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(54) Title: A COOLER DEVICE HAVING VERTICAL ICE MOLD PRODUCING CLEAR ICE

(57) Abstract: The present invention relates to a cooler device, in particular a refrigerator comprising: a heat insulated housing (1) delimiting a cooling compartment (3); an ice mold (10) placed vertically in the cooling compartment (3) so that a liquid conveyed from a liquid dispenser (30) placed on an upper portion of the ice mold (10) can flow thoroughly by passing through serial chambers (12) arranged on thereof; and a dispensing tube (20) extending on the upper portion of the ice mold (10) and configured so as to dispense liquid to the liquid dispenser (30) through at least one feeding bore (26) arranged in its bottom portion in order to obtain clear ice in the chambers (12).

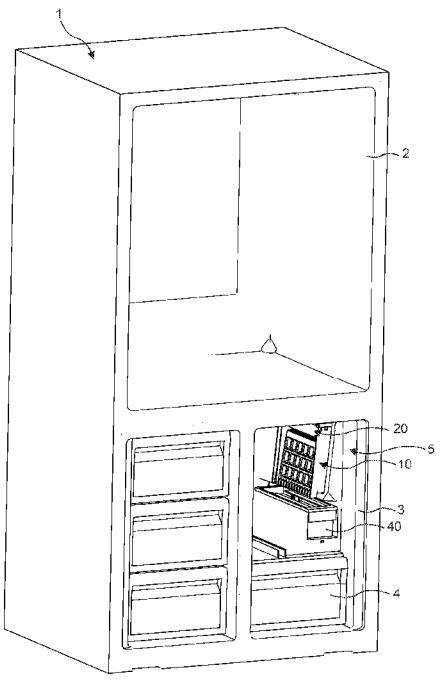


Figure 1

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# A COOLER DEVICE HAVING VERTICAL ICE MOLD PRODUCING CLEAR ICE

## Technical Field

The present invention relates to freezer devices having an ice making unit, in particular to domestic type refrigerators having a clear ice making system.

## Prior Art

Clear ice is produced by flowing water through a vertical metal mold connected to an evaporator and by cooling the metallic surface in a fresh food compartment or a separate ice production device inside a heat insulated body of cooler devices. Clear ice can be obtained as a result of removing air dissolved in water during or before freezing thereof, and purifying water as much as possible from foreign materials such as dust, chlorine or some minerals. The obtained ice has a clear and aesthetically pleasing look, to the extent of removal of the air content in crystallizing ice. During freezing, crystallizing ice transfers its air content to water. As ice forms, air dissolved in water is collected in the remaining water and particularly in the thin layer right over the freezing surface. Bubbling occurs if the concentration of dissolved air exceeds a certain value. In rapid freezing, a high amount of small bubbles form and the obtained ice looks foggy.

It is possible to produce clear ice by decreasing the speed of freezing and removing the air in water by way of diffusion. However, this process requires a long duration of 6 to 10 hours. Water has to be in a state of continuous flow on the freezing surface in order to obtain clear ice in shorter periods of time. This method is called fractional freezing method. When the freezing water is in a flowing state instead of standing, then the dissolved air decomposing from ice is conveyed with the flow of water and does not collect in ice. Thus, bubbling does not occur. In devices producing clear ice by way of fractional freezing method, various methods are used to decide if amount of ice produced is sufficient, and to complete ice making process. When ice production is completed, a discharge assembly activates and removes the content of the ice tray.

Patent no. US7340913 discloses a water dispenser in which one or more structural members form a first chamber. The first chamber configured to receive an inflow of water, distribute the water laterally, and to controllably release the water. A mating member forms together with the one or more structural elements, a second chamber. The second chamber is configured to receive water from the first chamber and to controllably release the water onto a receiving surface. The mating member is configured to be detachable in a direction perpendicular to the direction of lateral water distribution.

Brief Description of the Invention

The aim of the present invention is to provide equal ice thicknesses and increased ice clarity in refrigerators producing ice.

In order to achieve the above-mentioned aim, the present invention is a cooler device, in particular a refrigerator comprising: a heat insulated housing delimiting a cooling compartment; an ice mold placed vertically in the cooling compartment so that a liquid conveyed from a liquid dispenser placed on an upper portion of the ice mold can flow thoroughly by passing through serial chambers arranged on thereof; and a dispensing tube extending on the upper portion of the ice mold and configured so as to dispense liquid to the liquid dispenser through at least one feeding bore arranged in its bottom portion in order to obtain clear ice in the chambers. A preferred embodiment of the invention comprises at least one air discharge orifice provided on the dispensing tube, directing the air in the dispensing tube so as to discharge it before it reaches the liquid discharge bore while the liquid conveyed through the dispensing tube is passing through the feeding bore. The air discharge orifice prevents the air which may occur due to turbulence or another reason, from undesired reaching the feeding bore in a manner to damage a film shaped or another laminar flow character of the liquid dispensed by the liquid dispenser, providing clear ice. This is achieved by directing the air formed in the dispensing tube to an air discharge orifice. Since the air trapped in the dispensing tube is discharged, the liquid conveyed through

the feeding bore is dispensed homogeneously on the ice mold. Ice thickness thus becomes equal in each cell. The air discharge orifice can be shaped as annular, square, or in various different sectional forms. In an alternative embodiment, the air discharge orifice can be even elongated from a narrow to a dilating duct structure.

A preferred embodiment of the invention comprises an upper opening provided on the upper wall of a liquid conduit extending in the dispensing tube, and connected with the air discharge orifice so as to convey air. Thus, for example in cases where the liquid conduit is not completely full, during liquid flow undesired air spontaneously raises to the upper portion and reaches the upper opening from here, and is discharged to the outer environment through connection with the air discharge orifice.

In a preferred embodiment of the invention, the air discharge orifice is arranged angulated with respect to the upper opening. It is made difficult for the liquid reaching the upper opening in any way, to escape from the air discharge orifice when liquid flows in the liquid conduit.

In a preferred embodiment of the invention, the angle between the air discharge orifice and the upper opening is 90°. In this case, the liquid in the liquid conduit to escape from the air discharge orifice is made maximally difficult. The angle being perpendicular causes the air discharge orifice and the liquid conduit to extend spaced from and in parallel to each other.

A preferred embodiment of the invention, comprises an air discharge duct extended between the air discharge orifice and the upper opening. Any liquid droplet, for example water droplet coming from the liquid conduit in the air discharge duct, cannot reach the air discharge orifice without covering a distance along the length of the air discharge duct. Thus, liquid escape from the air discharge orifice becomes difficult.

In a preferred embodiment of the invention, the air discharge duct extends in opposite direction to the liquid flow in the liquid conduit. In this case, the liquid

can only access the air discharge duct by less likely splashing in the opposite direction.

In a preferred embodiment of the invention, the air discharge orifice is provided proximate to the final end of the dispensing tube. Thus, air collection is prevented even in the furthest and final portion of the dispensing tube.

In a preferred embodiment of the invention, the diameter of the air discharge orifice is smaller than the feeding bore. Thus, the low-density air freely moves towards the air discharge bore in the dispensing tube due to pressure difference.

In a preferred embodiment of the invention, the dispensing tube extends in full length on the ice mold. In this case, homogeneous and equally volumed liquid conveyance from the feeding bore or bores to all of the cells disposed on the ice mold, is facilitated.

The household appliance realized to achieve the aims of the present invention is illustrated in the accompanying drawings, wherein:

Figure 1 is a frontal perspective view of a refrigerator housing comprising a clear ice production assembly.

Figure 2 is a perspective view of an exemplary embodiment of the clear ice production assembly.

Figure 3 is a dismantled view of a liquid dispenser comprising a representative embodiment of a dispensing tube of the ice production assembly of figure 2.

Figure 4 is a longitudinal sectional view of a representative embodiment of a dispensing tube of the invention.

The elements in the figures are numbered individually and the correspondence of these numbers are given hereinafter.

1 Housing

2 Upper compartment

3 Cooling chamber

4 Ice drawer

5. Evaporator

10 Ice mold

12 Compartment

14 Outer wall

15 Dispensing wall

16 Lower edge

20 Dispensing tube

21 Inlet

22 Support plate

23 Air discharge assembly

24 Bearer plate

25 Air discharge orifice

26 Feeding bore

27 Liquid conduit

28 Upper opening

29 Air discharge duct

30 Liquid dispenser

32 Side wall

33 Base plate

35 Separator

36 Front wall

38 Dispensing opening

40 Water container

42 Upper portion

Figure 1 perspectively shows a heat insulated housing (1) of a domestic type refrigerator, surrounding a cooler compartment (2) in its upper portion and a cooling chamber (3) producing clear ice in its lower portion. The heat insulated housing (1) has a cabinet structure accessible by a closable door (not shown in figures). The inner lining of the housing (1) is a plastic panel. An ice drawer (4) in which ice cubes are stored, is provided on the base portion of the cooling chamber (3). A water container (40) is provided in the upper portion of the ice drawer (4). The water container (40) has a box shape wherein the shorter side extends transversely and the longer side extends in depth direction so as to occupy minimal space from front, having an open upper portion (42) on top. A vertical ice mold (10) resting on an evaporator (5) in the cooling chamber (3), is fixed on the open upper portion of the water container (40). The ice mold (10) has a tray structure having serial compartments (12) with a cavity form and matrix structure.

Figure 2 shows a frontal perspective view of the ice unit, visibly displaying the compartments (12). The upper edge of the ice mold (10) extends so as to form a dispensing wall (15). A liquid dispenser (30) is positioned in a spaced manner on the upper portion of the dispensing wall (15). Water fed from the water container (40) or obtained by circulation is received in the liquid dispenser (30) through an inlet (21). The compartments (12) are surrounded by a planar outer wall (14). Water conveyed by the liquid dispenser (30) spreads in the dispensing wall (15) and is flowed by circulation from the dispensing wall (15) towards a lower edge (16) of the ice mold (10), in a flow of homogeneous film structure. The water flow while contacting the chambers (12) cooled by the evaporator (5), enable collection of ice in the chambers (12). Ice mass collects in the chambers (12) as long as water flow is supplied and cooling is performed, forming clear ice. Clear ice is received into the ice drawer (4) from the open portion by an ice collection cycle.

Figure 3 shows a dismantled perspective view of the liquid dispenser (30) supplying water to the ice mold (10) for clear ice production, and a dispensing tube (20) feeding water to the liquid dispenser (30). The dispensing tube (20) is made of plastic material and, proximate to its two opposite ends a support plate (22) and a bearer plate (24) are provided in flange structure. The dispensing tube (20) is a straight tube of hollow structure and its inner portion defines a liquid conduit (27). The dispensing tube (20) has a liquid inlet (21) on a front end thereof. Feeding bores (26) are serially arranged in an angular and spaced manner on the lower portion of the dispensing tube (20) facing a base plate (33) of the liquid dispenser (30). An air discharge assembly (23) is provided on the upper portion of the dispensing tube (20), proximate to its further end. The air discharge assembly (23) has an air discharge orifice (25) in a proximate end of a prismatic body. The liquid dispenser (30) extends under the dispensing tube (20) and in parallel with the dispensing tube (20) so as to collect liquid. The liquid dispenser (30) has a liquid container structure on which dispensing openings (38) equally spaced from each other are arranged on its base plate (33). The liquid dispenser (30) hangs in the housing (1) so as to have a space between the dispensing wall (15) of the ice mold (10) and its the base plate (33) extending beneath a front wall (36) of panel structure extending on its front portion. Separators (35) standing laterally and distant from the base plate (33) form compartments in the liquid dispenser (30) and also hold the dispensing tube (20) so as to support it with their upper edges. The flow rate of water supplied from the inlet (21) is configured to provide a film thickness suitable for producing clear ice fractionally on the outer wall (14) of the ice mold (10).

The inlet (21) opens from one end to the straight liquid conduit (27), as shown in figure 4. A discharge assembly (23) is formed on the dispensing tube (20) at its further end proximate to the bearer plate (24). The discharge assembly (23) has on its lower end an upper opening (28) reaching the liquid conduit (27). The upper opening (28) reaches an air discharge orifice (25) by means of an L-shaped air discharge duct (29). The shorter extension of the air discharge duct (29) extends upwards from the upper opening (28) and in perpendicular to the liquid conduit

(27), and the longer extension extends in parallel with the liquid conduit (27) in inlet (21) direction but in opposite direction to the water flow. Water supplied from the inlet (21) advances along the liquid conduit (27) and flows through the feeding bores (26) to the base plate (33). Meanwhile, the air which is not desired to escape from the feeding bores (26) during the flowing of water, rises upwards in the liquid conduit (27) and reaches the upper opening (28) at the further end portion, there, air moves along the air discharge duct (29) and is discharged to the outer environment through the air discharge orifice (25). Considering the inlet (21) direction and the feeding direction in the liquid conduit (27), water moves in a direction of advancement along the length of the liquid conduit (27) and downpour through the feeding bores (26). Meanwhile, it is very difficult for water to escape from the upper opening (28). Moreover, it is made difficult for the water in the liquid conduit (27) to escape from the air discharge orifice (25) thanks to an air discharge duct (29) advancement path in opposite direction to the flow direction of water. In a possible embodiment, a valve can be placed in the air discharge orifice (25), which opens only in outlet direction making difficult for air or foreign substances to enter.

# CLAIMS

1 – A cooler device, in particular a refrigerator comprising: a heat insulated housing (1) delimiting a cooling compartment (3); an ice mold (10) placed vertically in the cooling compartment (3) so that a liquid conveyed from a liquid dispenser (30) placed on an upper portion of the ice mold (10) can flow thoroughly by passing through serial chambers (12) arranged on thereof; and a dispensing tube (20) extending on the upper portion of the ice mold (10) and configured so as to dispense liquid to the liquid dispenser (30) through at least one feeding bore (26) arranged in its bottom portion in order to obtain clear ice in the chambers (12), characterized in that, at least one air discharge orifice (25) is provided on the dispensing tube (20) and directs the air in the dispensing tube (20) so as to discharge it before it reaches the liquid discharge bore (26) while the liquid conveyed through the dispensing tube (20) is passing through the feeding bore (26).

2 – The cooler device according to claim 1, wherein it comprises an upper opening (28) arranged on the upper wall of a liquid conduit (27) extending in the dispensing tube (20), is connected with the air discharge orifice (25) so as to convey air.

3 - The cooler device according to claim 2, wherein the air discharge orifice (25) is arranged angulated with respect to the upper opening (28).

4 – The cooler device according to claim 3, wherein the angle between the air discharge orifice (25) and the upper opening (28) is 90°.

5 - The cooler device according to claim 2-4, wherein it comprises an air discharge duct (29) extended between the air discharge orifice (25) and the upper opening (28).

6 – The cooler device according to claim 5, wherein the air discharge duct (29) extends in opposite direction to the liquid flow in the liquid conduit (27).

7 – The cooler device according to any one of the preceding claims, wherein the air discharge orifice (25) is provided proximate to the final end of the dispensing tube (20).

8 – The cooler device according to any one of the preceding claims, wherein the diameter of the air discharge orifice (25) is smaller than the feeding bore (26).

9 - The cooler device according to any one of the preceding claims, wherein the dispensing tube (26) extends in full length on the ice mold (10).

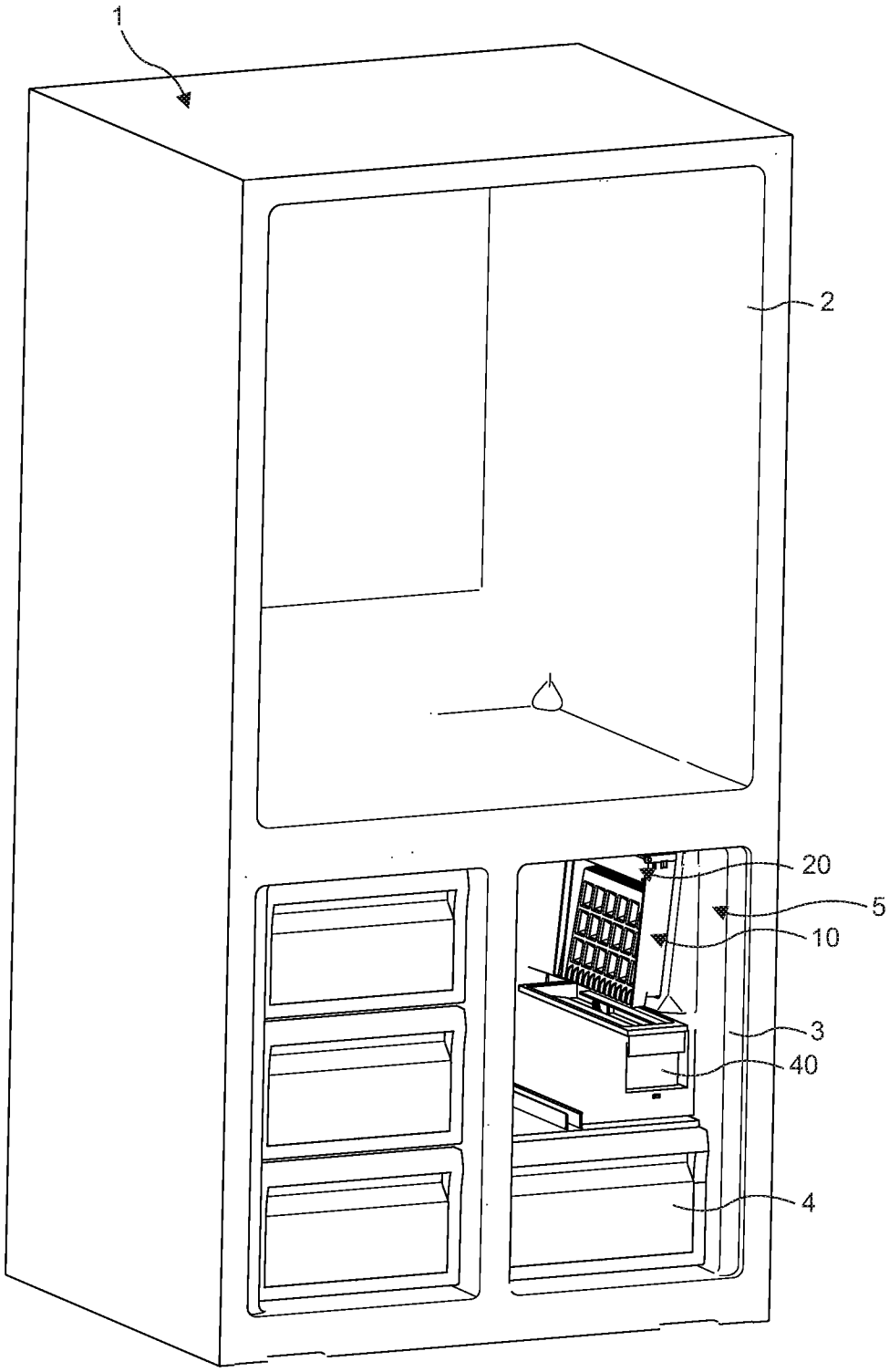


Figure 1

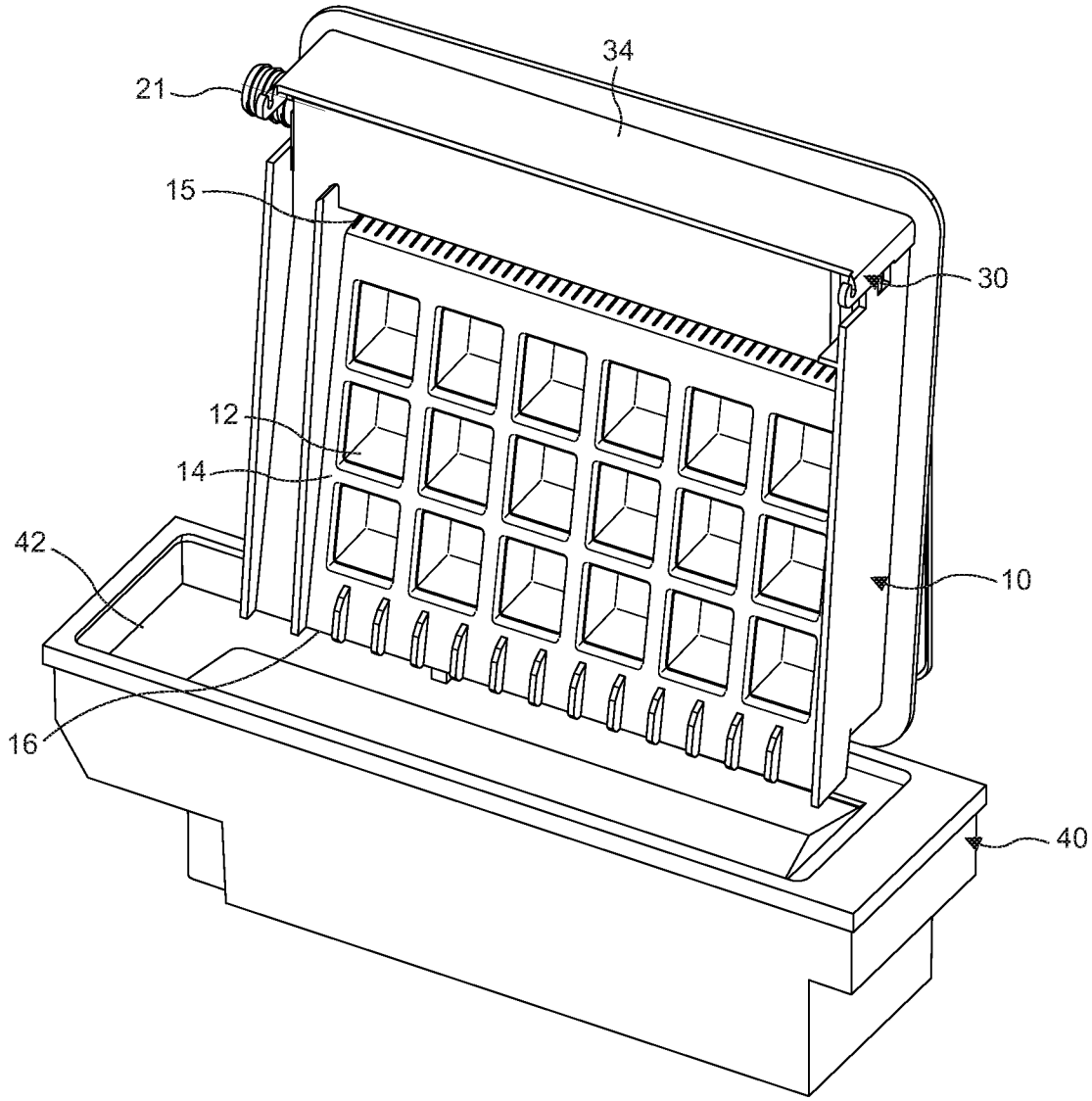


Figure 2

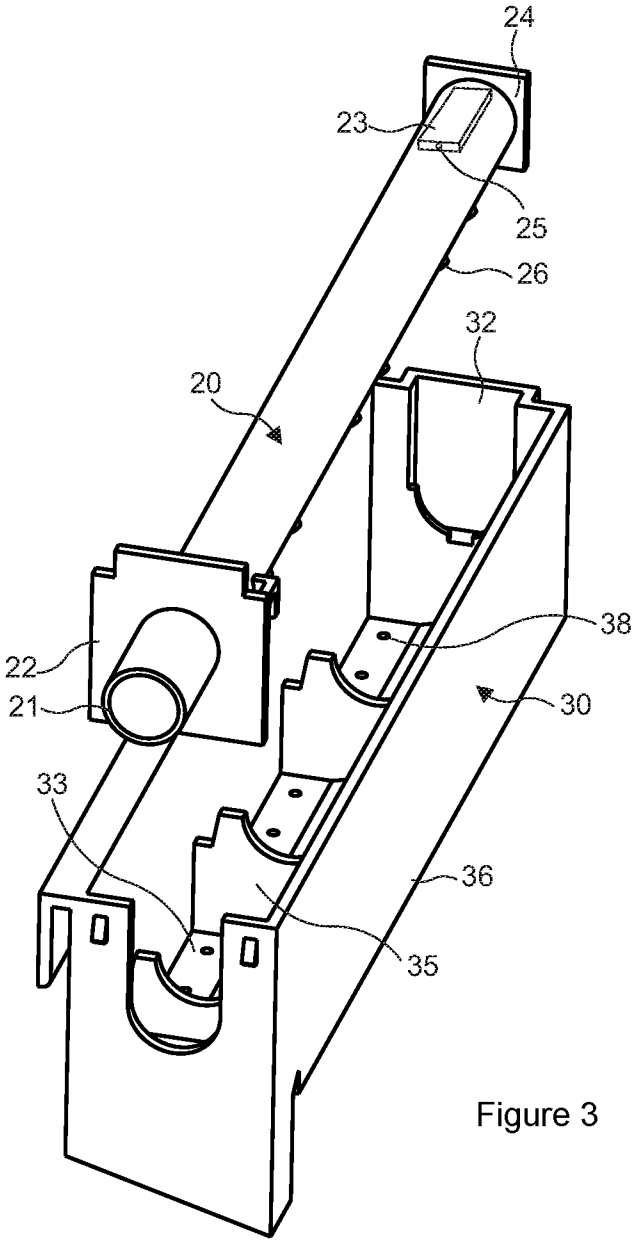


Figure 3

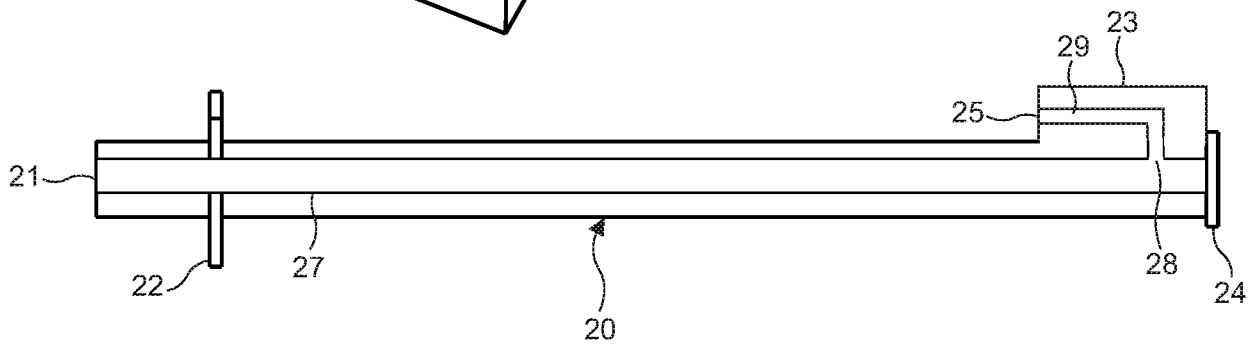


Figure 4