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(54) **BEVERAGE COOLER**

(57) The present disclosure concerns a beverage cooler (10) comprising a housing (12), an elongated cooling chamber (32) formed in the housing (12) for accommodating a beverage container (34), the cooling chamber (32) comprising an air inlet (36) and an air outlet (38), an air flow circuit comprising the air inlet (36), the cooling chamber (32) and the air outlet (38), a fan (74) arranged in the air flow circuit for inducing an air flow in the air flow circuit in an air flow direction, and a refrigerating device (58) arranged in the housing (12) and comprising a compressor (60), an evaporator (62), an expansion mechanism and a condenser (64) connected in a refrigerant circuit containing a refrigerant, wherein the evaporator (62) is positioned in the air flow circuit upstream of the air inlet (36) in the flow direction for exchanging heat between the air flow and the refrigerant in the refrigerant circuit.

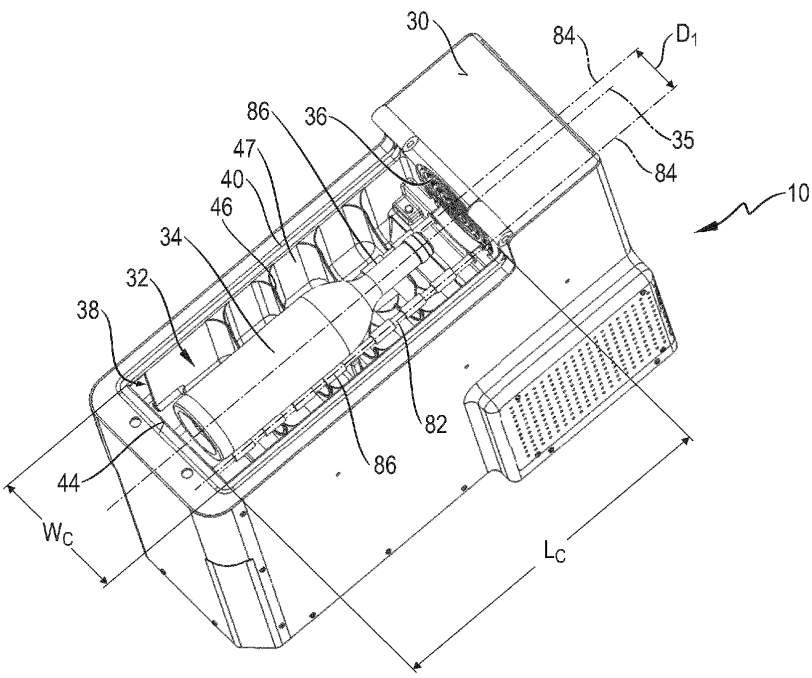

Fig. 2

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Description

Technical Field

[0001] The present disclosure relates to a beverage cooler for quickly cooling a beverage container, such as a bottle or can. More particularly, the present disclosure relates to a beverage cooler as a stand-alone unit. A stand-alone unit is intended, designed or able to be used or to function alone or separately. It is not connected to or requiring connection to something else in order to be used or to function. Yet, the stand-alone unit may still be configured as an installation unit for being installed in e.g. a countertop or drawer.

Background

[0002] Known beverage coolers of this kind define a cooling chamber formed in the housing, wherein the beverage container is to be accommodated in the cooling chamber (see e.g. US 4,164,851 A). The cooling chamber also comprises a rotating mechanism for rotating the beverage container. In use, a plurality of ice cubes is poured into the cooling chamber so as to be in frictional contact with the beverage container. Subsequently, the beverage container is rotated against the ice cubes to quickly cool the beverage in the beverage container to about 4°C to 8 °C. Yet, the necessity for ice cubes impairs ease of use and mobility of the device.

[0003] Other beverage coolers as disclosed in DE 10 2014 202 925 A1 and DE 10 2014 224 117 A1 are designed for use in a fridge and, hence, not as stand-alone units. Thus, mobility of the device is very limited. Further, efficiency and speed of cooling are relatively low.

[0004] An even further beverage cooler is known from US 2013/0291570 A1 suggesting a cooling cavity confining a coolant. An evaporator coil of a vapor compression cycle is arranged in the cooling cavity, wherein a refrigerant passes through the evaporator coil cooling the coolant. A beverage container placed within the cooling chamber is surrounded by the cooling cavity and may, thus, be cooled. Yet, the beverage container is not in contact with the wall of the cooling cavity or the coolant. Also with respect to those beverage coolers, efficiency and speed of cooling are relatively low.

Summary

[0005] In view of the aforesaid, it was an object to provide a beverage cooler as a stand-alone unit allowing quick and efficient cooling of a beverage container. A further object is ease of use and/or mobility of the beverage cooler.

[0006] At least one of the above objects is realized by a beverage cooler as defined in claim 1. Embodiments of the beverage cooler are defined in the dependent claims.

[0007] The basic idea of the present disclosure is to use a vapor compression cycle for cooling an airstream or airflow which is circulated around and in contact with the beverage container in a substantially closed system. More particular, the air flows through an evaporator of the vapor compression cycle, is thereby cooled and subsequently enters a cooling chamber accommodating the beverage container. The cool air flows around and past the beverage container cooling the beverage in the beverage container which is preferably rotated around its center axis during cooling. Finally, the air leaves the cooling chamber being returned to the evaporator for being again cooled by the vapor compression cycle. Hence, no ice cubes or coolant are necessary. Nevertheless, efficient and quick transfer of heat (cooling) is enabled due to the flow of air along and in contact with the beverage container.

[0008] According to an aspect, the beverage cooler comprises a housing defining an elongated cooling chamber. The cooling chamber may be substantially rectangular or cuboidal. The corners may, however, be rounded and/or the legs/surfaces of the rectangle/cuboid may be curved instead of being straight.

[0009] The cooling chamber, being elongated/longitudinal, has a length substantially larger than its width. In one example, the length is between 3 times and 5 times larger than the width.

[0010] For example, the length of the cooling chamber may be between 320 mm and 385 mm, preferably between 320 mm and 375 mm or between 320 mm and 365 mm. In another example, the length of the cooling chamber may be between 330 mm and 350 mm. The length of the cooling chamber is particularly governed by the largest height of a beverage container, e.g. a bottle, to be accommodated in the cooling chamber. An example may be a flail bottle or slender bottle, e.g. used for Riesling, having a height between 300 and 375 mm. Another example may be a burgundy bottle, e.g. used for Chardonnay, usually having a height between 300 mm and 320 mm.

[0011] The width of the cooling chamber may be between 100 mm and 190 mm. Again, the width of the cooling chamber is particularly governed by the largest diameter of a beverage container to be accommodated. In this context, the diameter of a burgundy bottle is usually between 78 mm and 90 mm and that of a flail bottle is usually between 60 mm to 82 mm. If baffle plates are provided (see below), the width may be larger and preferably between 120 mm and 180 mm. Without baffles plates, a smaller width between 100 mm and 140 mm may be selected.

[0012] As previously indicated, the elongated cooling chamber is formed in the housing for accommodating the beverage container. The cooling chamber may be closed relative to the atmosphere. In an embodiment, the housing may comprise a housing body and a lid (see below), wherein a first part of the cooling chamber (e.g. a receiving chamber having an insertion opening for inserting the beverage container into the receiving chamber) is formed in the housing body and a second part of the cooling chamber is formed in the lid (e.g. closing the insertion opening).

[0013] The beverage container may be a bottle, a can or any other suitable beverage container. The beverage cooler may also be suitable to accommodate two or more beverage containers one after the other along their longitudinal center axis, for example two cans instead of one bottle. The beverage cooler may also comprise more than one cooling chamber, wherein the cooling chambers are, in this case, separated (e.g. no direct fluid (cooling air) communication between the cooling chambers) from each other and each cooling chamber is configured to accommodate one or more of the beverage containers.

[0014] The cooling chamber comprises an air inlet for introducing air into the cooling chamber and an air outlet for exhausting air from the cooling chamber. Certainly, there may be more than one air inlet and/or air outlet.

[0015] The beverage cooler further comprises an air flow circuit or a closed air flow path. In this context, an air flow circuit or closed air flow path is to be understood as a substantially closed loop. A closed loop is in one embodiment to be understood in that there is no exchange of air within the air flow path. Hence, no external air is introduced into the air flow path during operation of the beverage cooler. In another embodiment, a closed loop is to be understood in that additional external air may be introduced into the air flow path but that air which had been used for cooling the beverage container is mixed with the external air before being reintroduced into the cooling chamber. Yet, also in this case no air from the closed air flow path should be exhausted to the outside. Thus, also in this embodiment air which is still relatively cool though already used for cooling the beverage container is re-fed to the cooling chamber after being anew cooled down as explained in more detail below. Due to the air flow circuit, cooling efficiency may be increased by reducing loss of already cooled air.

[0016] The air flow circuit/closed air flow path comprises the air inlet/-s, the cooling chamber and the air outlet/-s.

[0017] Moreover, the beverage cooler comprises a fan arranged in the air flow circuit/closed air flow path for inducing an air flow in the air flow circuit/closed air flow path in an air flow direction. The fan may be an axial fan or a radial fan. The volumetric flow rate of the fan may be at least 0.01 m^3/s, preferably at least 0.03 m^3/s and most preferred more than 0.05 m^3/s.

[0018] The beverage cooler further comprises a refrigerating device arranged in the housing. The refrigerating device may be a vapor compression cycle. The refrigerating device comprises a compressor, an evaporator, an expansion mechanism and a condenser connected in a refrigerant circuit containing a refrigerant. The evaporator and/or the condenser may be tube-fin type heat exchangers. Depending on the needs two or more evaporators/condensers may be connected in series or in parallel. The expansion mechanism may be an expansion valve or a capillary tube. The refrigerant may be R600A (isobutane, methylpropane).

[0019] The evaporator is positioned in the air flow circuit/closed air flow path upstream of the air inlet in the flow direction for exchanging heat between the air flow and the refrigerant in the refrigerant circuit.

[0020] Due to the configuration of the above-described beverage cooler, it is possible to quickly and efficiently cool a beverage container. The beverage cooler is easy to use and may be used as a stand-alone unit.

[0021] The cooling chamber may have a first side wall and a second side wall opposite to the first side wall, wherein the air inlet is formed in the first side wall and the air outlet is formed adjacent to or in the second side wall.

[0022] Alternatively, the cooling chamber may have a first side wall and a second side wall opposite to the first side wall, as well as third side wall and a fourth side wall opposite to the third side wall. In this configuration, air inlets may be formed in the first and the second side walls and air outlets may be formed in the third and fourth side walls.

[0023] Introducing the air at one side and exhausting the air at an opposite side allows that the air flows along and past the beverage container. Due to the direct contact of the air with the beverage container, the efficiency of the heat transfer and, therefore, the efficiency of cooling are enhanced.

[0024] The first and second side walls may be located at respective ends in the longitudinal direction of the cooling chamber (being transverse side walls) and/or along the longitudinal direction/a center axis of the beverage container to be accommodated in the cooling chamber (being longitudinal side walls).

[0025] Consequently, the air flows from one end of the beverage container to an opposite end thereby providing for an efficient contact with the entire surface of the beverage container. Accordingly, efficiency of cooling can be improved.

[0026] In one embodiment, the evaporator and/or the fan may be arranged adjacent the first wall outside the cooling chamber.

[0027] As a result, the evaporator and/or the fan are arranged closest to the inlet opening. Hence, any heat or pressure losses of the air flow upstream of the cooling chamber may be minimized.

[0028] In an alternative embodiment, the evaporator and/or the fan may be arranged below the cooling chamber (i.e. below a bottom of the cooling chamber), whereby the length of the beverage cooler in the longitudinal direction of the cooling chamber may be reduced. A radial fan may be advantageous in this embodiment providing for a higher volumetric flow rate.

[0029] Further, the evaporator may be sandwiched between the first wall and the fan.

[0030] As most fans are in general more efficient when blowing air through a flow restriction, such as the evaporator, this configuration provides for a more efficient use of the fan.

[0031] The air flow circuit/closed air flow path comprises a return passage connecting the air outlet and the air inlet. The air inlet and the air outlet are communicated by the cooling chamber. Thus, the air flow circuit comprises the air inlet, the cooling chamber, the air outlet and the return passage. It is self-evident that more than one return passage may be provided. The return passage/-s may be formed at the longitudinal sides of the cooling chamber (e.g. in a longitudinal sidewall/-s), above (e.g. in a lid) and/or below (i.e. in a bottom) of the cooling chamber. The return passage/-s may be provided in a housing body and/or a lid (see below). Preferably, the return passage/-s are integrated into the housing. In the embodiment in which the air inlet is provided in the first side wall and the air outlet/-s is/are provided adjacent to or in the second side wall opposite to the first side wall, the return passage/-s may be formed in a third and/or fourth side wall (longitudinal sidewall/-s) connecting the first and second side walls (transverse side walls). Alternatively, the return passage may be formed below the cooling chamber, i.e. in a bottom of the cooling chamber.

[0032] The cooling chamber may have a plurality of baffle plates (e.g. between 2 and 12), preferably extending perpendicular to the flow direction. The baffle plates reduce the flow rate of the air in certain areas of the cooling chamber. Accordingly, the retention time of the cooling air in these areas is increased. For example, adjacent baffle plates in the longitudinal direction of the cooling chamber may form dead spaces for reducing the flow rate of the introduced cool air along the beverage container. Baffle plates on opposite walls project towards each other. The baffle plates may be distanced in the longitudinal direction of the cooling chamber. Further, baffle plates on one wall may be offset to baffle plates on an opposite wall. Furthermore, the baffle plates may be arranged at the housing body and/or the lid (see below).

[0033] The baffle plates serve for improving the cooling efficiency of the beverage container.

[0034] The housing may have a housing body and a lid movably connected to the housing body for inserting a beverage container into the cooling chamber. The lid may be connected to the housing body like a door rotatable about a horizontal or vertical axis for example substituting a side wall of the cooling chamber. Alternatively, the lid may be rotatable relative to the housing body along a horizontal axis and covering the majority of the length of the cooling chamber, i.e. a top of the cooling chamber. The lid may be hollow or contained an insulating material for insulating the lid relative to the surroundings. Also, the housing may have hollow portions and/or contain insulating material in the areas corresponding to the bottom and/or at the side walls of the cooling chamber.

[0035] Due to the above configuration, ease of use, particular ease of inserting the beverage container into the beverage cooler is realized.

[0036] The air flow circuit/closed air flow path may be formed in the housing body and/or in the lid. For example, the housing body or parts thereof and/or the lid may be manufactured as injection molding parts and the air flow circuit/closed air flow path may at least in part be integrally formed in the injection molding part.

[0037] Thus, the manufacturing costs of the beverage cooler may be kept as low as possible.

[0038] The beverage container may further comprise a rotating mechanism for rotating the beverage container about its longitudinal center axis, the longitudinal center axis being preferably parallel to the longitudinal extension of the cooling chamber. Preferably, the rotating mechanism is configured to rotate the beverage container to up to 400 rpm, preferably between 150 and 350 rpm, such as between 250 rpm and 350 rpm.

[0039] Due to the rotation of the beverage container, heat transfer from the beverage in the container to the air flow may be enhanced and cooling efficiency be improved.

[0040] According to an embodiment, the rotating mechanism comprises a rotatable support arranged in the cooling chamber for rotatably supporting the beverage container and a motor for rotating the support, wherein the motor is located below the cooling chamber. For example, the motor and the rotatable support may be connected via a transmission located adjacent a side wall of the cooling chamber.

[0041] Due to this configuration, the length of the beverage cooler in the longitudinal direction of the cooling chamber may be reduced.

[0042] The rotatable support comprises two distanced rotatable axes extending along the longitudinal direction of the cooling chamber and being connected to the motor via a transmission. As previously indicated, the transmission may be located adjacent to the side wall of the cooling chamber. The motor may provide for up to 600 rpm. The two axes may be rotated to up to 2,000 rpm. Hence, the transmission ratio may be between 3 and 4. Further, the motor speed may gradually increase from 0 to 600 rpm to only gradually increase the rotational speed of the beverage container.

[0043] The minimum distance between the outer circumferences of the two axes may be between 48 mm and 50 mm and preferably is 49 mm. The distance is primarily governed by the minimum diameter of the beverage container to be accommodated in the cooling chamber, e.g. the diameter of a 0.25 liter Red Bull® can. The distance of the center axes of the two axes may be 60 mm, in case high friction support rings are mounted to the axes, the distance between the outer circumference of opposite support rings on the axes being between 48 mm and 50 mm.

[0044] The compressor and/or the condenser and/or the expansion mechanism is/are arranged below the cooling chamber.

[0045] As a consequence, a relatively short beverage cooler in the longitudinal direction of the cooling chamber may be achieved. Additionally, the center of gravity will be relatively low so that stability of the beverage cooler is high when being placed on a horizontal surface.

[0046] In an embodiment, a volumetric flow rate of the air flow induced by the fan is in the cooling chamber between 0.005 m^3/s and 0.03 m^3/s, preferably 0.01 and 0.03 m^3/s and most preferably between 0.02 m^3/s and 0.03 m^3/s. The volumetric air flow in the cooling chamber is particularly to be considered as the air flow in the longitudinal direction of the cooling chamber. As previously indicated, the baffle plates are intended to reduce the flow rate in certain areas to create an air circulation. Yet, the overall flow rate in the longitudinal direction of the cooling chamber should be within the above range. One may also consider this flow rate to be the flow rate of the air introduced into the cooling chamber at the air inlet.

[0047] The volumetric flow rate of the air flow induced by the fan is in the return passage larger than in the cooling chamber. The volumetric flow in the return passage is preferably between 0.03 m^3/s and 0.05 m^3/s.

[0048] According to this aspect, heat transfer between the beverage container and the air may be enhanced and cooling efficiency be improved.

[0049] The cooling chamber may have an internal volume of less than 10,000 cm^3, e.g. between 6,000 cm^3 and 10,000 cm^3 or between 4,000 cm^3 and 9,100 cm^3 excluding any internal mechanisms or features such as the baffle plates or the rotating mechanism described above.

[0050] Thus, the entire volume of the cooling chamber may be kept relatively low so that as compared to a common refrigerator/fridge, the heat transfer is improved. Therefore, quick and efficient cooling of the beverage container is achieved.

Brief Description of the Drawings

[0051] An embodiment will be described referring to the accompanying drawings, in which:

Figure 1 shows a perspective view of a beverage cooler.

Figure 2 shows a perspective view of the beverage cooler in Figure 1 with the lid being removed.

Figure 3 shows a perspective of the beverage cooler in Figure 1 with the housing body, the cooling chamber and the lid being shown in transparent.

Figure 4 shows a transvers cross-section of the beverage cooler perpendicular to the longitudinal direction of the cooling chamber.

Figure 5 shows a longitudinal cross-section of the beverage cooler perpendicular to the longitudinal direction of the cooling chamber.

Figure 6 shows a simulation of the air flow in the air flow circuit.

Detailed Description

[0052] In the accompanying drawings, the same features are denoted by the same reference numerals.

[0053] The drawings show a beverage cooler 10 according to an embodiment. The beverage cooler 10 comprises a housing 12. The housing 12 comprises a housing body 14 and a lid 16. The lid 16 is hinged to the housing body 14 so as to be rotatable about an axis of rotation 18 being oriented horizontally. Thus, the lid 16 may in use be moved upward and downward to open and close the later described cooling chamber 32 allowing the insertion and removal of a beverage container 34. For this purpose, the lid may have a recess 20 embodying a handle.

[0054] The housing 12 has a length L, a width W and a height H. The length L is larger than the width W. Thus, the housing 12 is elongated.

[0055] The housing 12 is basically parallelepiped. Thus, the housing 12 has first and second opposite longitudinal side walls 22 and first and second opposite transverse side walls 24. One or two of the side walls may have a grid 26 allowing the exchange of air between the interior of the housing 12 and the exterior of the housing 12. In the present embodiment, a grid 26 is provided in each of the first and second longitudinal side walls 22 adjacent a transverse side wall 24 and a bottom 28.

[0056] Further, the bottom 28 serves as a support for supporting the beverage cooler 10 on a horizontal surface such as a table or a kitchen countertop. In the present embodiment, the lid 16 forms a top 30 of the housing 12 opposite to the bottom 28.

[0057] The beverage cooler 10 further comprises a cooling chamber 32 part of which is shown in Figure 2. In particular, the cooling chamber 32 in the present embodiment is defined by the housing body 14 and the lid 16. With the lid 16 in the closed position, the cooling chamber is a closed space. To improve the cooling efficiency, a sealing 40 is provided in the housing body 14 to seal the interface between the lid 16 and the housing body 14.

[0058] The cooling chamber 32 as well has a length L_c, a width W_c and a height H_c (shown in Figure 4). The length L_c of the cooling chamber 32 is as larger than its width W_c. Thus, the cooling chamber 32 is elongated. In one example, the length L_c is between 3 times and 5 times larger than the width W_c.

[0059] The length L_c may be in the range of 320 mm and 385 mm, preferably between 320 mm and 375 mm. In another example, the length L_c of the cooling chamber 32 may be between 320 mm and 365 mm. The length L_c of the cooling chamber is particularly governed by the largest height of a beverage container 34, e.g. a bottle, to be accommodated in the cooling chamber. An example may be a flail bottle or slender bottle, e.g. used for Riesling, having a height between 300 and 375 mm. Another example may be a burgundy bottle, e.g. used for Chardonnay, usually having a height between 300 mm and 320 mm.

[0060] The width W_c of the cooling chamber 32 may be between 100 mm and 190 mm. Again, the width W_c of the cooling chamber 32 is particularly governed by the largest diameter of a beverage container to be accommodated. In this context, the diameter of a burgundy bottle is usually between 78 mm and 90 mm and that of a flail bottle is usually between 60 mm to 82 mm. If baffle plates are provided (see below), the width may be larger and preferably between 120 mm and 180 mm. Without baffles plates, a smaller width between 100 mm and 140 mm may be selected.

[0061] The height H_c may be in a similar range as the width. The height H_c may be in the range of 120 mm and 200 mm. Similar as the width W_c, the height H_c is particularly governed by the largest diameter of a beverage container to be accommodated. Again, if baffle plates are provided, the height HC may be larger (between 120 mm and 200 mm) as compared to a cooling chamber without baffle plates (between 110 mm and 150 mm).

[0062] The cooling chamber 32 has an internal volume of less than 10,000 cm^3, e.g. between 6,000 cm^3 and 10,000 cm^3 or between 4,000 cm^3 and 10,000 cm^3 excluding any internal mechanisms or features such as the baffle plates or the rotating mechanism described above.

[0063] The cooling chamber 32 is generally parallelepiped being limited by first and second opposite longitudinal side walls 42 and first and second opposite transverse side walls 44. In a plan view, the cooling chamber 32 is basically rectangular with rounded corners. In the present embodiment, the first and second opposite longitudinal side walls 42 extend in the longitudinal direction (length L_c) of the cooling chamber corresponding to the longitudinal direction of the housing 12 (length L). Thus, the first and second longitudinal side walls 42 extend parallel to the longitudinal center axis 35 of the beverage container 34. To the contrary, the first and second transverse side walls 44 extend along the width W^c direction of the cooling chamber 32 and in the present embodiment also the width direction W of the housing 12. Thus, the first and second transverse side walls 44 extend perpendicular to the longitudinal center axis 35 of the beverage container 34. In other words, the first and second transverse side walls 44 are located at the respective ends of the beverage containers 34 along the longitudinal center axis 35 of the beverage container 34. As also visible from Figure 2, the beverage container 34 in the present invention is oriented horizontally, i.e. with is longitudinal center axis 35 being parallel to the bottom 28 of the housing 12.

[0064] The cooling chamber 12 further comprises a bottom 48 and a top 50, wherein the top is located in the lid 16 (see Figure 4). The lid 16 may have hollow portions 76 so that the air within the hollow portion 76 may serve as insulation material for insulating the cooling chamber 32.

[0065] The cooling chamber 32 comprises an air inlet 36 and an air outlet 38. In the present embodiment, two air outlets 38 are provided. In particular, the air inlet 36 is arranged in the first transverse side wall and the air outlets are positioned in the first and second longitudinal side walls 42 adjacent to the second transverse side wall 44.

[0066] Moreover, the cooling chamber 32 comprises a plurality of baffle plates 46 (8 in the embodiment depicted in Figure 2 and 10 in the simulation of Figure 6). The baffle plates 46 protrude from the first and second longitudinal side walls 42 as well as from the bottom 48 and the top 50 towards a center axis (the center axis 35 of the beverage containers 34). Therefore, the baffle plates extend perpendicular to the flow direction of the later described air flow through the cooling chamber 32. A free or leading edge 52 of the baffle plate 46 defines an area within the cooling chamber and is sized to accommodate the beverage containers 34 (see Figure 4). As shown in the simulation in Figure 6, the baffle plates 46 may be offset on the opposite longitudinal side walls 42. To put it differently, a baffle plate 46 on one of the longitudinal side walls 44 may be positioned intermediate two adjacent baffle plates 46 on the opposite longitudinal side wall 44.

[0067] The beverage cooler 10 further comprises an air flow circuit. The air flow circuit is constituted by the air inlet 36, the cooling chamber 32, the air outlet/-s 38 and a return passage 54. The return passage 54 extends from the air outlet/-s 38 parallel to the first and second longitudinal side walls 42 as best visible from Figures 4 and 5. The return passage 54 may comprise a return chamber 56 located at an end of the return passage 54 opposite to the air outlet/-s 38. The return passage 54 extends from the air outlet/-s 38 via the optional return chamber 56 to the air inlet 36.

[0068] Moreover, the beverage cooler 10 comprises a refrigerating device 58 best visible from Figure 3. The refrigerating device 58 is a vapor compression refrigerator. The refrigerating device 58 comprises a compressor 60, an evaporator 62, an expansion mechanism not visible in the drawings (here the form of the capillary tube) and a condenser 64. In the present embodiment, two condensers 64 are provided in order to increase the cooling capacity. Yet, only one condenser 64 may be sufficient. The evaporator 62 and/or the condensers 64 may be fin-tube-type heat exchangers.

[0069] The compressor 60, the evaporator 62, the expansion mechanism and the condensers 64 are connected by refrigerant pipes 66 forming a refrigerant circuit and containing a refrigerant. In the present in embodiment, the refrigerant is R600A. Yet, other refrigerants may as well be used.

[0070] The compressor 60, the expansion mechanism and the condensers 64 are located in a lower portion of the housing 12.

[0071] Particularly, the compressor 60 and the condenser 64 are mounted on a bottom plate 68 of the housing 12 and comprising the bottom 28. In this context, the condensers 64 are located adjacent and parallel to the longitudinal side walls 22 of the housing 12 adjacent to the grids 26. A fan 70, particularly an axial fan, is located between the condenser/-s 64 and the grid/-s 16 or the condenser/-s may be located between the fan/-s 70 and the grid/-s 16. A plurality of holes 72 is further provided in the first transverse side wall 24 of the housing 12. Thus, outdoor air may be drawn in via the grids 16 by means of the fan 70, passes through the condensers 64 and may again be exhausted from the interior of the housing 12 via the holes 72 to the outside. Thus, heat may be exchanged between the sucked in outdoor air and the refrigerant flowing through the condensers 66 before the outdoor air is again exhausted.

[0072] The compressor 60, the condenser 64 and the expansion mechanism are located below the cooling chamber 32. The evaporator 62 is in the present embodiment located adjacent to the first transverse side wall 44 of the cooling chamber 32 comprising the air inlet 36. Further, a fan 74 for inducing an airstream through the air flow circuit is also located in the vicinity or adjacent the first transverse side wall 44 of the cooling chamber 32. In the particular embodiment, the evaporator 62 is sandwiched between the first transverse side wall 44 and the fan 74. Further, in the present embodiment the fan 74 is an axial fan. The fan 74 as? the fans 72 may provide for an air flow rate of at least 0.01 m^3/s, preferably 0.05 m^3/s.

[0073] When the fan 74 is operating, an air flow is induced in a closed loop. In particular, air is flown by the fan 74 to pass through the evaporator 62, wherein the air exchanges heat with the refrigerant flowing through the evaporator 62. In particular, the air is cooled, and heat is transferred from the air to the refrigerant for evaporating the refrigerant in the evaporator 62. Subsequently, the air flows via the air inlet 36 into the cooling chamber 32. The cool air introduced into the cooling chamber 32 flows along the surfaces of the beverage container 34 and past the beverage container 34 towards the air outlet 38 at the opposite end of the cooling chamber 32. In order to retain the cool air as long as possible within the cooling chamber 32, the baffle plates 46 form dead spaces 47 in which the cool air may circulate (see simulation in Figure 6). When the cool air has reached the air outlets 38, it enters the return passage 54, flows to the return chamber 56 and is sucked in by the fan 74 and again flown through the evaporator 62 for cooling. From this explanation, it is clear that the evaporator 62 is positioned in the air flow circuit upstream of the air inlet 36 in the flow direction of the air flow in the air flow circuit. In this embodiment, also the fan is arranged in the air flow circuit. Moreover, it becomes clear that the return passage connects the air outlet/-s 38 and the air inlet 36. Similarly, the cooling chamber 32 forms a passage that connects the air inlet 36 and the air outlet/-s 38.

[0074] The volumetric flow rate of the air flow induced by the fan 74 may in the cooling chamber be between 0.005 m^3/s and 0.03 m^3/s, preferably 0.01 and 0.03 m^3/s and most preferably between 0.02 m^3/s and 0.03 m^3/s. It is also clear, that the volumetric flow rate in the dead spaces 47 formed by the baffle plates 46 is by far slower. Hence, the above volumetric flow rate particularly relates to the air volumetric air flow in the longitudinal direction of the cooling chamber 32 or at the air inlet. The volumetric flow rate of the air flow in the return passage 54 may be larger than in the cooling chamber 32 and preferably between 0.03 m^3/s and 0.05 m^3/s.

[0075] The refrigerant in the evaporator 62 is vaporized and, hence, gaseous. The gaseous refrigerant is returned to the compressor 60. The refrigerant compressed in the compressor 60 is subsequently fed to the condensers 64. In the condensers 64, the refrigerant is condensed by transferring heat from the refrigerant to the outdoor air sucked in and flown through the condenser 64 by the fans 70. The condensed and, hence, liquid refrigerant passes through the expansion mechanism (capillary tube or expansion valve) being expanded. Due to the expansion, the refrigerant will change to a two-phase state, i.e. liquid and gas (vapor). The two-phase refrigerant is subsequently fed to the evaporator 62 in which the refrigerant is fully vaporized by taking up the heat from the air passed through the evaporator 62 by the fan 74, thereby cooling the air.

[0076] In order to further enhance the cooling efficiency, it may be beneficial to rotate the beverage container 34 along its longitudinal center axis 35. For this purpose, the beverage cooler 10 comprises a rotating mechanism 78 for rotating the beverage container 34 (see particularly Figures 2 and 3).

[0077] The rotating mechanism 78 comprises a rotatable support 80 comprising two distanced axes 82. The axes 82 are rotatable about their center axes 84. Each of the axes 82 comprises a plurality of high friction (e.g. rubber) support rings 86 for supporting the beverage container 34. The beverage container 34 particularly rests on the support rings 86.

[0078] The distance D_1 between the axes 82 is about 60 mm. More important, however, is the distance D_2 between the outer circumferential surfaces of opposite support rings 86. The distance D_2 is between 48 mm and 50 mm and preferably 49 mm. The distance D_2 is primarily governed by the minimum diameter of the beverage container 34 to be accommodated in the cooling chamber 32, e.g. the diameter of a 0.25 liter Red Bull® can. Yet, also the largest diameter of the beverage container 34 to be accommodated in the cooling chamber 32 has some influence. The distance should be large enough to also stably support those beverage containers 34 having a larger diameter.

[0079] Moreover, the rotating mechanism 78 comprises an electric motor 88. The electric motor 88 is located below the bottom 48 of the cooling chamber 32. The electric motor 88 has a driving axis 90 parallel to the longitudinal extension of the axes 82 and protruding beyond the second transverse side wall 44 of the cooling chamber

32. A driving gear 92 is mounted to the driving axis 19.

[0080] Driven gears 94 are mounted at the respective ends of the axes 82 which protrude through the second transverse side wall 44. The driven gears 94 meshing with the driving gear 92. Due to the different diameters of the driven gears 94 and the driving gear 92, they form a transmission 96.

[0081] When a beverage container 34 is placed on the support rings 86 of the two axes 82 and the cooling process is started, the electric motor 88 gradually increases its speed. Thus, the rotational speed of the driving axis 90 gradually increases. The rotation of the driving axis 90 is transferred via the driving gear 92 to the driven gears 94, whereby the axes 82 are rotated both in the same rotational direction. Due to the high friction support rings 86 in contact with the outer circumference of the beverage container 34, also the beverage container 34 is rotated.

[0082] The rotational speed of the electric motor 88 may be up to 600 rpm. The rotational speed of the axes 82 may be up to maximum 2,000 rpm. The rotational speed of the beverage container 34 may be up to 400 rpm.

[0083] Even though one particular embodiment has been described above, it is clear that several modifications are conceivable.

[0084] For example, a beverage cooler having only one cooling chamber 32 has been described. Yet, it is also possible to provide more than one cooling chamber 32, e.g. two cooling chambers 32. In this instance, however, the two cooling chambers 32 will be separated by an intermediate partition wall so as to obtain the beneficial heat transfer between the airflow through the cooling chamber and the beverage container 34.

[0085] Moreover, it has been described to position most of the components of the refrigerating device 58 below the cooling chamber 32. This is particularly advantageous when talking about a stand-alone unit to be placed on a kitchen countertop or table. Yet, the beverage cooler may as well be configured for being accommodated in a drawer. In this instance, the height H of the housing 12 should be not more than 29 mm. According to such an embodiment, the components of the refrigerating device 58 will most likely be arranged at the side of the cooling chamber 32, i.e. adjacent one of the longitudinal sidewalls 42.

[0086] Further, the airflow circuit has been described as a completely closed loop with no exchange of air between the airflow circuit and external air. Yet, it is also conceivable to provide the airflow circuit with an external air inlet and/or an external air outlet to introduce air from the outside of the housing 12 and/or exhaust air to the outside of the housing 12 and thereby increase the volume flow.

[0087] Additionally, instead of the axial fan 74 also a radial fan may be used with the benefit of increasing the volume flow. The same applies to the fans 70.

[0088] Furthermore, the evaporator 62 and the fan 74 have been described as being positioned adjacent the first transverse side wall 44 of the cooling chamber 32. Yet, the evaporator 62 and/or the fan 74 may also be positioned below the cooling chamber 32. In this instance, but also in other cases, the return passage may pass along the bottom 48 of the cooling chamber 32 from the air outlet/-s 38 back to the air inlet 36 rather than along the longitudinal sidewalls 42 of the cooling chamber 32 as described.

[0089] Further, it would also be conceivable to incorporate the or part of the return passage in the lid 16.

[0090] In addition, two return passages 54 have been described in the embodiment. Yet, more return passages or only one return passage are conceivable as well.

[0091] Another possible embodiment arranges the evaporator 62 and the fan 74 adjacent to one of the longitudinal sidewalls 42 of the cooling chamber 32 or provides an evaporator 62 and a fan 74 at each of the longitudinal sidewalls 42 of the cooling chamber 32. In this case, but also in other cases, two air inlets 36 may be provided. In this case, but also in other cases, the air inlet 36 may be provided in the longitudinal sidewall/-s 42 instead of the first transverse side wall 44.

[0092] Moreover, the above embodiment has been described in combination with a glass bottle as beverage container 34. Yet, the beverage cooler 10 is not limited in this regard and any beverage container including bottles of any kind and cans can be cooled.

Reference List

[0093]

10	beverage cooler
12	housing
14	housing body
16	lid
18	axis of rotation
20	recess
22	longitudinal sidewall
24	transverse side wall
26	grid
28	bottom
30	top
32	cooling chamber
34	beverage containers
35	longitudinal center axis
36	air inlet
38	air outlet
40	sealing
42	longitudinal sidewall
44	transverse side wall
46	baffle plate
47	dead space
48	bottom
50	top
52	free/leading edge
54	return passage

56 return chamber
58 refrigerating device
60 compressor
62 evaporator
64 condenser
66 refrigerating pipe
68 bottom plate
70 fan
72 hole
74 fan
76 Hollow portion
78 rotating mechanism
80 rotatable support
82 axes
84 center axis
86 support ring
88 motor
90 driving axis
92 driving gear
94 driven gear
96 transmission

Claims

1. Beverage cooler (10) comprising:

a housing (12),
an elongated cooling chamber (32) formed in the housing (12) for accommodating a beverage container (34), the cooling chamber (32) comprising an air inlet (36) and an air outlet (38),
an air flow circuit comprising the air inlet (36), the cooling chamber (32) and the air outlet (38),
a fan (74) arranged in the air flow circuit for inducing an air flow in the air flow circuit in an air flow direction, and
a refrigerating device (58) arranged in the housing (12) and comprising a compressor (60), an evaporator (62), an expansion mechanism and a condenser (64) connected in a refrigerant circuit containing a refrigerant, wherein the evaporator (62) is positioned in the air flow circuit upstream of the air inlet (36) in the flow direction for exchanging heat between the air flow and the refrigerant in the refrigerant circuit.

2. Beverage cooler according to claim 1, wherein the cooling chamber (32) has a first side wall (42; 44) and a second side wall (42; 44) opposite to the first side wall, wherein the air inlet (36) is formed in the first side wall and the air outlet (38) is formed adjacent to or in the second side wall.

3. Beverage cooler according to claim 2, wherein the first and second side walls (42; 44) are located at respective ends in the longitudinal direction of the cooling chamber (32).

4. Beverage cooler according to claim 2 or 3, wherein the evaporator (62) and/or the fan (74) is/are arranged adjacent the first wall (42; 44) outside the cooling chamber (32).

5. Beverage cooler according to claim 4, wherein the evaporator (62) is sandwiched between the first wall (42; 44) and the fan (74).

6. Beverage cooler according to any one of the preceding claims, wherein the air flow circuit comprises a return passage (54) connecting the air outlet (38) and the air inlet (36) .

7. Beverage cooler according to any one of the preceding claims, wherein the cooling chamber (32) has a plurality of baffle plates (46), preferably extending perpendicular to the flow direction.

8. Beverage container according to any one of the preceding claims, wherein the housing (12) has a housing body (14) and a lid (16) movably connected to the housing body (14) for inserting a beverage container (34) into the cooling chamber (32) .

9. Beverage cooler according to claim 8, wherein the air flow circuit may be formed in the housing body (14) and/or the lid (16).

10. Beverage container according to any one of the preceding claims, further comprising a rotating mechanism (78) for rotating the beverage container (34) about its longitudinal center axis (35), the longitudinal center axis (35) being preferably parallel to the longitudinal extension of the cooling chamber (32).

11. Beverage cooler according to claim 10, wherein the rotating mechanism (78) comprises a rotatable support (80) arranged in the cooling chamber (82) for rotatably supporting the beverage container (34) and a motor (88) for rotating the support (80), wherein the motor (88) is preferably located below the cooling chamber.

12. Beverage cooler according to claim 11, wherein the rotatable support (80) comprises two distanced axes (82) extending along the longitudinal direction of the cooling chamber (32) and being connected to the motor (88) via a transmission (96).

13. Beverage container according to any one of the preceding claims, wherein the compressor (60) and/or the condenser (64) and/or the expansion mechanism is/are arranged below the cooling chamber (32).

14. Beverage cooler according to any one of the preceding claims, wherein a volumetric flow rate of the air flow induced by the fan (74) is in the cooling chamber (32) between 0.005 m^3/s and 0.03 m^3/s, preferably 0.01 and 0.03 m^3/s and most preferably between 0.02 m^3/s and 0.03 m^3/s and/or, depending on claim 6, in the return passage (54) larger than in the cooling chamber (32) and/or between 0.03 m^3/s and 0.05 m^3/s.

15. Beverage cooler according to any one of the preceding claims, wherein the cooling chamber (32) has an internal volume of less than 10,000 cm^3, preferably between 6,000 cm^3 and 10,000 cm^3.

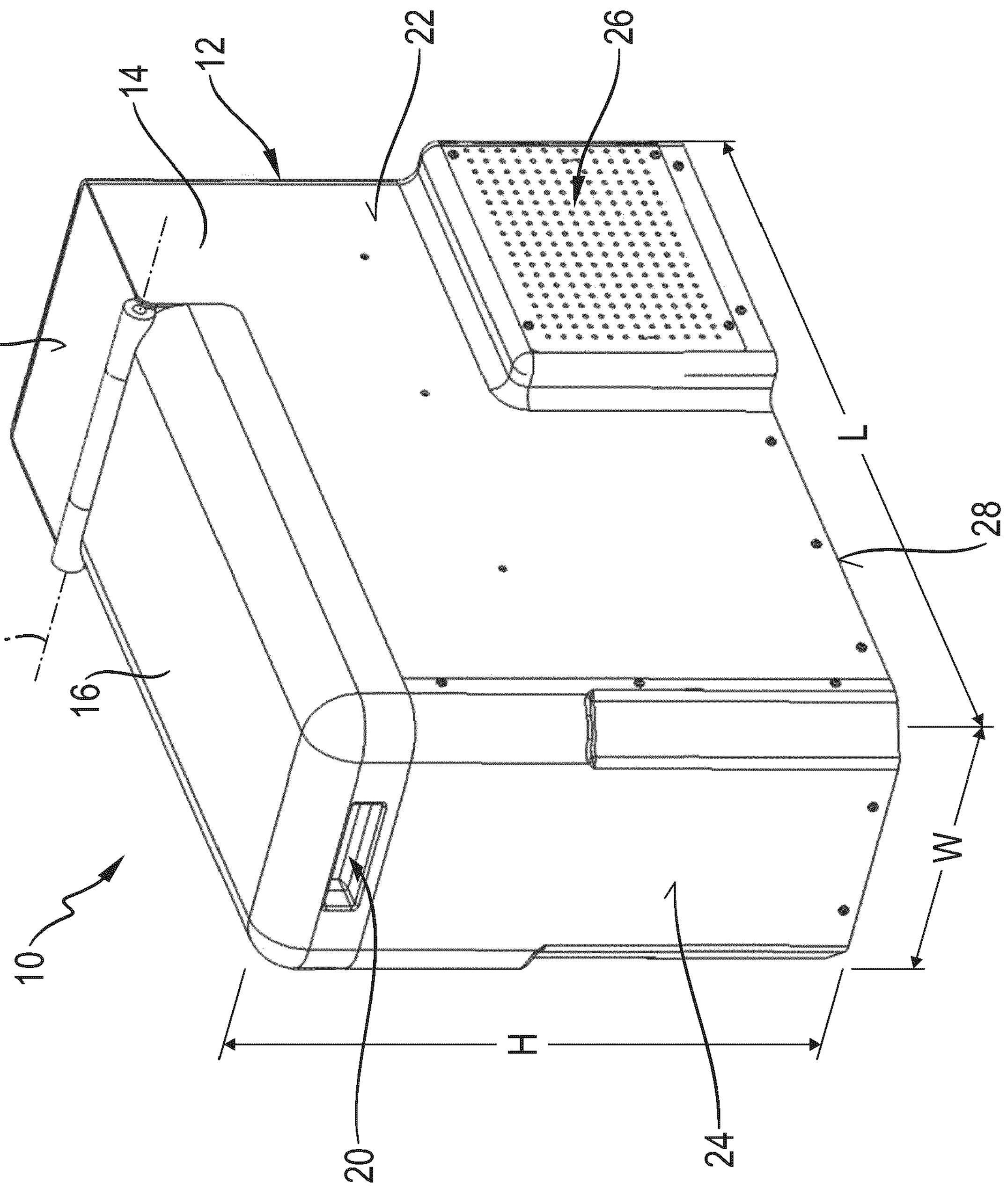

Fig. 1

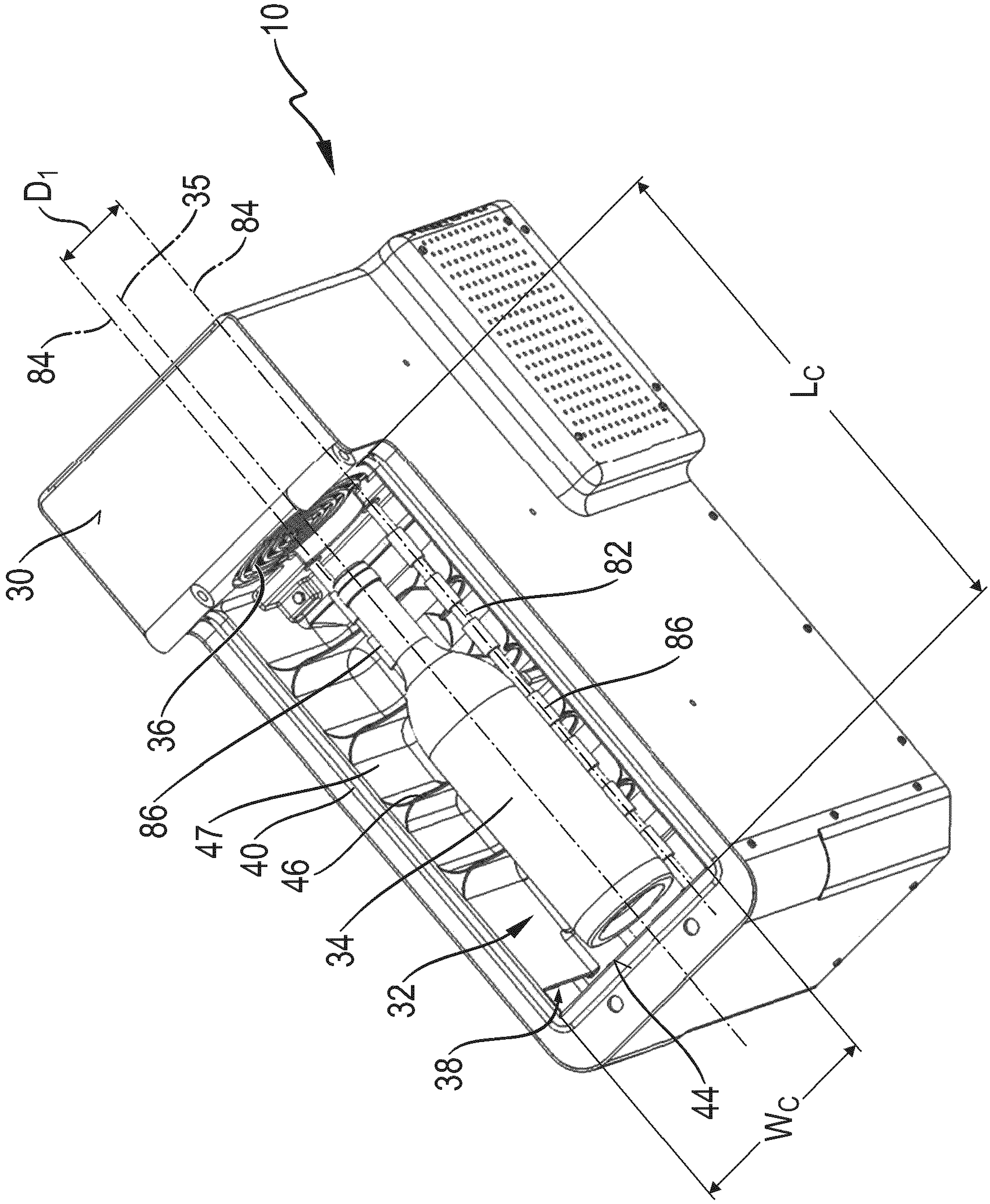

Fig. 2

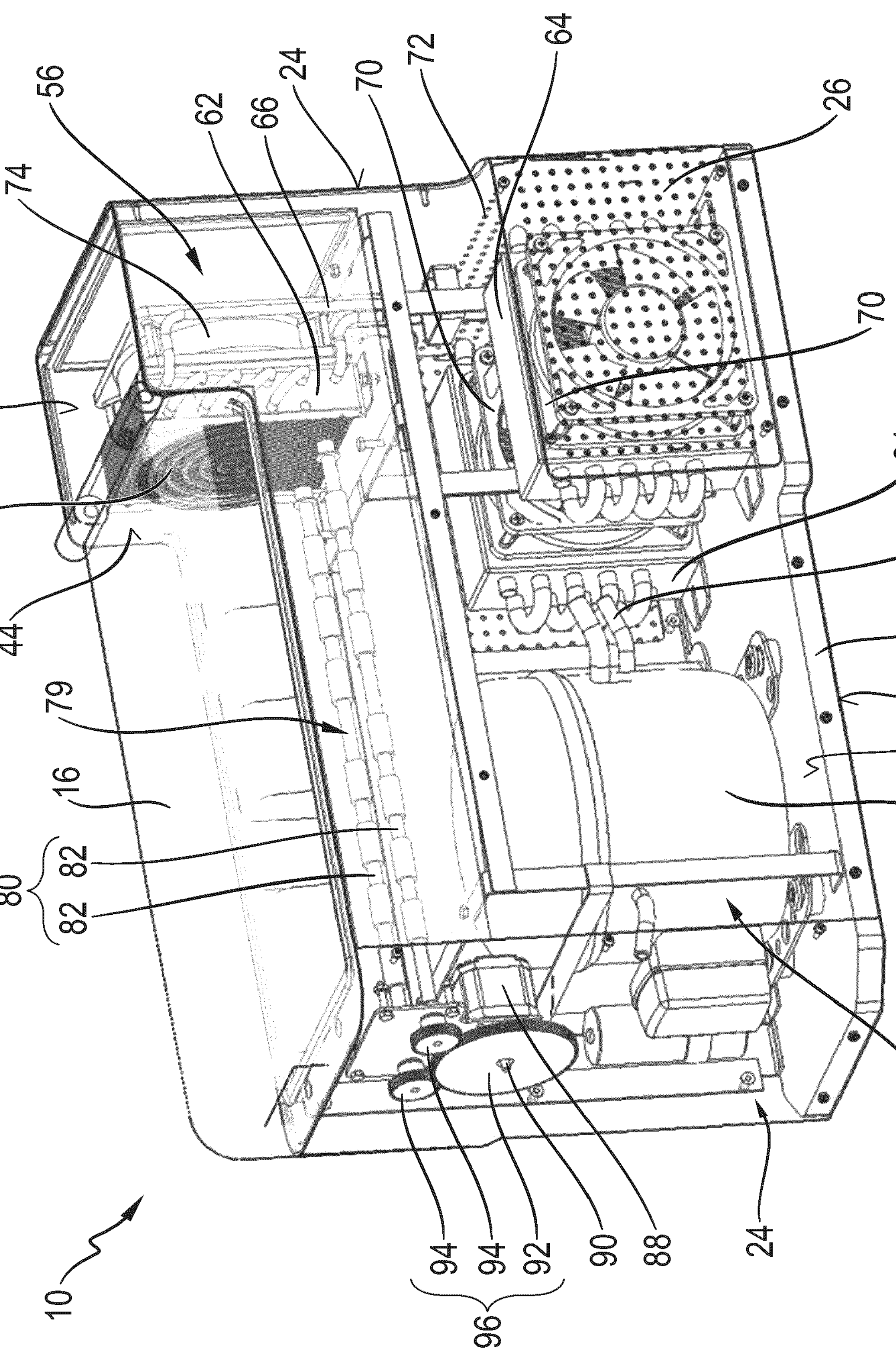
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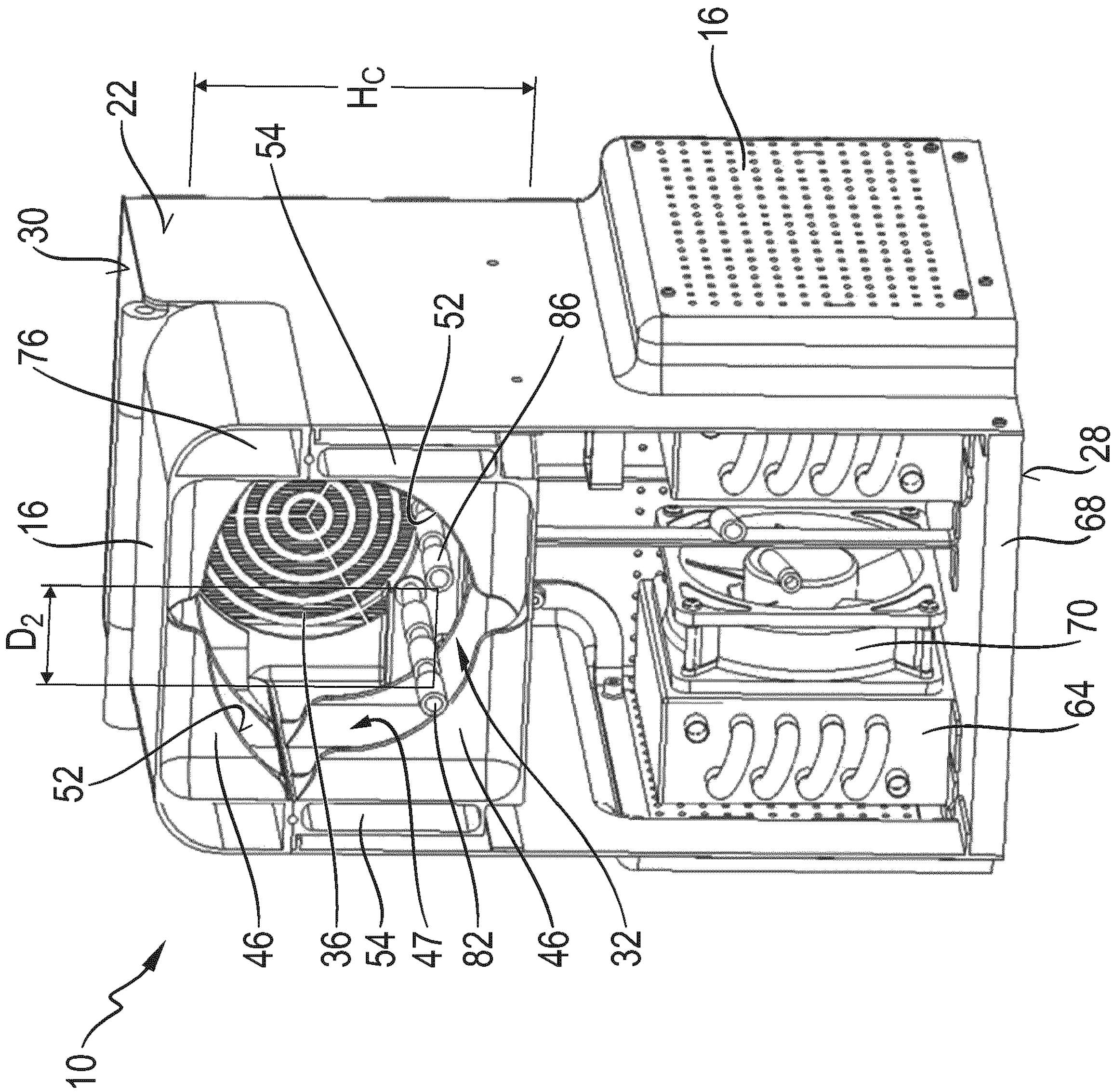
Fig. 3

Fig. 4



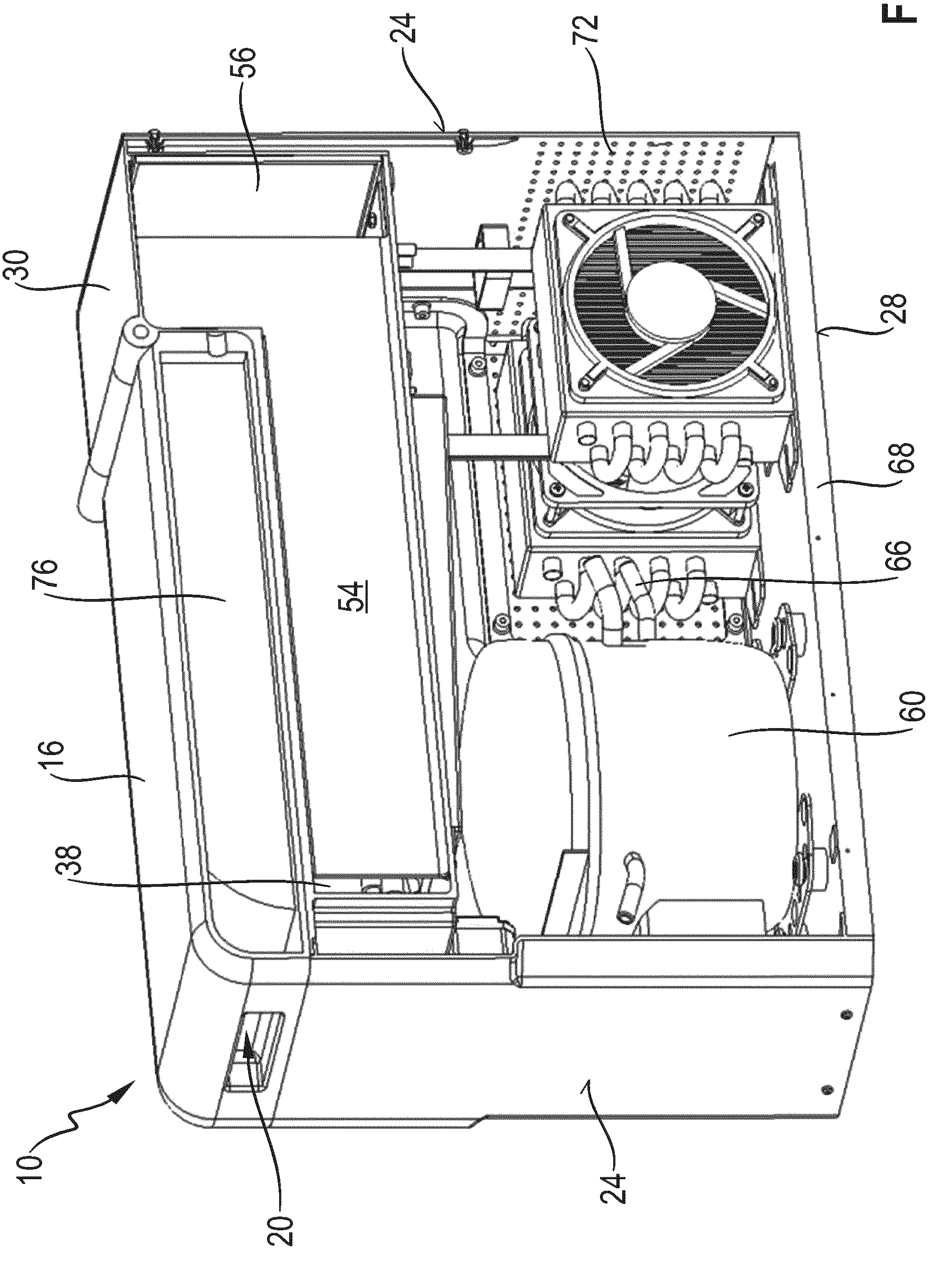
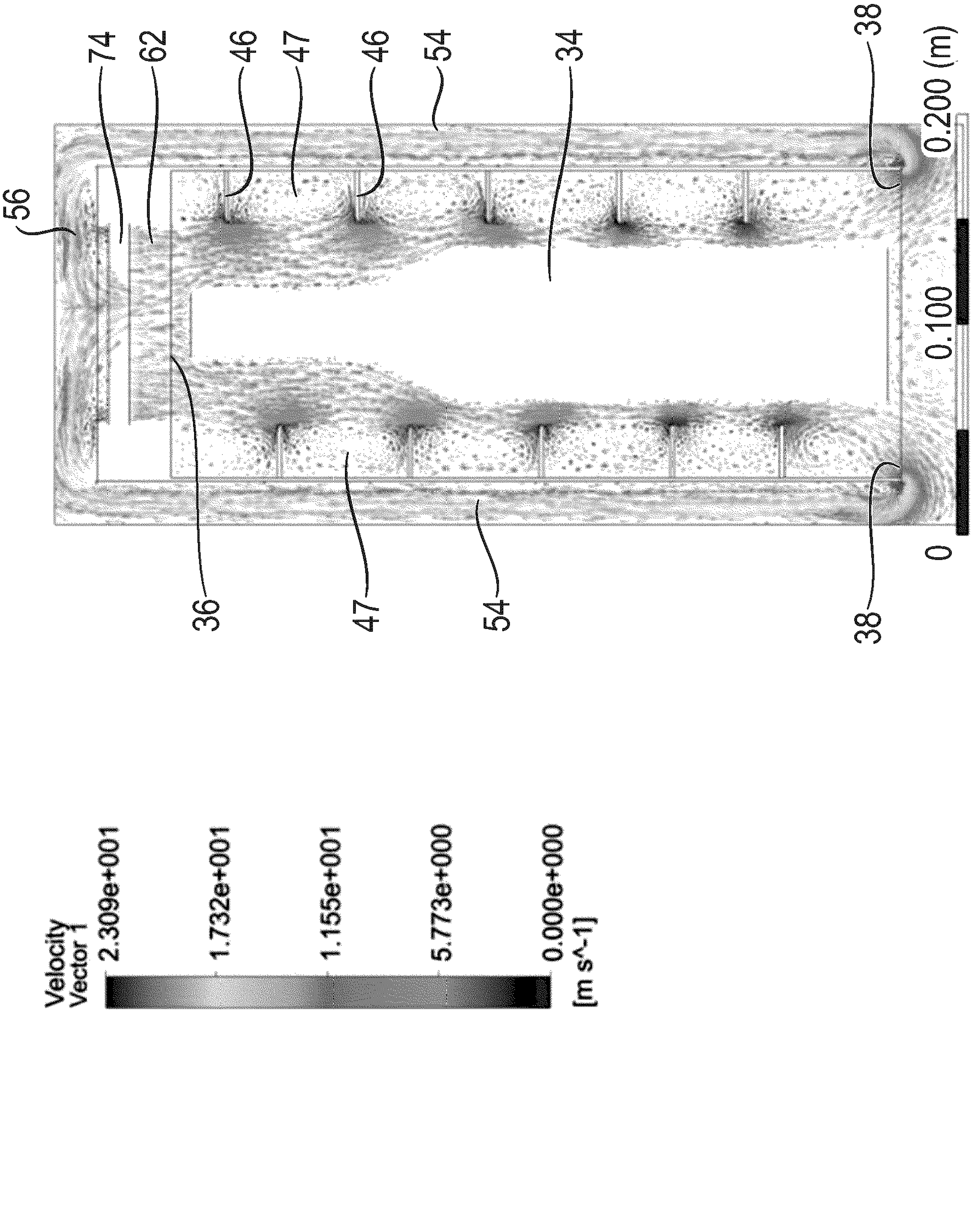


Fig. 5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74
62
46
47
46
54
34
38
36
47
54
38
0
0.050
0.100
0.150
0.200 (m)
Velocity
Vector 1
2.309e+001
1.732e+001
1.155e+001
5.773e+000
0.000e+000
[m s^-1]

Fig. 6

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Application Number
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