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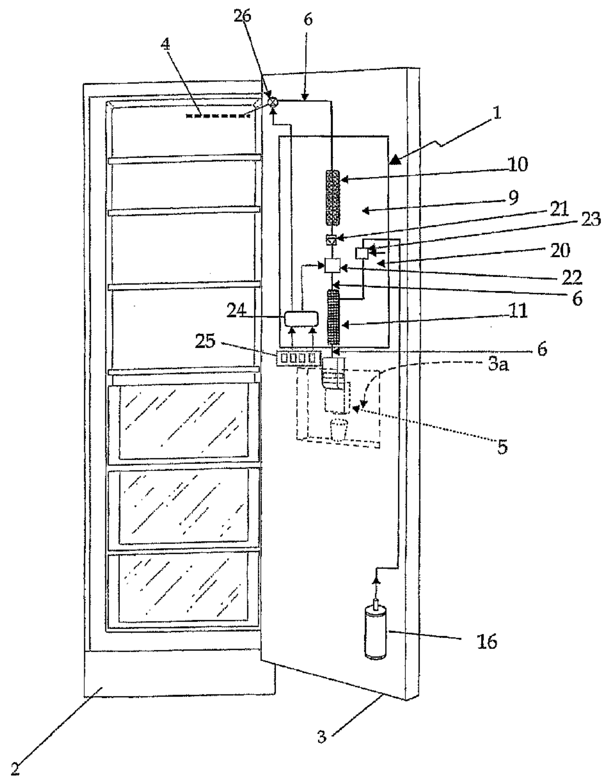

Fig. 1

(57) Abstract: A cool drink dispenser (1) having a main pipe (6) connected to a supply source (4) to receive a beverage; a metering valve (5) connected to the main pipe (6) to receive the beverage, and designed to permit controlled outflow of the beverage from the main pipe (6) into a container positioned temporarily beneath the metering ' valve (5); an in-line cooling unit (10) located along the main pipe (6) to cool the beverage flowing along a first portion of the main pipe (6); and an in-line gas-adding unit (11) located along the main pipe (6) to add a gas to the beverage flowing along a second portion of the main pipe (6).

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COOL DRINK DISPENSER FOR HOME USE, AND REFRIGERATOR EQUIPPED WITH SUCH A DISPENSER

DESCRIPTION

The present invention relates to a cool drink dispenser for home use, and to a refrigerator equipped with such a drink dispenser.

More specifically, the present invention relates to a household refrigerator with a built-in dispenser for cool water with added gas; to which electric household appliance the following description refers purely by way of example.

As is known, household refrigerators have been marketed for some years now, in which the refrigeration compartment door has a built-in dispenser for dispensing, on command, a given quantity of cool sparkling water.

More specifically, dispensers of the above type normally comprise a tap for dispensing water at ambient temperature; a first water tank connected to the tap by a water feed pipe; and a cooling assembly for cooling the water in the first tank.

Dispensers of the above type also comprise a second tank, in turn substantially comprising a first inlet connected to the first tank by a pipe to receive pressurized cool water; a second inlet for pressurized carbon dioxide; and an outlet connected by a pipe to a metering valve located in a water dispensing recess formed in the outer surface of the refrigerator door to allow the user to draw sparkling water as required.

The dispenser also normally comprises two hand-operated metering valves also located in the recess. A first metering valve is connected by a pipe to the tap, and is hand-operated by the user to draw water at ambient temperature; and the second metering valve is connected to the first tank by a further pipe to dispense, on command, cool carbon-dioxide-free water.

Drink dispensers of the above type have the major drawback of being bulky, mainly on account of featuring two tanks, one for cooling the water, and one for adding carbon dioxide. In fact, being of roughly one- or ten-litre capacity, the two tanks combined are extremely bulky and seriously affect the overall size of the dispenser.

Another drawback of dispensers of the above type is the relatively long time taken to restore the cooling temperature of the water and/or the added carbon dioxide level in the water whenever the two tanks are emptied partly or completely. For example, when both tanks are partly emptied, it is necessary to add water to the first tank, wait for the water in the first tank to cool, feed the cooled water from the first tank to the second tank, add carbon dioxide to the water in the second tank, and wait for the water and carbon dioxide in the second tank to mix completely.

In addition to the above operating drawbacks, the two tanks are ideal receptacles for uncontrolled formation of mould and bacteria, with all the drawbacks this entails, in the event the cool drink dispenser is only used sporadically, and the water is left to stagnate inside the tanks for a prolonged period of time.

It is an object of the present invention to provide a refrigerator cool drink dispenser designed to eliminate the aforementioned drawbacks.

According to the present invention, there is provided a cool drink dispenser, as claimed in Claim 1 and preferably, though not necessarily, in any one of the dependent Claims.

According to the present invention, there is also provided a household refrigerator featuring a cool drink dispenser as claimed in Claim 11.

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 cool drink dispenser in accordance with the teachings of the present invention;

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

Figure 3 shows a schematic side view of an alternative embodiment of a in-line cooling unit integrated in the Figure 1 refrigerator;

Figure 4 shows a schematic side view of an alternative embodiment of a in-line carbonation unit integrated in the Figure 1 refrigerator; and

Figure 5 shows a schematic side view of an alternative embodiment of a in-line carbonation unit integrated in the Figure 1 refrigerator.

Number 1 in Figures 1 and 2 indicates as a whole a dispenser for dispensing cool drinks with added gas, e.g. carbon dioxide or similar, and which is particularly suitable for integration in a household refrigerator 2, preferably, though not necessarily, inside the swing door 3 of refrigerator 2.

Drink dispenser 1 comprises a main pipe 6 connected to a supply source 4 to receive a beverage - preferably, though not necessarily, water; and a metering valve 5 connected to main pipe 6 to receive the water or any other beverage, and designed to permit controlled outflow of water from main pipe 6 into a container positioned temporarily beneath metering valve 5.

In the Figure 1 example, metering valve 5 is located at a drink dispensing recess 3a formed in the outer surface of door 3 of refrigerator 2, is connected to main pipe 6 to receive water for dispensing, and is designed to permit controlled outflow of water from main pipe 6 to recess 3a, when a glass or other container for receiving the water engages recess 3a.

Unlike known drink dispensers, drink dispenser 1 comprises a cooling and carbonation device 9 located along main pipe 6 to cool the water flowing along a first portion of main pipe 6, and to add carbon dioxide to the water flowing along a second portion of main pipe 6.

More specifically, cooling and carbonation device 9 substantially comprises an in-line cooling unit 10 and an in-line carbonation unit 11, which are located in series along main pipe 6 to respectively cool and add carbon dioxide to the water flowing along main pipe 6.

More specifically, in-line cooling unit 10 is preferably, though not necessarily, located along main pipe 6 upstream from in-line carbonation unit 11, so as to cool the water along a first portion of main pipe 6 before the carbon dioxide is added.

In the Figure 2 example, in-line cooling unit 10 comprises an inlet 10a connected to the supply source 4 by a portion of pipe 6 to receive water at ambient temperature; and an outlet 10b supplying water at a predetermined cooled temperature preferably ranging between approximately 3 and 8 degrees centigrade.

More specifically, in the schematic example in Figure 2, in-line cooling unit 10 comprises a closed tubular member 12 housing the first portion of main pipe 6, which is defined by a water cooling pipe 13. Cooling pipe 13 extends inside tubular member 12 along a predetermined, e.g. spiral path, and is connected at one end to inlet 10a to receive water at ambient temperature, and at the other end to outlet 10b to supply cooled water.

Tubular member 12 also houses latent heat accumulating means 14, which absorb a certain amount of heat from cooling pipe 13 to lower the temperature of the water circulating inside cooling pipe 13.

In the example shown, heat accumulating means 14 comprise a certain amount of heat accumulating material, such as paraffin or any other similar material, which rapidly absorbs heat from the water flowing in cooling pipe 13 to cool the water to a predetermined cooling temperature. Paraffin, in fact, is known to melt above zero degrees centigrade, and, to change from solid to liquid, requires a relatively large amount of latent heat.

In-line cooling unit 10 also comprises a cooling circuit (not shown) to maintain the solid state of the heat accumulating material inside tubular member 12. It should be pointed out that, by maintaining the paraffin inside tubular member 12, for example, at roughly zero degree centigrade temperature, i.e. in the solid state, by means of the cooling circuit, an extremely large amount of heat is absorbed to rapidly reduce the temperature of the water circulating in cooling pipe 13.

In one possible embodiment (shown in Figure 3) the in-line cooling unit 10 does not comprise the internal cooling pipe 13 but is defined by a tubular body 12 made of elastically deformable material and closed hermetically at both ends by two caps 31 of rigid material to form a variable-volume closed container.

The tubular body 12 of the in-line cooling unit 10 contains a semisolid, high-viscosity mixture of frozen water or other beverage, i.e. ice or frozen beverage crystals. More specifically, the in-line cooling unit 10 comprises cooling means 32, i.e. a number of electric fans 33 which, on command, circulate, inside compartment of the in-line cooling unit 10, a stream of cold air at a temperature below a freezing temperature T_0, i.e. T_0=0°C, and/or a stream of hot air at a temperature above the freezing temperature T_0.

The stream of cold air may come from the freezer compartment of refrigerator storing frozen food requiring a temperature of -25°C to 0°C, and the stream of hot air may come from the fresh-food compartment of refrigerator 2 storing fresh food requiring a temperature of 0°C to 15°C.

The fans 33 are able to alternate and mix the two air streams to bring the liquid inside the tubular body to, and maintain it at, around the freezing temperature of water or other beverage. In particular, by controlling cold and/or hot air streams provided by the cooling means 32, 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 tubular body 12, ensuring free circulation of the water inside tubular body 12 thorough the solid or semisolid frozen water.

Inside the tubular body 12 of the in-line cooling unit 10, the water at ambient temperature from source 4 mixes with and partly melts the solid or semisolid frozen water mixture to form cooled water at a predetermined cooled temperature (i.e. at a temperature below ambient temperature), which flows immediately along main pipe 6 to the metering valve 5.

In-line carbonation unit 11 is located along main pipe 6, between in-line cooling unit 10 and metering valve 5, and provides for adding carbon dioxide to the water flowing along the second portion of main pipe 6.

In-line carbonation unit 11 receives both cooled water at a given pressure from in-line cooling unit 10, and carbon dioxide at a given pressure, and appropriately mixes the two, i.e. water and carbon dioxide, to supply metering valve 5 with cool sparkling water.

More specifically, in-line carbonation unit 11 comprises the second portion of main pipe 6, which is defined by an elongated tubular body 15 in turn comprising an inlet 11a connected to outlet 10b of in-line cooling unit 10 to receive cooled water, an inlet 11b connected to a carbon dioxide source 16; and an outlet 11c connected to and for supplying cool sparkling water to metering valve 5.

In the Figure 2 example, tubular body 15 has a small inside volume, i.e. is sized to substantially contain a volume of water measurable in tens of millilitres, and preferably equal to 20-30 millilitres, and contains a number of balls 15a for rapidly mixing the cooled water and carbon dioxide. In the example shown, the balls 15a increase the water-carbon dioxide contact surface to thoroughly mix the two extremely rapidly.

It should be pointed out that in-line carbonation units 11 may be used with an internal structure of tubular body 15 differing from the one described above.

In one possible embodiment (shown in figure 4), as opposed to balls 15a, tubular body 15 may contain porous material 40, which, like balls 15a, increases the water-carbon dioxide contact surface.

In another possible embodiment (shown in Figure 5), as opposed to containing balls, tubular body 15 may house a perforated tubular membrane 50 or liner, over which water flows on the inside, and pressurized carbon dioxide on the outside. More specifically, water flows longitudinally through the perforated liner 50, which has a number of transverse holes 51 designed to only let carbon dioxide through to the water, while at the same time preventing outflow of water from the liner. In this way, the carbon dioxide comes into contact with the water at a number of points to rapidly carbonate the water.

Drink dispenser 1 also comprises flow adapting means 20, which, on command, regulate the pressure of the cooled water and/or carbon dioxide to adjust the percentage of carbon dioxide added to the cooled water.

More specifically, flow adapting means 20 may, for example, comprise a non return valve 21 interposed between outlet 10b of in-line cooling unit 10 and inlet 11a of in-line carbonation unit 11 to prevent carbon dioxide flow to in-line cooling unit 10 in the event the carbon dioxide pressure exceeds the water pressure; and/or a pressurized-water supply pump 22 interposed between outlet 10b and inlet 11a to adjust the pressure of the water supply to in-line carbonation unit 11 on command; and/or a flow regulating device 23 interposed between carbon dioxide source 16 and inlet 11b of in-line carbonation unit 11 to regulate the pressure of the carbon dioxide supply to inlet 11b on command.

In the Figure 2 example, flow adapting means 20 are controlled by an electric control unit 24 connected to a setting device 25, which may preferably, though not necessarily, be located at metering valve 5 to allow the user to adjust the carbon dioxide level in the cool water for dispensing.

More specifically, setting device 25 may be designed to set two or more carbon dioxide levels ranging between a minimum level, corresponding to no carbon dioxide at all in the water, and a maximum level, corresponding to a predetermined maximum value.

Electric control unit 24 receives the set level, and controls flow adapting means 20 accordingly. For example, if the user selects the minimum carbonation level, electric control unit 24 controls flow regulating device 23 to zero the pressure of the carbon dioxide supply to inlet 11b of in-line carbonation unit 11, which therefore supplies cool still water.

Flow regulating device 23 may obviously be replaced with an on-off valve or any similar device designed to cut off source 16 from inlet 11b of in-line carbonation unit 11 on command.

If the user selects an intermediate carbon dioxide level, electric control unit 24 controls flow regulating device 23 to adjust the pressure of the carbon dioxide supply to inlet 11b of in-line carbonation unit 11 accordingly.

As regards supply source 4, this provides for continuously supplying water or any other beverage at above atmospheric pressure - normally at about 2-bar pressure - and, in the example shown, comprises a drinking water circuit of the premises in which refrigerator 2 is installed. More specifically, in the example shown, supply source 4 is connected to main pipe 6 via an on-off valve 26 for isolating supply source 4 from main pipe 6 on command.

Carbon dioxide source 16, on the other hand, may comprise a cylinder containing high-pressure carbon dioxide, and for supplying carbon dioxide at a predetermined, e.g. 4-bar, pressure via a pressure reducer.

Operation of cool drink dispenser 1 will now be described, assuming the user has selected a given carbon dioxide level and activated metering valve 5.

In this case, electric control unit 24 controls flow regulating device 23 to supply inlet 11b of in-line carbonation unit 11 with carbon dioxide at a given pressure, and, at the same time, activates on-off valve 26 to allow water to flow along the first portion of main pipe 6, i.e. cooling pipe 13, where it is cooled by in-line cooling unit 10.

The cooled water then flows along the second portion of main pipe 6, i.e. through tubular body 15 of in-line carbonation unit 11, where it is gradually mixed with carbon dioxide. The carbonated water then flows along the end portion of main pipe 6 to metering valve 5, by which it is dispensed into the container inside recess 3a.

Cool drink dispenser 1 obviously has numerous advantages. In the first place, it is extremely compact, by having no water tanks, unlike known dispensers.

Secondly, eliminating the tanks, and the very small water containing capacity of in-line cooling unit 10 and in-line carbonation unit 11 - which, as stated, is measurable in tens of millilitres - practically rule out any possibility of mould or bacteria forming in the dispenser, with obvious advantages in terms of user health and hygiene.

Thirdly, cool drink dispenser 1 provides a continuous, fast supply of cooled water with a carbon dioxide percentage varying as required by the user. The user, in fact, can opt to dispense either cooled still water, or cooled water containing one of a predetermined range of carbon dioxide levels.

Clearly, changes may be made to cool drink dispenser 1 as described herein without, however, departing from the scope of the present invention.

CLAIMS

1) A cool drink dispenser (1) comprising,

a main pipe (6) connected to a supply source (4) to receive a beverage,

a metering valve (5) connected to said main pipe (6) to receive said beverage, and designed to permit controlled outflow of the beverage from said main pipe (6) into a container positioned temporarily beneath the metering valve (5),

an in-line cooling unit (10) adapted to house latent heat accumulating material (14) for absorbing a given amount of heat from the beverage flowing along a first portion of said main pipe (6) so as to cool the beverage,

a second portion of the main pipe (6) being configured as an in-line carbonation unit (11) for mixing the cooled beverage coming from the in-line cooling unit (10) and carbon dioxide coming from a carbon dioxide source (16), characterized by comprising flow adapting means (20) for regulating the pressure of the beverage and/or of the carbon dioxide to be mixed inside the in-line carbonation unit (11).

2) A dispenser as claimed in Claim 1, comprising setting means (25), by which a user selects a value indicating the percentage of gas in the beverage for dispensing; and control means (24) for controlling said flow adapting means (20) to regulate the pressure of said beverage and/or of said gas, so as to adjust the

percentage of gas in the beverage on the basis of the value selected by said user.

3) A dispenser as claimed in Claim 1 or 2, wherein said latent heat accumulating material (14) comprises a solid or semisolid high-viscosity mixture of frozen water or other beverage.

4) A dispenser as claimed in Claim 3, wherein the beverage from source (4) is adapted to flow through and mix with said semisolid mixture to form cooled beverage at a predetermined cooled temperature.

5) A dispenser as claimed in Claim 4, wherein said first portion of said main pipe (6) comprises a tubular body (12) made of elastically deformable material for containing said solid or semisolid high-viscosity mixture of frozen water or other beverage.

6) A dispenser as claimed in any one of the foregoing Claims 3-5, wherein said in-line cooling unit (10) comprises a cooling circuit to maintain the solid or semisolid state of said solid or semisolid high-viscosity mixture of frozen water or other beverage.

7) A dispenser as claimed in any one of the foregoing Claims, wherein said in-line carbonation unit (11) comprises mixing means (15a,40,50) housed inside said second portion of the main pipe (6) to mix said beverage with said carbon dioxide.

8) A dispenser as claimed in Claim 7, wherein said mixing means (15a,40,50) comprise a number of balls (15a), or a porous material (40), or a perforated liner

(50) with one-way holes (51) designed to allow the gas into said perforated liner (50), and to prevent outflow of the beverage from the perforated liner (50).

9) A refrigerator (2), characterized by comprising a cool drink dispenser (1) as claimed in any one of the foregoing Claims.

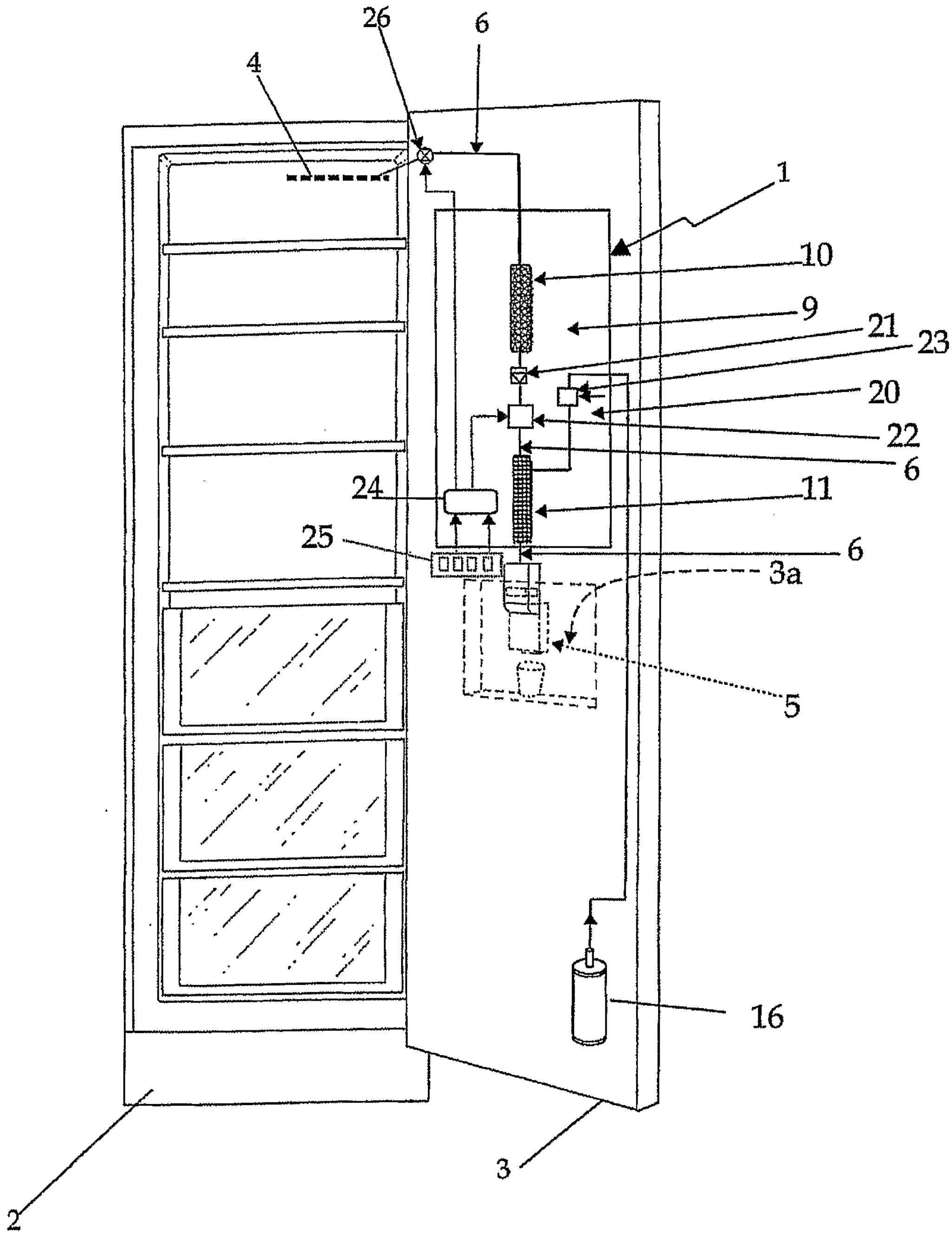

Fig. 1

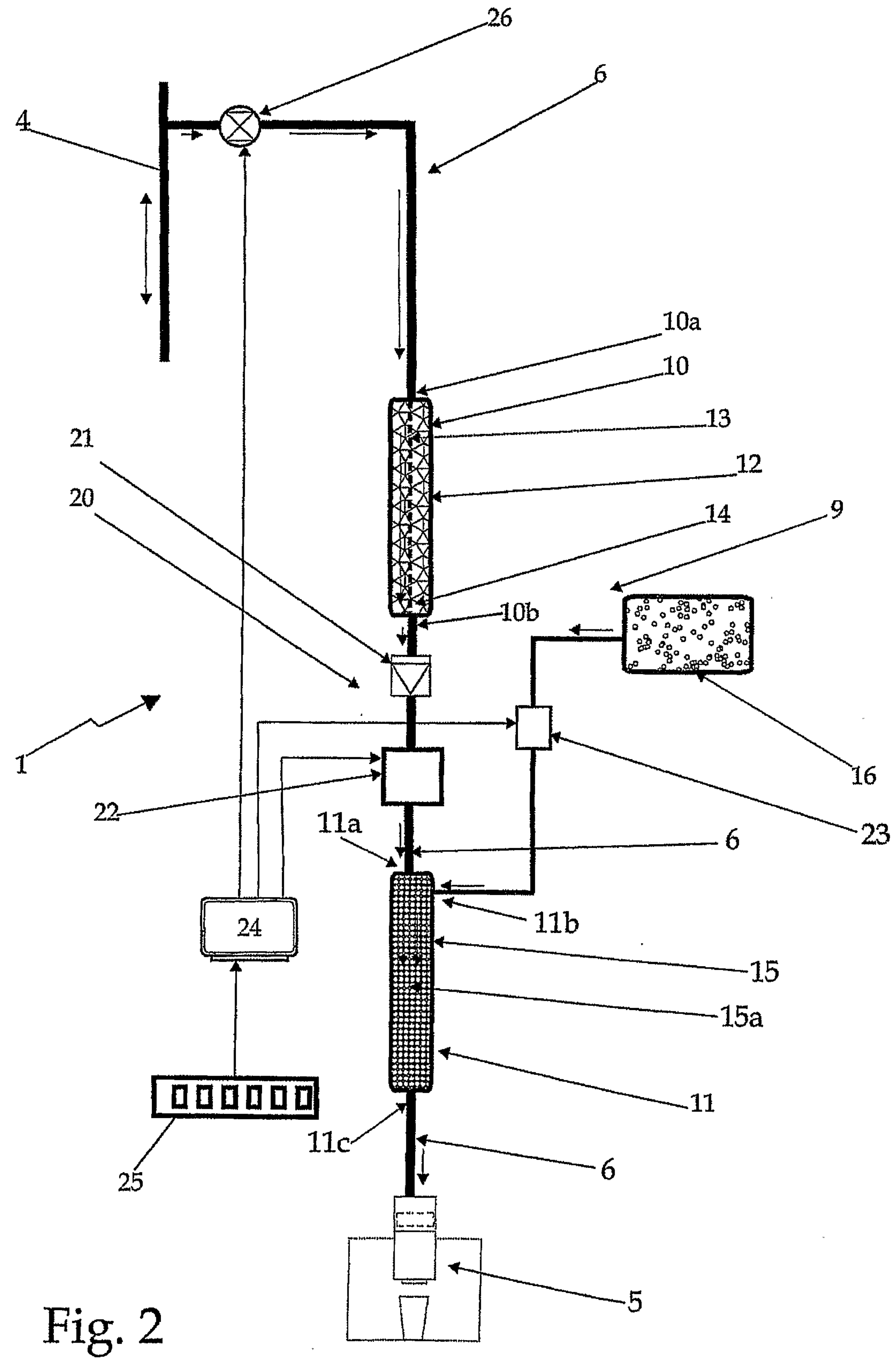
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Fig. 2

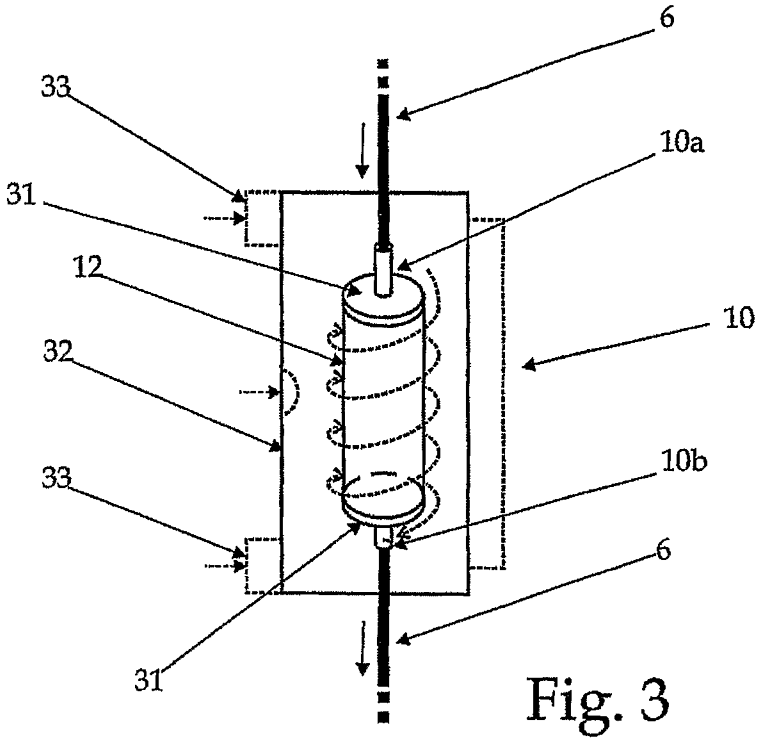

Fig. 3

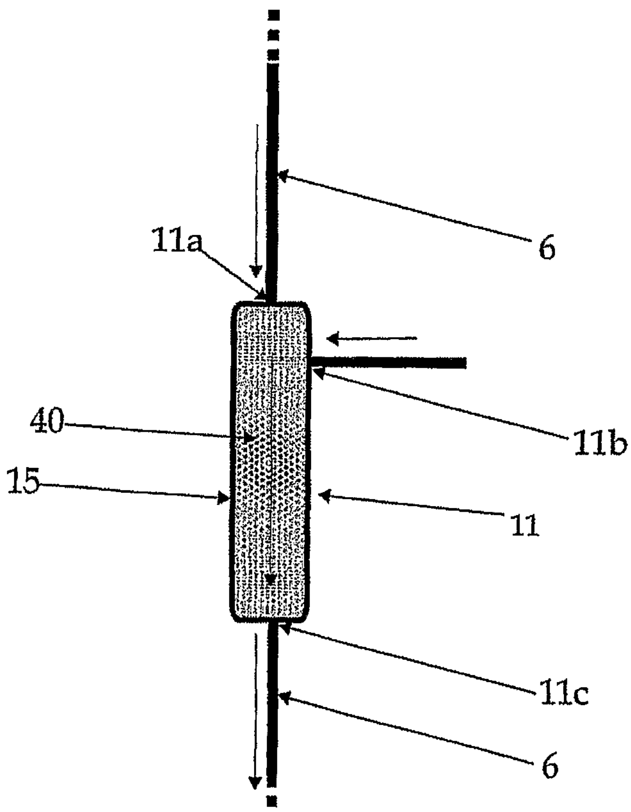

Fig. 4

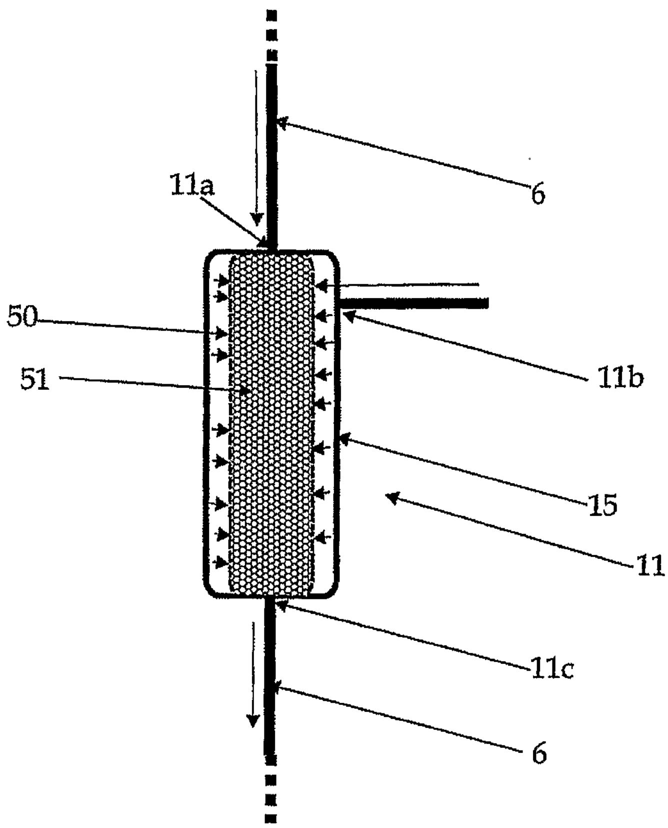

Fig. 5