A refrigerator comprising a water tank comprising a mixing area and a laminar flow area connected in series with the mixing area.
REFRIGERATOR COMPRISING A WATER TANK

[0001] The present invention relates to a refrigerator with a water tank, and especially with a water tank which is intended to be connected to the drinking water network via an inlet connection and which feeds a drinking water dispenser or the like via an outlet connection.

[0002] Such a tank is mostly mounted on the inner side of a housing wall of the refrigerator or embedded in an insulation layer of the wall.

[0003] When a user draws off cold water from the tank, it is automatically replenished by fresh water from the drinking water network. This water is generally at the temperature of the drinking water network and warms up the contents of the tank when mixing with said contents. Since a connecting line between the drinking water network and the tank mostly runs adjacent to an area on the rear of the appliance, where a compressor or a condenser give off heat during operation, a part of the replenishment water can even have a temperature greatly above room temperature. When this water mixes with the tank contents chilled water can no longer be drawn off, which the user finds annoying. To avoid this problem it is actually possible to implement the tank as an elongated line, from which the freshly inflowing water is only output once all the chilled water contained within it has been drawn off. When this occurs however, the user receives extremely warm water, which is also annoying.

[0004] The object of the invention is to create a refrigerator in which on the one hand it is ensured that a quantity of well chilled water satisfying most practical conditions and not warmed by freshly replenished warmed water can be drawn off, and in which on the other hand an abrupt increase in the water temperature is avoided when a full tank has been completely drawn off.

[0005] The object is achieved in that, for a refrigerator with a water tank having an inlet connection and an outlet connection connected to a water dispenser, the tank is divided up into a mixing area and a laminar flow area which are connected in series.

[0006] Preferably the mixing area is adjacent to the inlet connection and the laminar flow area adjacent to the outlet connection, so that fresh inflowing warm water initially mixes in the mixing area with already chilled water before reaching the laminar flow area and finally being output. There is also the option however, through a reversed arrangement, to first receive freshly inflowing water in the laminar flow area, where, because of its initially high temperature difference to the inner chamber of the refrigerator, it can be rapidly cooled down, so that, if the entire contents of the tank is not drawn off within a short period, it reaches the mixing area in a good pre-chilled state. In the one case as in the other an increase in temperature of the water drawn off only occurs gradually once a quantity of water corresponding to the volume of the laminar flow area has been drawn off.

[0007] In order to obtain a compact-shaped tank, the laminar flow area is preferably embodied by a line which follows a roundabout path between the mixing area and the inlet or outlet connection of the tank.

[0008] To make the tank easy to implement and compact it is further preferable for the line of the laminar flow area to be delimited by fins projecting from outer walls of the tank into its inside.

[0009] If the tank is assembled from a shell and a cover, in the interests of simple manufacturing the fins can be formed just on the shell.

[0010] To stabilize the tank against the water pressure obtaining inside it, pillars are preferably distributed over the floor of the shell which are rigidly connected to the cover.

[0011] An output of the mixing area is preferably arranged on its floor, so that water which has cooled down on the outer walls of the mixing area and thus sunk down is the first to be output.

[0012] To enable the air to be easily forced out of the water tank during startup or after repair, an outlet connection is preferably placed at a highest point of the water tank. A ventilation opening expediently connects the highest point of the mixing area with the outlet connection, so that trouble-free ventilation is guaranteed for this, even if its output is located on the floor.

[0013] The water tank is preferably let into a housing wall of the refrigerator.

[0014] Further features and advantages of the invention emerge from the enclosed figures. The figures are as follows:

[0015] FIG. 1 a schematic section through an inventive refrigeration device;

[0016] FIG. 2 a perspective exploded view of a water tank of the refrigeration device; and

[0017] FIG. 3 a detail of the water tank in cross section.

[0018] The refrigerator shown in schematic cross section in FIG. 1 has a heat-insulating chassis 1 and a door 2 which delimit a chilled interior 3. A recess 4 open to the outside is formed in a central area of the door 2, on the roof of which an outlet 5 for drawing off chilled drinking water into a container 6 placed in the recess 4 is arranged. The outlet 5 is connected via a supply line 7 to a water tank 8 placed in a rear wall of the recess 4. The water tank 8 is surrounded on all sides by an insulating material layer of the door 2.

[0019] The water tank 8 is connected to the drinking water network via a line 9 which extends out from the water tank 8 initially through the door 2 via a hinge in the chassis 1 and along its rear wall. The line 9 crosses a pedestal area 10 of the chassis, in which a compressor (not shown) is accommodated. Local warming up of the line 9 by waste heat from the compressor or from an (also not shown) condenser generally mounted outside on the rear wall of the chassis 1 can thus not be excluded.

[0020] FIG. 2 shows an exploded perspective view of the water tank 8. The water tank 8 is composed of two parts, a shell 11 and a flat cover 12. The shell 11 has a flat floor 13 in parallel to the cover 12 and a narrow wall 14 running around the floor 13, which carries a flat frame 15 facing towards the cover 12. In the assembled state the cover 12 is attached to this frame 15 by gluing, ultrasound welding or the like. In the mounting orientation of the tank 8 shown in the figure cover 12 and floor 13 are parallel to the rear wall of the recess 4.

[0021] An inlet connection 16 for connection to the line 9 and an outlet connection 17 for connection to the line 7, each in the form of a one-piece pipe stub projecting from the wall 14, are arranged respectively in an upper area of the tank 8 in its mounted orientation. The inside of the water tank 8 is multiply subdivided by fins projecting from the floor 13 and the surrounding wall 14 of the shell 11. A first such fin 18 extends out adjacent to the outlet connection 17 from an upper section 19 of the wall 14 in a vertical direction to close to an opposite lower wall section 20 and thus divides a riser line 21 from the remainder of the inner chamber of the tank 8.
This remainder is divided approximately in half into an upper mixing area 22 and a lower laminar flow area 23. While the mixing area 22 is largely free of fins, many fins 24 extend into the laminar flow area 23 each alternating from the vertical fin 18 or a vertical section 25 of the wall 14 in opposite directions and thus force an essentially zigzag shaped, low-eddy flow of the water through the area 23.

A horizontal fin 26 is arranged in the mixing area 22 adjacent to the inlet connection 16, to guide inflowing water and stimulate it into an eddied flow in the counterclockwise direction in the mixing area 22. A fin 27 projecting from below into the mixing area 22 forms an obstacle for this eddied flow, at which eddies in the clockwise direction are produced, which ensures an effective mixing of the inflowing warm water with chilled water which has already been in the mixing area 22 for a longer time.

If a user water draws off water from the tank he thus initially receives water chilled to the static temperature of the water tank 8 while simultaneously fresh water flowing into the mixing area 22 gradually warms up this area. This water becoming warmer over the course of time refills the laminar flow area 23. If the volume of water drawn off reaches the volume of the laminar flow area 23, the water mixed with fresh water reaches the outlet 17, and the temperature of the drawn-off water gradually rises. The user can recognize from the gradual increase in the temperature of the drawn-off water that the tank 8 needs a period of rest in order to enable to supply well chilled water again.

The floor 13 of the tank is not precisely rectangular but is trapezoidal, such that in the installed position the lower end section 20 runs horizontally, but the upper end section 19 by contrast rises slightly up to the outlet connection 17. A through-hole 28 is formed in the fin 18 immediately adjacent to the wall section 19, of which the free cross-section is significantly smaller than that of the riser line 21 or that of the fin 24 of the sections of line delimited by the laminar flow area 23, so that when water is drawn off, the throughflow of water through the through-hole 28 is small by comparison to the quantity of water flowing through the laminar flow area 23 and has no significant influence on the temperature of the drawn-off water. When the tank 8 is first put into operation however the through-hole 28 makes it possible for the air initially contained in the mixing area 22 to reach the outlet connection 17 and to escape from the tank.

Distributed over the floor 13 of the shell 11 are a number of pillars 29 each at a height corresponding to the width of the wall 14 or of the fins 18, 24, 26, 27. Preferably an arrangement of five pillars 29 is provided corresponding to the spots on a die, as shown in FIG. 2, but there can also be other numbers of pillars 29, depending on the size of the floor 13. The pillars 29 can each have a closed end face surface which is connected in the same way as the frame 15 to the cover 12, in order to prevent or at least to limit any deformation of the tank 8 under the pressure of the water contained within it. Preferably however the pillars 29 are hollow, as shown in the cross section depicted in FIG. 3, and have a front face side opening 30 which is aligned to a respective corresponding opening 31 of the cover 12, to accommodate a rivet 32.

1-10. (canceled)
11. A refrigerator comprising a water tank having an inlet connection and an outlet connection in fluid communication with a water dispenser wherein the water tank includes a mixing area and a laminar flow area connected in series with the mixing area.
12. The refrigerator according to claim 11 wherein the mixing area is disposed adjacent the inlet connection and the laminar flow area is adjacent the outlet connection.
13. The refrigerator according to claim 11 wherein the laminar flow area is formed by a line following a circuitous path between the mixing area and one of the connections of the tank.
14. The refrigerator according to claim 13 wherein the line is delimited by fins projecting into the tank from outer walls of the tank.
15. The refrigerator according to claim 14 wherein the tank includes a shell and a cover wherein the fins are formed on the shell.
16. The refrigerator according to claim 15 wherein the tank includes pillars rigidly connected to the cover and distributed over the floor of the shell.
17. The refrigerator according to claim 11 wherein the mixing area includes an outlet formed on a floor thereof.
18. The refrigerator according to claim 11 and further comprising an outlet connection disposed at a highest point of the water tank.
19. The refrigerator according to claim 18 and further comprising a ventilation opening connecting a highest point of the mixing area with the outlet connection.
20. The refrigerator according to claim 11 wherein the water tank is let into a housing wall of the refrigerator.

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