferably, though not necessarily, between +2°C and +8°C, so refrigerated compartment 4 is suitable for preserving non-freezable perishable foodstuffs; and to keep refrigerated compartment 5 (i.e. the bottom compartment of the refrigerator) at a lower reference temperature than refrigerated compartment 4 (i.e. below 0°C) and preferably, though not necessary, ranging between -2°C and -20°C, so refrigerated compartment 5 is suitable for freezing perishable foodstuffs and/or producing ice.

[0020] In other words, top refrigerated compartment 4 constitutes the "fresh-food compartment", and bottom refrigerated compartment 5 the "frozen-food compartment" of refrigerator 1.

[0021] Casing 3, doors 6 and 7, and heat-pump cooling circuit 8 are commonly known parts in the industry and therefore not described in detail.

[0022] In the example shown, cooled-drink dispenser 2 is integrated in the top door 6 of refrigerator 1, but may obviously be located on the vertical front wall of casing 3, beside top door 6 or bottom door 7 of refrigerator 1.

[0023] With reference to Figures 1 and 2, cooled-drink dispenser 2 comprises a tank 9 for temporarily storing drinkable water or any other beverage to be dispensed; and a draw valve 10, which is housed in a drink dispensing recess 6a formed in the outer surface of top door 6, is connected to tank 9 by a connecting pipe 11, and is designed to only permit controlled outflow of water or other beverage from tank 9 to recess 6a when recess 6a is engaged by a glass or other container to receive the water.

[0024] More specifically, tank 9 is housed inside refrigerated compartment 4, i.e. the fresh-food compartment 4, of refrigerator 1, next to the fan that circulates the cold air in fresh-food compartment 4 through the evaporator of heat-pump cooling circuit 8, so that the cold air also flows over the outer surfaces of tank 9 to cool and keep the water or other beverage in tank 9 at the reference temperature of fresh-food compartment 4.

[0025] Obviously, in a different embodiment, tank 9 may be housed inside an auxiliary compartment formed inside casing 3 or door 6, near recess 6a, and said auxiliary compartment may be cooled either by heat-pump cooling circuit 8, or by an independent cooling system such as a Peltier-effect cooling system.

[0026] With reference to Figure 2, cooled-drink dispenser 2 also comprises a second connecting pipe 12 permanently connecting tank 9 to a generic external source 13 of drinkable water or other beverage preferably, though not necessarily, at ambient temperature, so that tank 9 is always completely filled with drinkable water or other beverage; an electric supply pump 14, along connecting pipe 12, for feeding drinkable water or other beverage, on command, along connecting pipe 12 at a given flow rate; a temperature detecting device 15 for determining the instantaneous temperature of the drinkable water or other beverage flowing along connecting pipe 12; and preferably, though not necessarily, an on-off valve 16 for isolating connecting pipe 12, on command, from source 13 to cut off flow of the drinkable water or other beverage.

[0027] More specifically, in the example shown, on-off valve 16 and temperature detecting device 15 are located upstream and downstream from pump 14, respectively; and source 13 is defined by the drinkable water circuit of the building in which refrigerator 1 is located.

[0028] Obviously, source 13 may also consist of a common pressurized container storing a given quantity of drinkable water or other beverage.

[0029] With reference to Figure 2, along connecting pipe 12, downstream from temperature detecting device 15 and upstream from tank 9, cooled-drink dispenser 2 also comprises an electrically operated hydraulic distributor 17 designed, on command, to channel a given part of the drinkable water or other beverage flowing along connecting pipe 12, to an auxiliary connecting pipe 18 which bypasses tank 9 and terminates directly inside connecting pipe 11, so as to divert at least part of the ambient-temperature water or other beverage from source 13 directly to draw valve 10.

[0030] More specifically, in the example shown, the end of auxiliary connecting pipe 18 is branch connected to connecting pipe 11, and hydraulic distributor 17 consists of a three-way electrovalve 17 having the inlet connected to connecting pipe 12, and the two outlets connected respectively to tank 9 and auxiliary connecting pipe 18, so that all the drinkable water or other beverage flowing along connecting pipe 12 can be channeled, on command, to tank 9 or auxiliary connecting pipe 18.

[0031] With reference to figure 2, cooled-drink dispenser 2 also comprises an electronic central control unit 19, which controls hydraulic distributor 17 on the basis of signals from temperature detecting device 15, and the selected temper-

ature of the drinkable water or other beverage to be supplied by cooled-drink dispenser 2; and a user control panel 20, by which to communicate to central control unit 19 the selected temperature T_0 of the drinkable water or other beverage to be supplied by cooled-drink dispenser 2.

[0032] In particular, detecting device 15 measures the instantaneous current temperature T_1 of the incoming drinkable water or other beverage from source 13; and control unit 19 calculates the estimated current temperature T_2 of the drinkable water or other beverage in tank 9 on the basis of a tank cooling system mathematical model, which is specific for each model of refrigerator 1, and which describes the temperature T_2 pattern of the drinkable water or other beverage in tank 9 as a function of the time lapsed since draw-off of the last drink, and as a function of the temperature and amount of ambient-temperature drinkable water or other beverage fed into tank 9 from source 13 when drawing off the last drink, taking into account the real cooling capacity of the environment surrounding tank 9 (i.e. the tank cooling system formed, in the example shown, by fresh-food compartment 4 and heat-pump cooling circuit 8).

[0033] More specifically, in the examples shown, control unit 19 calculates the estimated current temperature T_2 of the drinkable water or other beverage in tank 9 on the basis of a given number of experimentally-obtained work curves stored in control unit 19, and which describe the patterns of temperature T_2 as a function of the time lapsed since draw-off of the last drink (Figure 4); and the patterns of temperature T_2 as a function of the temperature T_1 and of the amount M_x of cold water or other beverage last drawn off from tank 9 (Figure 3).

[0034] The cold water or other beverage drawn from tank 9, in fact, is systematically replaced (either instantaneously or belatedly) by an equal amount of ambient-temperature water or other beverage from source 13. Ambient-temperature water or other beverage which has the temperature T_1.

[0035] In fact, with reference to Figure 3, assuming that, immediately before the supply of the drink, the water or other beverage stored in tank 9 is at a given minimum temperature depending on the environment surrounding tank 9 (i.e. the temperature of fresh-food compartment 4), the temperature T_2 of the water or other beverage stored in tank 9, after dispensing the drink, rises to a value T_2' which depends on the amount M_x of ambient-temperature water or other beverage from source 13 that enters in tank 9 to replace the cold water or other beverage drawn off from tank 9, and on the actual temperature T_1 of the ambient-temperature water or other beverage arriving from source 13.

[0036] Having a sufficient number of experimentally-obtained curves of the temperature T_2' pattern as a function of the amount M_x of cold water or other beverage drawn off from tank 9, each for a specific value of the temperature T_1 of the water or other beverage arriving from source 13 (two temperature T_2' patterns are shown in Figure 3, one for temperature T_1 equal to 14°C and the other for temperature T_1 equal to 22°C), control unit 19 can calculate, immediately after having dispensed a drink, the estimated current temperature T_2' of the drinkable water or other beverage in tank 9 on the basis of the amount M_x of cold water or other beverage drawn off from tank 9, and of the actual temperature T_1 of the water or other beverage entering in tank 9 from source 13.

[0037] Whereas, with reference to Figure 4, the time which cold water or other beverage stored in tank 9 takes to return to the given minimum temperature of the environment surrounding tank 9 (i.e. the temperature of fresh-food compartment 4), depends on the cooling capacity of the environment surrounding tank 9 (i.e. the tank cooling system formed, in the example shown, by fresh-food compartment 4 and heat-pump cooling circuit 8), and it is a function of the temperature T_2' of the drinkable water or other beverage stored in tank 9 immediately after having dispensed last drink, and of the time lapsed since the supply of the last drink.

[0038] Having a sufficient number of experimentally-obtained curves of the temperature T_2 time pattern, each for a specific temperature T_2' starting value (two temperature T_2 time patterns are shown in Figure 4, one for a temperature T_2' starting value of 15°C and the other for a temperature T_2' starting value of 20°C), control unit 19 can calculate the estimated current temperature T_2 of the drinkable water or other beverage in tank 9 when a new drink is requested, on the basis of lapsed time since draw-off of the last drink.

[0039] In addition to the above, after extrapolating the estimated current temperature T_2 of the drinkable water or other beverage in tank 9, electronic central control unit 19, implementing the calculating method referred below, is able to determine the amount M_1 of drinkable water or other beverage at temperature T_1 from source 13, and the amount M_2 of cold water or other beverage at temperature T_2 from tank 9, to be mixed to obtain the drinkable water or other beverage at the user-selected temperature T_0 from draw valve 10; and then to drive hydraulic distributor 17 to selectively split between tank 9 and auxiliary connecting pipe 18 the drinkable water or other beverage flowing along connecting pipe 12, so as to channel to draw valve 10 the calculated amount M_1 of drinkable water or other beverage at temperature T_1, and the calculated amount M_2 of drinkable water or other beverage at estimated temperature T_2.

[0040] More specifically, given the flow rate of the ambient-temperature water or other beverage fed along connecting pipe 12 by electric supply pump 14, electronic central control unit 19 drives, or rather quickly switches, three-way electrovalve 17 so that the drinkable water or other beverage flowing along connecting pipe 12 is selectively channeled to tank 9 or directly to draw valve 10 according to the calculated amounts M_1 and M_2. In fact, the flow rate of the water or other beverage along connecting pipe 12 being known and constant, the amount M_2 of drinkable water or other beverage channeled to tank 9 is a direct function of the time interval in which hydraulic distributor 17 connects pipe 12 to tank 9; and the amount M_1 of drinkable water or other beverage channeled directly to draw valve 10 is a direct function

of the time interval in which hydraulic distributor 17 connects pipe 12 to auxiliary connecting pipe 18.

[0041] Operation of household appliance 1 as a whole, i.e. home refrigerator 1, is clearly inferable from the above description, with no further explanation required, whereas operation of cooled-drink dispenser 2 will now be described, assuming the user has already communicated to control unit 19, via control panel 20, the selected temperature T_0 of the drinkable water or other beverage to be supplied immediately by cooled-drink dispenser 2.

[0042] On receiving the selected temperature T_0 of the drinkable water or other beverage to be dispensed, electronic central control unit 19 determines the current temperature T_1 of the drinkable water or other beverage from source 13 via temperature detecting device 15, and calculates, using the tank cooling system mathematical model, the estimated current temperature T_2 of the drinkable water or other beverage in tank 9 on the basis of the time lapsed since draw-off of last drink by cooled-drink dispenser 2; of the temperature T_1 of the drinkable water or other beverage from source 13 at the time of last drink draw-off; and of the amount M_x of cold water or other beverage drawn from tank 9 during draw-off of the last drink by cooled-drink dispenser 2.

[0043] After calculating the estimated temperature T_2 of the drinkable water or other beverage currently stored in tank 9, electronic central control unit 19 determines the amounts M_1 and M_2 of drinkable water or other beverage to be channeled to draw valve 10, on the basis of the following two-equation system:

$$M_1 \cdot T_1 + M_2 \cdot T_2 = (M_1 + M_2)\ T_0$$

$$M_1 + M_2 = K$$

where K is a predetermined constant value preferably, though not necessarily, equal to 100 milliliters; T_0 is the selected temperature of the drinkable water or other beverage to be supplied by cooled-drink dispenser 2; T_1 is the current temperature of the drinkable water or other beverage from source 13; and T_2 is the estimated current temperature of the cooled drinkable water or other beverage stored in tank 9.

[0044] Finally, on the basis of the calculated amounts M_1 and M_2 of drinkable water or other beverage to be channeled to, and mixed in, draw valve 10, and the flow rate of the ambient-temperature water or other beverage flowing along connecting pipe 12, electronic central control unit 19 activates supply pump 14 and regulates the switching time of three-way electrovalve 17 so that the calculated amounts M_1 and M_2 of drinkable water or other beverage are channeled to auxiliary connecting pipe 18 and tank 9 respectively.

[0045] In other words, since auxiliary connecting pipe 18 is connected directly to draw valve 10, and the ambient-temperature water or other beverage channeled into tank 9 by hydraulic distributor 17 feeds out of tank 9 an equal amount of cold water or other beverage via connecting pipe 11, electronic central control unit 19 regulates the switching time of three-way electrovalve 17 to channel the calculated amounts M_1 and M_2 of drinkable water or other beverage to draw valve 10, and so supply the user with cooled water or other beverage at user-selected temperature T_0.

[0046] The advantages of cooled-drink dispenser 2 are obvious: it provides for supplying drinks at different user-selected temperatures in a low-cost manner, and with no need for auxiliary heating devices.

[0047] Clearly, changes may be made to household appliance 1 as described herein without, however, departing from the scope of the present invention.

[0048] For example, with reference to Figure 5, electrically operated hydraulic distributor 17 may be located along connecting pipe 11, upstream from draw valve 10.

[0049] In which case, one of the two outlets of hydraulic distributor 17 is connected to connecting pipe 11; the other outlet of hydraulic distributor 17 is connected to the bottom end of auxiliary connecting pipe 18; and the inlet of hydraulic distributor 17 is connected to draw valve 10. Lastly the top end of auxiliary connecting pipe 18 is branch connected to connecting pipe 12.

[0050] In a further non shown embodiment, electric supply pump 14 may be replaced by a flow rate detecting device for measuring the current flow rate of drinkable water or other beverage along connecting pipe 12, and by an electrovalve for controlling outflow of ambient-temperature drinkable water or other beverage along connecting pipe 12. Obviously, the electrovalve is controlled by electronic central control unit 19, and selectively opened for drink supply by cooled-drink dispenser 2; whereas three-way electrovalve 17 is driven on the basis of signals from the flow rate detecting device.

[0051] With reference to Figure 6, in a much more sophisticated embodiment, electric supply pump 14 is removed from cooled-drink dispenser 2, and the two ends of auxiliary connecting pipe 18 are branch connected respectively to connecting pipe 11, and to connecting pipe 12.

[0052] In which case, electrically operated hydraulic distributor 17 comprises two independent electro-valves 17' and 17" located one along connecting pipe 12, downstream from the connection between connecting pipe 12 and auxiliary connecting pipe 18 and upstream from tank 9, and the other along auxiliary connecting pipe 18, for separately and independently controlling the flow of ambient-temperature drinkable water or other beverage from source 13 to tank 9,

and from source 13 to auxiliary connecting pipe 18.

[0053] Both electro-valves 17' and 17" are controlled by electronic central control unit 19 independently one form the other, and cooled-drink dispenser 2 also comprises two flow rate detecting devices 21 which are located along connecting pipe 12 and, respectively, auxiliary connecting pipe 18, downstream from corresponding electro-valves 17' and 17", for measuring the current flow rate of the drinkable water or other beverage flowing towards tank 9 and along connecting pipe 18.

[0054] Obviously, central control unit 19 drives both electro-valve 17' and 17" on the basis of the signals from the two flow rate detecting devices 21, and from the temperature detecting device 15 which is still located along connecting pipe 12, preferably, though not necessarily, upstream from the connection between connecting pipe 12 and auxiliary connecting pipe 18.

[0055] In combination with all the embodiments referred above, household appliance 1 may also consist of a stand-alone beverage dispenser, a food and/or beverage vending machine or any other kind of beverage dispensing apparatus.

Claims

1. Household appliance (1) for the controlled supplying of cooled water or other beverage, and comprising:

- a beverage container (9) to store a given amount of drinkable water or other beverage,
- a beverage container cooling system (4, 8) for cooling the drinkable water or other beverage stored in the beverage container (9),
- a first connecting pipe (12) connecting said beverage container (9) to a beverage source (13) supplying drinkable water or other beverage at a generic temperature, and
- a user-controlled draw device (10) connected to said beverage container (9) to control outflow of the cooled drinkable water or other beverage;

said household appliance (1) being **characterized by** also comprising :

- a temperature detecting device (15) for detecting the current temperature (T_1) of the drinkable water or other beverage arriving from said beverage source (13),
- electrically-operated mixing means (17, 18) for mixing, on command, a given amount of the drinkable water or other beverage arriving directly from said beverage source (13), and a given amount of the cold water or other beverage flowing out of the beverage container (9) to said user-controlled draw device (10), and
- an electronic central control unit (19), which calculates the estimated current temperature (T_2) of the cooled drinkable water or other beverage in the beverage container (9) on the basis of a given mathematical model describing the cooling capacity of the beverage container cooling system (4, 8); said central control unit (19) also calculating, according to a given algorithm, and on the basis of the selected temperature (T_0) of the drinkable water or other beverage to be supplied by said household appliance (1), of the temperature (T_1) of the drinkable water or other beverage arriving directly from the beverage source (13), and of the estimated current temperature (T_2) of the cooled drinkable water or other beverage stored in the beverage container (9), a first amount (M_1) of drinkable water or other beverage arriving directly from the beverage source (13), and a second amount (M_2) of cold water or other beverage from the beverage container (9), to be mixed together to obtain drinkable water or other beverage at the specific user-selected temperature (T_0) from the draw device (10), and driving said electrically-operated mixing means (17, 18) to supply said draw device (10) with said first amount (M_1) of drinkable water or other beverage arriving directly from the beverage source (13), and said second amount (M_2) of cold water or other beverage from the beverage container (9).

2. A household appliance as claimed in Claim 1,
characterized by also comprising a user control panel (20) by which to communicate to said central control unit (19) the selected temperature (T_0) of the drinkable water or other beverage to be dispensed.

3. A household appliance as claimed in Claim 1 or 2,
characterized in that said electrically-operated mixing means (17, 18) are designed to channel, on command, directly to said draw device (10), at least part of the drinkable water or other beverage flowing along the first connecting pipe (12).

4. A household appliance as claimed in Claim 3,
characterized in that said electrically-operated mixing means (17, 18) comprise an electrically-operated hydraulic distributor (17) located along said first connecting pipe (12); and an auxiliary connecting pipe (18) connecting said electrically-operated hydraulic distributor (17) to said draw device (10) and bypassing the beverage container (9).

5. A household appliance as claimed in Claim 3, **characterized in that** said electrically-operated mixing means (17, 18) comprise an electrically-operated hydraulic distributor (17) interposed between the beverage container (9) and the draw device (10); and an auxiliary connecting pipe (18) connecting said electrically-operated hydraulic distributor (17) to said first connecting pipe (12) and by-passing said beverage container (9).

6. A household appliance as claimed in Claim 4 or 5, **characterized in that** said hydraulic distributor (17) is a three-way electrovalve (17).

7. A household appliance as claimed in any of the foregoing Claims, **characterized in that** said cooled-drink dispenser (2) comprises pumping means (14) for feeding the drinkable water or other beverage along said first connecting pipe (12) at a given flow rate; said central control unit (19) also driving said electrically-operated mixing means (17, 18) on the basis of said flow rate.

8. A household appliance as claimed in any of Claims 1 to 6, **characterized by** also comprising means for measuring the flow rate of the drinkable water or other beverage along said first connecting pipe (12); and means for controlling outflow of the drinkable water or other beverage along said first connecting pipe (12); said means for controlling outflow of the drinkable water or other beverage along said first connecting pipe (12) being controlled by said central control unit (19).

9. A household appliance as claimed in Claim 4, **characterized in that** said hydraulic distributor (17) comprises two electrovalves (17', 17") located one along said auxiliary connecting pipe (18), and the other along said first connecting pipe (12), downstream from the connection between said first connecting pipe (12) and said auxiliary connecting pipe (18); said two electrovalves (17', 17") being able to separately and independently control the flow of drinkable water or other beverage from the beverage source (13) to the beverage container (9), and from the beverage source (13) to the auxiliary connecting pipe (18).

10. A household appliance as claimed in Claims 9, **characterized by** also comprising means (21) for measuring the flow rate of the drinkable water or other beverage flowing into said beverage container (9), and along said auxiliary connecting pipe (18); said two electrovalves (17', 17") being controlled by said central control unit (19) on the basis of the signals from said means (21) for measuring the flow rate of the drinkable water or other beverage flowing into said beverage container (9) and along said auxiliary connecting pipe (18).

11. A household appliance as claimed in any of the foregoing Claims, **characterized in that** said household appliance is a refrigerator (1) and the beverage container (9) is housed inside a refrigerated compartment (4) of said refrigerator (1).

12. A method of operating a household appliance (1) for the controlled supplying of cooled water or other beverage, and comprising:

- a beverage container (9) to store a given amount of drinkable water or other beverage,
- a beverage container cooling system (4, 8) for cooling the drinkable water or other beverage stored in the beverage container (9),
- a first connecting pipe (12) connecting said beverage container (9) to an beverage source (13) supplying drinkable water or other beverage at a generic temperature, and
- a user-controlled draw device (10) connected to said beverage container (9) to control outflow of the cooled drinkable water or other beverage into a glass or other generic receptacle;
- a temperature detecting device (15) for determining the current temperature (T_1) of the drinkable water or other beverage arriving from said beverage source (13), and
- electrically-operated mixing means (17, 18) for mixing, on command, a given amount of the drinkable water or other beverage flowing directly arriving from said beverage source (13), and a given amount of the cold water or other beverage flowing out of the beverage container (9) to said user-controlled draw device (10);

said method being **characterized by** comprising the steps of:

- measuring the temperature (T_1) of the drinkable water or other beverage from said beverage source (13);
- calculating an estimated current temperature (T_2) of the cooled drinkable water or other beverage in the beverage container (9) on the basis of a given mathematical model describing the cooling capacity of the environment (4, 8) surrounding the beverage container (9);

- calculating, according to a given algorithm, and on the basis of the current temperature (T_1) of the drinkable water or other beverage from the beverage source (13), and of the estimated current temperature (T_2) of the cooled drinkable water or other beverage in the beverage container (9), a first amount (M_1) of ambient-temperature drinkable water or other beverage from the beverage source (13), and a second amount (M_2) of cold water or other beverage from the beverage container (9), to be mixed together to obtain drinkable water or other beverage at a specific user-selected temperature (T_0) from the draw device (10); and
- driving said electrically-operated mixing means (17, 18) to supply said draw device (10) with said first amount (M_1) of drinkable water or other beverage from the beverage source (13), and said second amount (M_2) of cold water or other beverage from the beverage container (9).

13. A method as claimed in Claim 12, **characterized in that** said first amount (M_1) of drinkable water or other beverage from the beverage source (13), and said second amount (M_2) of cold water or other beverage from the beverage container (9), are determined on the basis of the following two-equation system:

$$M_1 \cdot T_1 + M_2 \cdot T_2 = (M_1 + M_2)\ T_0$$

$$M_1 + M_2 = K$$

where K is a predetermined constant value, T_0 is the selected temperature of the drinkable water or other beverage to be supplied by the household appliance (1), T_1 is the current temperature of the drinkable water or other beverage from the beverage source (13), and T_2 is the estimated current temperature of the cooled drinkable water or other beverage stored in the beverage container (9).

14. A method as claimed in Claim 12 or 13,
characterized in that said household appliance (1) is a refrigerator.

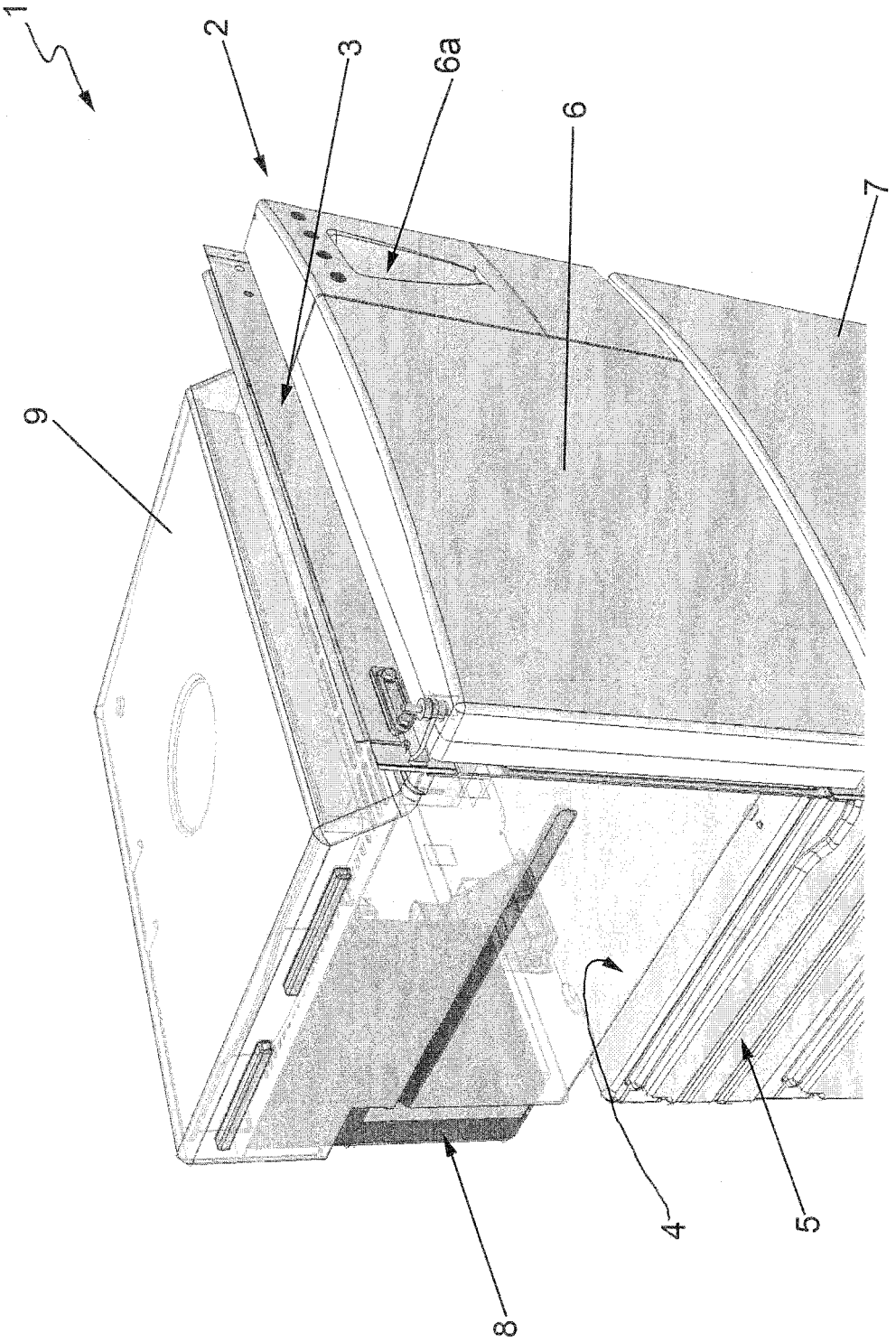

FIG.1

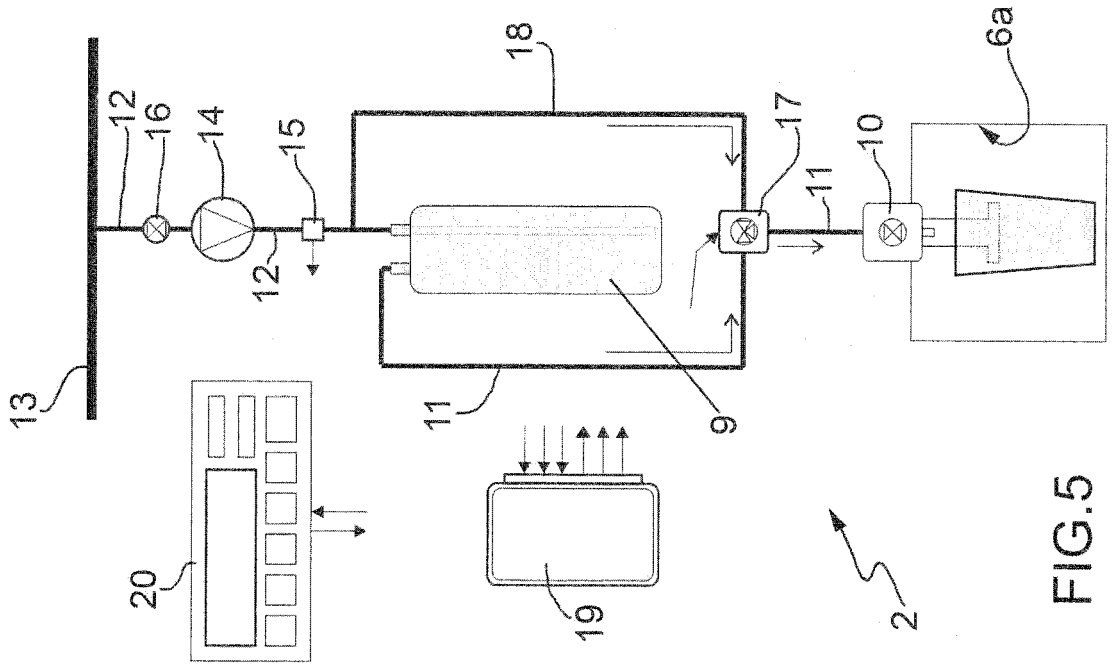
18
6a
12
16
14
15
17
10
11
12
13
11
9
20
19
2

FIG.5

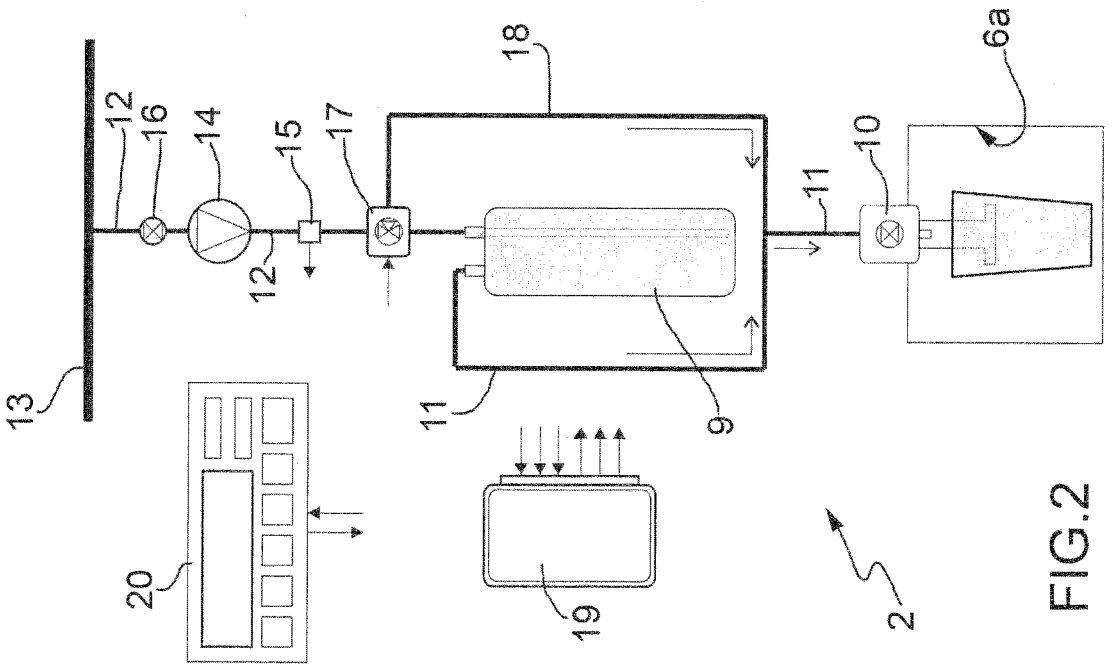
18
6a
12
16
14
15
17
10
11
12
13
11
9
20
19
2

FIG.2

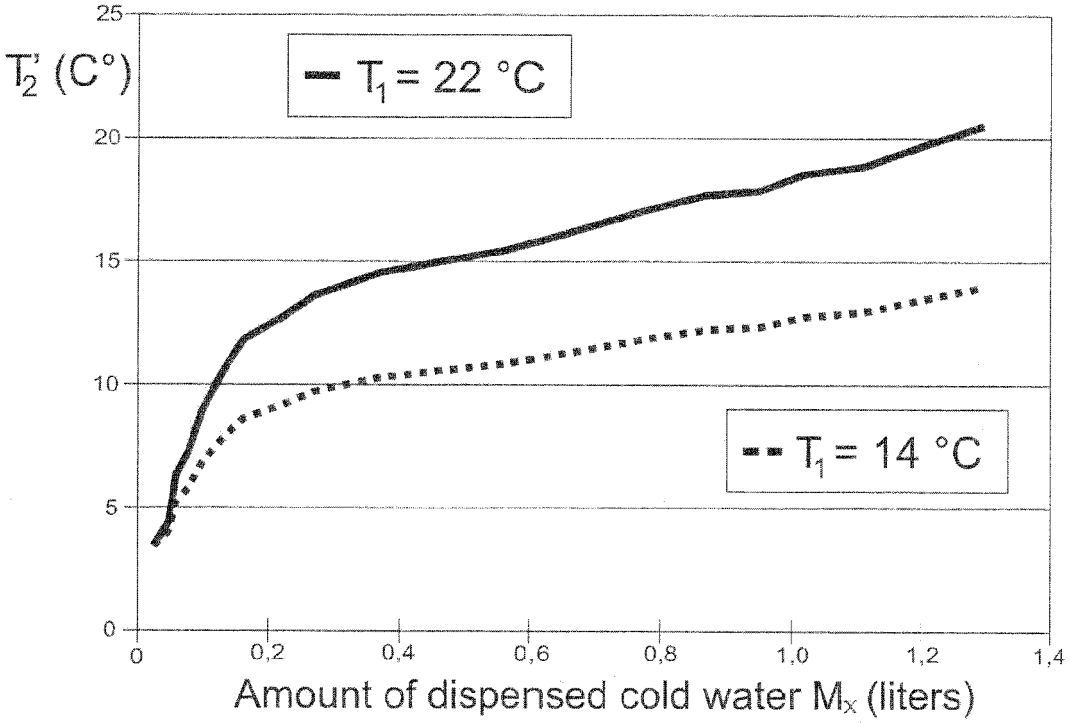
T2' (C°)
T1 = 22 °C
T1 = 14 °C
25
20
15
10
5
0
0
0,2
0,4
0,6
0,8
1,0
1,2
1,4
Amount of dispensed cold water Mx (liters)

FIG.3

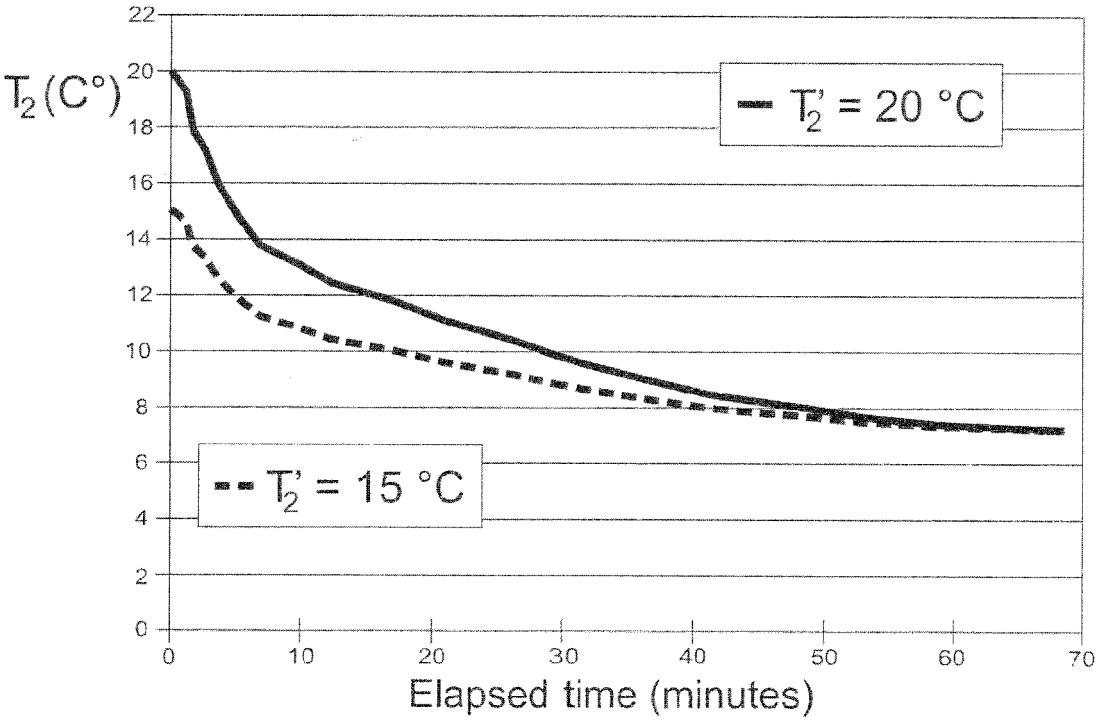
T2 (C°)
T2' = 20 °C
T2' = 15 °C
22
20
18
16
14
12
10
8
6
4
2
0
0
10
20
30
40
50
60
70
Elapsed time (minutes)

FIG.4

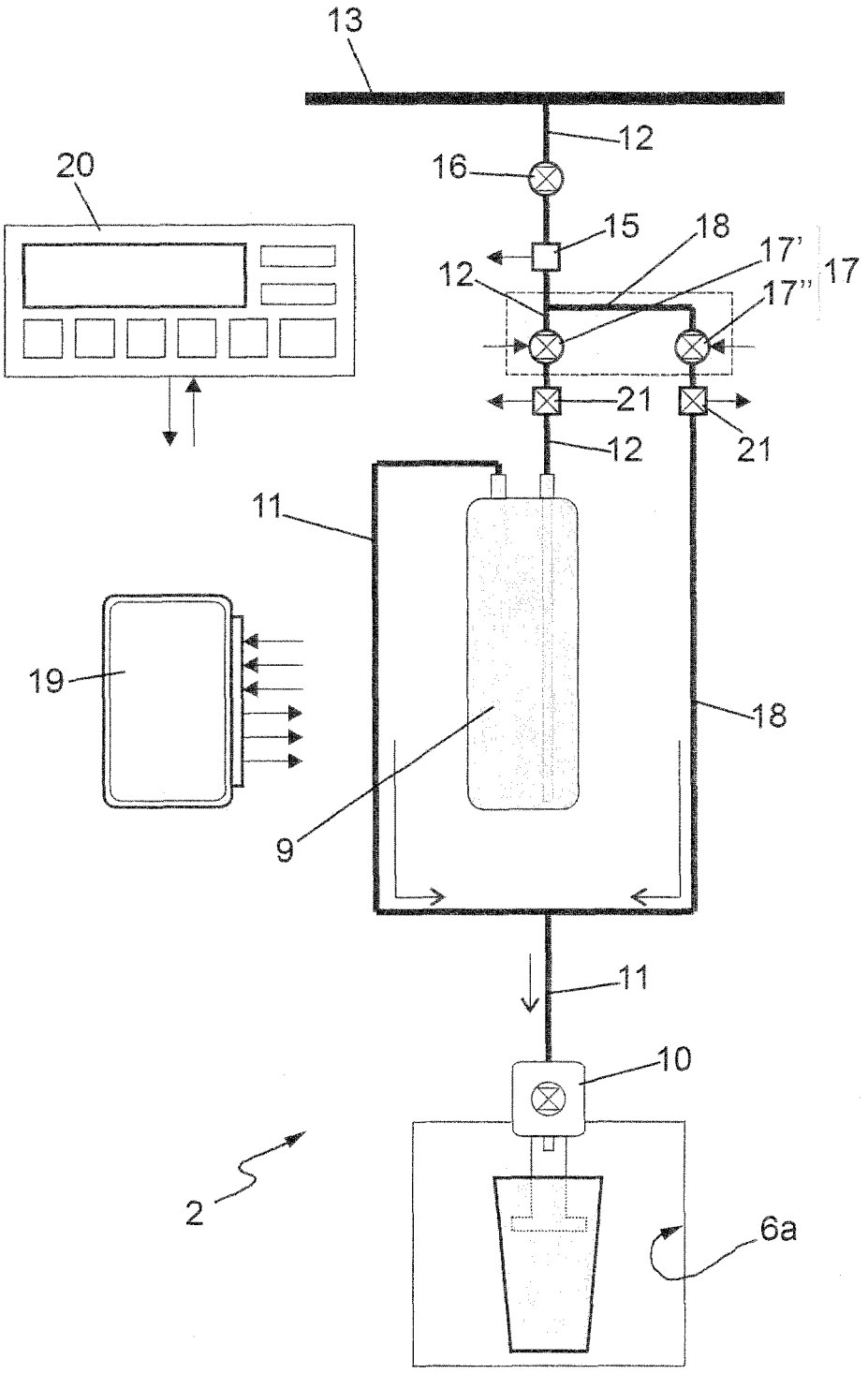

FIG.6

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EUROPEAN SEARCH REPORT

Application Number
EP 08 15 1713

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	GB 2 329 460 A (LG ELECTRONICS INC [KR]) 24 March 1999 (1999-03-24) * the whole document *	1,12	INV. F25D23/12
A	EP 1 614 986 A (DAEWOO ELECTRONICS CORP [KR]) 11 January 2006 (2006-01-11) * the whole document *	1,12	

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	2 June 2008	Jessen, Flemming

CATEGORY OF CITED DOCUMENTS

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2

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02-06-2008

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
GB 2329460 A	24-03-1999	AU 730337 B2	01-03-2001
		AU 4930897 A	15-04-1999
		CA 2225836 A1	23-03-1999
		CN 1212356 A	31-03-1999
		JP 11108550 A	23-04-1999
		US 5956967 A	28-09-1999
EP 1614986 A	11-01-2006	NONE	

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82