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(54) **HOT WATER TANK**

(57) A hot water tank comprising a top, a bottom and a cylindrical side wall; a heat exchanger positioned in the tank; a cold water inlet for introducing cold water, the cold water inlet being positioned in the bottom of the tank; a hot water outlet for discharging hot water, wherein the bottom of the tank has an outwardly convex dome shape, and the cold water inlet is positioned in the bottom of the tank between a centre of the bottom and the cylindrical side wall, the hot water tank further comprising a baffle that is positioned in the tank covering the cold water inlet so that the flow of water discharged from the cold water inlet is redirected to a flow along the bottom; wherein the baffle comprises a top plate facing the cold water inlet and onto which water is discharged from the cold water inlet, a front, and sides, wherein a main outlet opening is defined in the front, the main outlet opening being directed towards the centre of the tank.

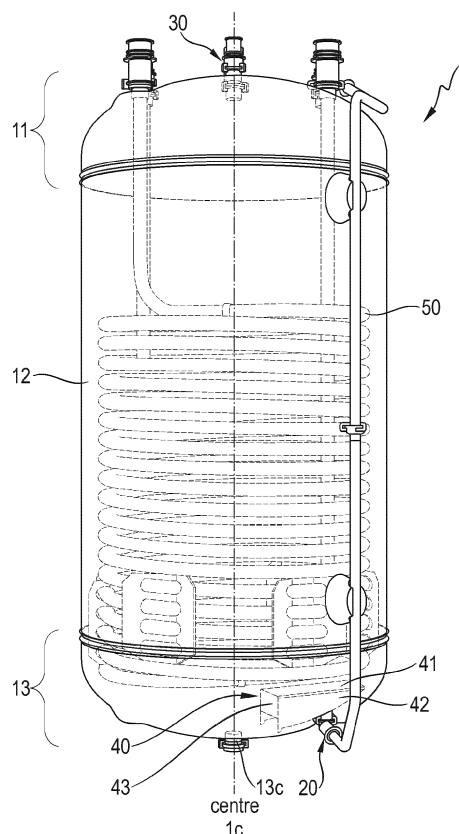


Fig. 1

Description

TECHNICAL FIELD

[0001] The present invention relates to a hot water tank.

BACKGROUND ART

[0002] Hot water tanks are mostly used as domestic hot water tanks, wherein a hot water outlet is provided in the upper half of the water tank, a cold water inlet is positioned in the lower half of the water tank, and a heat exchanger is positioned in the tank. In known hot water tanks, the cold water inlet is provided either in the cylindrical sidewall or at the centre of the bottom of the tank. It is further known that hot water tanks may have a dome shape structure covering the cold water inlet in order to distribute the cold water in the hot water tank. In other current designs, the cold water inlet is a vertical pipe in the hot water tank that is connected from the top of the tank, going through the hot zone in the upper half of the hot water tank, and releasing water at the bottom of the vertical pipe. At the bottom of the vertical pipe of the cold water inlet can a diffuser or a baffle box be positioned to minimize the water velocity entering the tank and to reduce the vortex phenomenon. However, such a design may create an undesired heat transfer between the cold vertical pipe and the already heated water, especially in the upper half of the hot water tank. Furthermore, known dome shape structures, diffusers, or baffle boxes (deflection devices) have the disadvantage that the cold water still enters the tank with high flow velocity and creates a significant vortex which impact the stratification process, as cold water is mixed with the already heated water.

[0003] In general, cold water enters the hot water tank from the cold water inlet and is heated due to a heat transfer from the heat exchanger. When the cold water is heated, the heated water rises in the water tank due to a change in density and collects in the upper half of the water tank. Due to differences in density, the heated water may accumulate in layers in the hot water tank. Thereby, each layer has one temperature and is distinguished from the other layer by a different temperature. This layering of different water temperatures is called stratification process. In the upper half portion of the water tank, where the heated water collects in the water tank, the hot water outlet is usually provided. In known hot water tanks, there is the problem of a heat loss which is caused by a mixing of the cold water entering the hot water tank with already heated water. Furthermore, in cases where the cold water inlet is a vertical pipe, the cold water flowing in the vertical pipe may already cool the heated water that has already collected in the upper half of the hot water tank.

[0004] Accordingly, it is desired to avoid a mixing of cold water entering the water tank with the already heated

water. Higher performance in thermal storage for domestic hot water tanks is also desired.

SUMMARY OF THE INVENTION

[0005] In view of the above, it is an object of the present invention to provide a hot water tank having a higher performance in thermal storage.

[0006] This object is solved by a hot water tank according to claim 1. The dependent claims describe optional features and preferred embodiments.

[0007] According to a **first aspect** of the invention, a hot water tank comprises a top, a bottom and a cylindrical side wall, a heat exchanger positioned in the tank, a cold water inlet for introducing cold water, wherein the cold water inlet being positioned in the bottom of the tank, and a hot water outlet for discharging hot water. The bottom of the tank has an outwardly convex dome shape, and the cold water inlet is positioned in the bottom of the tank between a centre of the bottom and the cylindrical side wall. The hot water tank further comprises a baffle that is positioned in the tank covering the cold water inlet so that the flow of water discharged from the cold water inlet is redirected to a flow along the bottom. The baffle comprises a top plate facing the cold water inlet and onto which water is discharged from the cold water inlet, a front, and sides, wherein a main outlet opening is defined in the front, the main outlet being directed towards the centre of the tank.

[0008] The baffle may not be fixed to the cold water inlet. The baffle front may be oriented towards the centre of the tank in the installed state. The hot water outlet may be positioned in the upper portion of the tank. The hot water outlet may be positioned at a centre of the top of the hot water tank.

[0009] The baffle may discharge cold water, preferably from the main outlet opening, with a non-turbulent flow. The flow direction of cold water leaving the baffle, preferably from the main outlet opening, may be parallel to the internal bottom surface of the tank. The flow direction of cold water entering the baffle from the cold water inlet may be parallel to a central axis of the cold water inlet. The central axis of the cold water inlet is the axis of the cold water inlet at the connection of the cold water inlet with the bottom of the tank. The central axis of the cold water inlet is the central axis of the discharge opening of the cold water inlet in the direction of the piping. The flow direction of cold water entering the tank may be redirected by the baffle. The flow direction of cold water entering the tank through the cold water inlet may be redirected by the baffle top plate and the baffle front. The flow of cold water entering the tank may be discharged from the discharge opening of the cold water inlet and the cold water may then flow from the discharge opening further until it impacts onto the baffle top plate. When the flow of cold water impacts onto the baffle top plate, the flow of cold water may be redirected, so that the flow of cold water is directed away from the impact area. The

redirected flow of cold water may then impact onto the baffle side, the baffle front, and on the internal bottom surface of the tank, where the flow is again redirected. The redirected flow of cold water may be discharged from the main outlet opening and flows in a non-turbulent state along the internal bottom surface of the tank towards the centre of the bottom of the tank. Thus, the top plate of the baffle may stop the flow of cold water going upward in the hot water tank and may release cold water in a controlled way along the bottom of the tank via defined openings. In this context, the centre of the tank means the central vertical axis of the tank.

[0010] The front of the baffle may not extend to the internal bottom surface of the tank. The front of the baffle may be distant to the internal bottom surface of the tank, so that the main outlet opening is formed. The hot water outlet may be positioned in the upper part of the tank. The cold water inlet may be positioned between the centre of the tank and the cylindrical side wall in an intermediate position. The cold water inlet may not be positioned at the centre of the tank.

[0011] By providing a hot water tank with a baffle that is positioned to cover the cold water inlet, the velocity of inflowing cold water from the cold water inlet is reduced by the baffle. Due to a reduced flow velocity of the cold water exiting the baffle through the main outlet opening, mixing of cold water with already heated water is reduced. Thus, the baffle provides a buffer zone for the inflowing cold water in the hot water tank. In addition, by providing a baffle, the flow direction of cold water entering the hot water tank through the cold water inlet is redirected so that the cold water flowing out from the main outlet opening of the baffle is along the bottom of the hot water tank. The direction of the main outlet opening towards the centre of the tank limits the disturbance of the stratification of the tank. Because the cold water inlet is not provided at the centre of the tank, the cold water inlet can fit below the slope of the convex dome shape of the bottom and the height of the hot water tank is reduced. The cold water inlet does also not interfere with features at the centre of the tank, which are necessary and used during the manufacturing process of the tank. In addition, as the cold water inlet is not provided directly at the cylindrical side wall but at the bottom of the tank, the building dimension of the hot water tank can be reduced. By positioning the cold water inlet at an intermediate position on the bottom of the tank, the freedom to position the cold water inlet is maximized and the complete design is simplified.

[0012] Accordingly, the hot water tank allows that less space is required in the width direction and in height. Thus, the hot water tank is smaller in size. Due to the provision of the cold water inlet in the bottom of the hot water tank, the turbulence of the cold water in the already heated water is avoided, so that a better water stratification process is enabled. Thus, the hot water tank has a reduced heat loss.

[0013] A hot water tank according to a **second aspect**

is the hot water tank of the first aspect, wherein the baffle is fixed to the tank by at least three fixation points.

[0014] Optionally, the baffle may be fixed to the bottom of the tank by at least three fixation points. Optionally, the baffle is fixed to the tank by at least three fixation points by welding. The baffle may be fixed to the tank by a screw connection. The baffle may be fixed to the tank by connecting the at least three fixation points to stud bolts connected at the bottom of the tank. The stud bolts may be welded to the bottom of the tank. The baffle may be only fixed to the tank at the at least three fixation points and may be in a distance to the tank at other portions.

[0015] The baffle may have at least three small protrusions on its edges which come into contact with the internal bottom surface of the tank at the at least three fixation points. A first small protrusion may be formed at one baffle side next to the baffle front, a second small protrusion may be formed at another baffle side next to the baffle front, and a third small protrusion may be formed at the baffle top plate at a side which is opposite to the side where the baffle front is provided at a central position. The length of the at least three small protrusions may vary. The length of the at least three small protrusions may determine the height of the opening between the baffle and the internal bottom surface of the tank. The length of the at least three small protrusions may be kept to a minimum but high enough to ensure that there is no contact between the baffle sides and the internal bottom surface of the tank and to eliminate the risk of crevice corrosion. The baffle may be produced by punching a mould out of a metal sheet. This punched-out mould already has the small protrusions on the sides, which protrude from the sides as small protrusions when the sides are bent.

[0016] By fixing the baffle to the tank, the baffle is held in a stable position within the tank and is not moved by changes in the flow velocity of the cold water entering the baffle from the cold water inlet. Even if the hot water tank is transported or moved, the baffle will not move within the tank. By limiting the number of fixation points to a minimum of three, the manufacturing process is faster, as fewer welds are required, and the risk of corrosion (crevice corrosion) in the tank is minimised. In addition, by providing three or more fixation points, the discharge flow of cold water is almost 360° and is only obstructed at these fixation points. As a result, the discharged cold water from the baffle is evenly distributed (360°) throughout the bottom of the tank. By distributing the discharged cold water evenly by the baffle, the water stratification process is not disrupted. In addition, an opening is maintained around the entire circumference of the baffle between the at least three fixation points. It is also possible for the baffle to be pre-mounted or pre-assembled.

[0017] A hot water tank according to the **third aspect** is the hot water tank according to the first or second aspect, wherein the top plate of the baffle is positioned at an angle of 70° to 110° to a central axis of the cold water inlet. The

top plate of the baffle may be positioned perpendicular to a central axis of the cold water inlet. The central axis of the cold water inlet in the present context is the axis in the cold water inlet directly in contact with the bottom of the tank. The central axis is along the pipe of the cold water inlet close to the bottom of the tank. The central axis is perpendicular to the cross-section of the discharge opening of the cold water inlet.

[0018] Cold water entering the tank will normally continue to flow in the direction of flow of the piping. By positioning the top plate of the baffle substantially perpendicular to the central axis of the cold water inlet, the cold water entering the tank will impact onto the baffle top plate and will be redirected by the top plate of the baffle. When the top plate of the baffle is positioned at an angle of 70° to 110° to a central axis of the cold water inlet, the inflow of the cold water is sufficiently deflected. When the top plate of the baffle is positioned at an angle of 90° to a central axis of the cold water inlet, the inflow of the cold water is maximally deflected. Thus, the cold water entering the tank changes its flow direction through the baffle, in particular through the top plate of the baffle, and flows from the baffle into the hot water tank, spreading 360° from the bottom of the hot water tank.

[0019] A hot water tank according to the **fourth aspect** is the hot water tank according to any one of the first to third aspects, wherein a top edge of the main outlet opening is positioned in a vertical direction at a same height or lower than a discharge opening of the cold water inlet. In other words, the discharge opening of the cold water inlet is at the same height or higher than the top edge of the main outlet opening. There may be no vertical distance between the top edge of the main outlet openings and the discharge opening of the cold water inlet. The top edge of the main outlet opening may be positioned lower than the discharge opening of the cold water inlet.

[0020] The vertical distance between the top edge of the main outlet opening and the discharge opening of the cold water inlet ensures that the cold water flow from the baffle is directed along the bottom of the tank.

[0021] A hot water tank according to the **fifth aspect** is the hot water tank according to any one of the first to fourth aspects, wherein each bottom edge of the sides of the baffle follows a profile of an internal bottom surface of the tank.

[0022] Each baffle side may have a curved edge at the bottom edge. The curved bottom edge may follow the curvature of the internal bottom surface of the tank. Each of the bottom edges of the sides of the baffle may be parallel to an internal bottom surface of the tank. Each of the bottom edges of the sides of the baffle may have a constant distant to an internal bottom surface of the tank. Each of the bottom edges of the sides of the baffle may be at a constant angle to an internal bottom surface of the tank.

[0023] This ensures that the cold water flowing into the hot water tank from the baffle is evenly distributed over

the entire bottom of the tank.

[0024] A hot water tank according to the **sixth aspect** is the hot water tank according to any one of the first to fifth aspects, wherein a cross section of the main outlet opening of the baffle has a rectangular shape.

[0025] The baffle front may have a rectangular opening in the lower section. The main outlet opening of the baffle may be formed during the manufacturing process by bending the front of the baffle at 90° from the baffle top plate. The length of the front may be shorter than the length of the baffle sides. In other words, the main outlet opening may be formed as there is no stainless steel sheet metal in this section of the baffle.

[0026] The distance between the internal bottom surface of the tank and the top edge of the main outlet opening may be low enough to prevent a turbulent flow of cold water leaving the baffle into the hot water tank. The flow of cold water leaving the baffle into the hot water tank may be without a vortex or free of turbulence.

[0027] A hot water tank according to the **seventh aspect** is the hot water tank according to any one of the first to sixth aspects, wherein the baffle top plate has a rectangular shape.

[0028] By using a standard shape of a stainless steel sheet metal, the baffle is more cost effective to manufacture.

[0029] A hot water tank according to the **eighth aspect** is the hot water tank according to any one of the first to seventh aspects, wherein the baffle is made from stainless steel sheet metal.

[0030] The baffle may be bent from stainless steel sheet metal. The baffle may be made of one sheet of metal which is folded to form a front and sides. The front may be bent during the manufacturing process to be at an angle of 90° to the top plate in the finished baffle. The front may be welded to the sides of the baffle. The front of the baffle may be open or slightly open to the sides of the baffle. The baffle may be formed from a single stainless steel sheet or may be formed from more than one stainless steel sheet. The baffle may be made of a stainless steel plate bent into a rectangular shape. The baffle may be open at the bottom and may have curved edges. The baffle sides may be bent during the manufacturing process to be at an angle of 90° to the top plate in the finished baffle.

[0031] Because the baffle is made from a single sheet of metal, the manufacturing process for the baffle is faster and more cost effective. By using stainless steel sheet metal for the baffle instead of plastic, the baffle is less expensive and more durable.

[0032] A hot water tank according to the **ninth aspect** is the hot water tank according to any one of the first to eighth aspects, wherein each of the sides comprises a sub outlet opening.

[0033] Each side of the baffle may comprise a bottom positioned at a distance from the tank bottom to form the sub outlet opening. The sub outlet opening may be formed between the bottom edge of one side and the

internal bottom surface of the tank. The small protrusions of the fixation points may form a spacer, so that the bottom edge of each side does not come into contact with the internal bottom surface of the tank and the sub outlet openings are formed.

[0034] The size of the main outlet opening may be determined by the width of the baffle and the height of a cut-out in the baffle front. The size of the sub outlet openings may be determined by the width and length of the baffle. The sub outlet openings may have a long and narrow form.

[0035] A hot water tank according to the **tenth aspect** is the hot water tank according to the ninth aspect, wherein a sum of a cross section of the main outlet opening and of cross sections of the sub outlet openings is greater than a cross section of the cold water inlet.

[0036] The sum of a cross section of the main outlet opening and of cross sections of the sub outlet openings is the sum of the cross section of the main outlet opening, the cross section of the sub outlet opening on one side, the cross section of the sub outlet opening on another side, and the cross section of the sub outlet opening between the baffle top plate and the internal bottom surface of the tank on a side of the top plate opposite to another side of the top plate where the baffle front is located. The cross section of the cold water inlet is the cross section of the discharge opening of the cold water inlet. Preferably, the sum of a cross section of the main outlet opening and of cross sections of the sub outlet openings may be at least 10 times larger than a cross section of the cold water inlet. More preferably, the sum of a cross section of the main outlet opening and of cross sections of the sub outlet openings may be at least 15 times larger than a cross section of the cold water inlet. In this context, the cross section means the area of the cross section.

[0037] By ensuring that the cross section of all openings in the baffle is larger than the cross section of the cold water inlet, it is ensured that the flow velocity of cold water entering the tank from the baffle is lower than the flow velocity of cold water entering the baffle from the cold water inlet. By reducing the flow velocity of the cold water entering the hot water tank, the inflow of cold water is evenly distributed, and a turbulence is reduced.

[0038] A hot water tank according to the **eleventh aspect** is the hot water tank according to the ninth or tenth aspect, wherein a cross section of the main outlet opening is greater than a cross section of the sub outlet openings.

[0039] This ensures optimum distribution of cold water from the baffle towards the centre of the tank and across the entire bottom of the tank.

[0040] A hot water tank according to the **twelfth aspect** is the hot water tank according to any one of the first to eleventh aspects, wherein an upper surface of the top plate is inclined towards the centre of the tank. The top plate may be inclined by 1° to 5° towards the centre of the tank. The top plate may be inclined by 2° towards the

centre of the tank.

[0041] The inclination of the upper surface of the top plate ensures that during a cleaning process where the tank is emptied, the water flows from the upper surface of the top plate. In case that the cleaning process is performed when the hot water tank is in an upside-down position, it is ensured by the inclination of the upper surface of the top plate that the water flows out of the baffle and is not trapped by the baffle front and baffle sides.

[0042] A hot water tank according to the **thirteenth aspect** is the hot water tank according to any one of the first to twelfth aspects, wherein the bottom of the tank further comprises a shoulder protruding outward and having a surface, the surface being parallel to a tangent passing through the centre of the bottom of the tank, wherein the cold water inlet passes through the surface of the shoulder.

[0043] The centre of the bottom of the tank is a vertical axis in this context which pass through the centre of the bottom of the hot water tank. The tangent passing through the centre of the bottom of the tank may be parallel to the surface of the shoulder to which the cold water inlet is connected. The shoulder may have an outwardly convex dome shape, wherein in one section of the outwardly convex dome shape one flat surface is provided where the cold water inlet is connected. This flat surface may be parallel to a tangent passing through the centre of the bottom of the tank.

[0044] If the tangent passing through the centre of the bottom of the tank is parallel to a surface where the hot water tank is installed, the surface of the shoulder is also parallel to the surface where the hot water tank is installed, which reduces the size of the hot water tank. The shoulder ensures that the cold water inlet can be sufficiently positioned and connected to the bottom of the hot water tank. Due to the provision of a shoulder protruding outward from the bottom of the tank, the cold water inlet can be easier welded to the tank. Providing a shoulder in the bottom of the hot water tank being parallel to the tangent passing through the centre of the bottom of the tank, simplifies the manufacturing process for connecting the cold water inlet to the bottom of the hot water tank. The cold water inlet can be easier and faster attached to the bottom of the hot water tank.

[0045] The cold water inlet may be connected to a cold water piping which is provided outside of the hot water tank. The cold water piping may be held by mounting means at an outer surface of the cylindrical side wall of the hot water tank. All connections to the hot water tank may be provided at the top of the hot water tank and only the cold water inlet may be provided in the bottom of the hot water tank.

BRIEF DESCRIPTION OF THE DRAWINGS

[0046]

Fig. 1 is a front view illustrating the hot water tank of an embodiment of the present invention.

Fig. 2 is a bottom view illustrating the hot water tank of an embodiment of the present invention.

Fig. 3 is a perspective view illustrating the bottom of the hot water tank of an embodiment of the present invention.

Fig. 4A-D are perspective views illustrating the baffle of the hot water tank of an embodiment of the present invention.

Fig. 5A is a perspective view illustrating the baffle in the hot water tank of an embodiment of the present invention.

Fig. 5B is a perspective view illustrating the baffle in the bottom of the hot water tank of an embodiment of the present invention.

Fig. 6 is a perspective view illustrating the main outlet opening and the sub outlet opening of an embodiment of the present invention.

Fig. 7 is a side view of the bottom of the hot water tank of an embodiment of the present invention.

DESCRIPTION OF EMBODIMENTS

[0047] Hereinafter, embodiments according to the disclosure will be described in detail with reference to the accompanying drawings in order to describe the disclosure using illustrative examples. Further modifications of certain individual features described in this context can be combined with other features of the described embodiments to form further embodiments of the disclosure. Throughout the drawings, the same reference numerals are used for the same or similar elements.

[0048] Fig. 1 is a front view of a hot water tank according to an embodiment of the present invention. The hot water tank 1 comprises a top 11, a bottom 13 and a cylindrical side wall 12. The bottom 13 of the tank has an outwardly convex dome shape. The top 11 of the tank has also an outwardly convex dome shape. The hot water tank 1 comprises a heat exchanger 50, which is positioned in the hot water tank 1. The hot water tank 1 further comprises a cold water inlet 20 for introducing cold water, wherein the cold water inlet 20 is positioned in the bottom 13 of the tank. The hot water tank 1 further comprises a hot water outlet 30 for discharging hot water. The hot water outlet 30 is positioned in the top 11 of the hot water tank 1. The hot water outlet 30 is positioned in the upper portion of the tank 1. The hot water outlet 30 is positioned at a centre of the top 11 of the hot water tank 1. The cold water inlet 20 is positioned between the centre of the tank 1C and the cylindrical side wall 12 in an intermediate position. The cold water inlet 20 is not positioned at the centre of the tank 1C as illustrated in Fig. 1 and Fig. 5B. The cold water inlet 20 is positioned in the bottom 13 of the tank between a centre of the bottom 13C and the cylindrical side wall 12. The cold water inlet 20 is connected to a cold water piping. As illustrated in Fig. 2, the cold water inlet 20 is connected to a cold water piping.

The cold water piping is outside of the hot water tank 1. The cold water piping is held by mounting means which are attached on the outer surface of the cylindrical side wall 12. The hot water tank 1 further comprises a baffle 40 that is positioned in the tank 1 covering the cold water inlet 20 so that the flow of water discharged from the cold water inlet 20 is redirected to a flow along the bottom 13. The baffle is not fixed to the cold water inlet 20. Fig. 2 illustrates that the baffle 40 is positioned within the hot water tank 1 covering the cold water inlet 20. The baffle 40 comprises a top plate 41, a front 43, and sides 42. The top plate 41 faces the cold water inlet 20 and onto which water is discharged from the cold water inlet 20. A main outlet opening 44 is defined in the front 43. The main outlet opening 44 is directed towards the centre of the tank 1C. The baffle front 43 is oriented towards the centre of the tank 1C in the installed state, as illustrated in Fig. 1 and Fig. 3. All connections to the hot water tank 1 are provided at the top 11 of the hot water tank 1 and only the cold water inlet 20 is provided in the bottom 13 of the hot water tank 1 (Fig. 1).

[0049] The baffle 40 discharges cold water, preferably from the main outlet opening 44, with a non-turbulent flow. The flow direction of cold water leaving the baffle 40, preferably from the main outlet opening 44, is parallel to the internal bottom surface 131 of the tank. The flow direction of cold water entering the baffle from the cold water inlet 20 is parallel to a central axis 20C of the cold water inlet 20, as illustrated in Fig. 5B. The central axis 20C of the cold water inlet 20 is the axis of the cold water inlet at the connection of the cold water inlet 20 with the bottom 13 of the tank. The central axis 20C is the central axis which is perpendicular to the cross-section of the discharge opening 20D of the cold water inlet 20. The flow direction of cold water entering the tank 1 through the cold water inlet 20 is redirected by the baffle top plate 41 and the baffle front 43. The cold water may flow from the discharge opening 20D of the cold water inlet 20 onto the baffle top plate 41 and changes its flow direction. The flow of cold water is then redirected, so that the flow of cold water is directed away from the impact area. The redirected flow of cold water then flows to the baffle side 42, the baffle front 43, and onto the internal bottom surface 131 of the tank 1. At the baffle side 42, the baffle front 43, and on the internal bottom surface 131 of the tank 1 the flow is again redirected due to an impact. The redirected flow of cold water is then discharged from the main outlet opening 44 and flows in a non-turbulent state along the internal bottom surface 131 of the tank 1 towards the centre of the bottom 13C of the tank. The centre of the tank 1C means the central vertical axis of the tank, as illustrated in Fig. 1.

[0050] The baffle 40 is fixed to the tank 1 by at least three fixation points 60. In particular, the baffle 40 is fixed to the bottom 13 of the tank. Preferably, the baffle 40 is fixed to the bottom 13 of the tank by welding. As illustrated in Fig. 3, the baffle 40 is fixed to the internal bottom surface of the tank 131 at three fixation points 60, which

are welded to the bottom of the tank 13. The baffle 40 is only fixed to the tank at the at least three fixation points 60 and is in a distance to the tank at other portions, as illustrated in Fig. 3 and Fig. 6.

[0051] In Fig. 4A to Fig. 4D the baffle 40 is illustrated. The baffle 40 has three small protrusions 61 on its edges. The three small protrusions 61 come into contact with the internal bottom surface 131 of the tank 1 at three fixation points 60 in the installed state. A first small protrusion is formed at one baffle side 42 next to the baffle front 43, a second small protrusion is formed at an other baffle side 42 next to the baffle front 43, and a third small protrusion is formed at the baffle top plate 41 at a side which is opposite to the side where the baffle front 43 is provided at a central position. The length of the three small protrusions determines in the installed state the height of the opening between the baffle 40 and the internal bottom surface 131 of the tank, as illustrated in Fig. 6.

[0052] As illustrated in Fig. 5A and Fig. 5B, the top plate 41 of the baffle 40 is positioned at an angle of 70° to 110° to a central axis 20C of the cold water inlet 20. Preferably, the top plate 41 of the baffle 40 is positioned perpendicular to a central axis 20C of the cold water inlet 20.

[0053] A top edge 441 of the main outlet opening 44 is positioned in a vertical direction at the same height or lower than a discharge opening of the cold water inlet 20. As illustrated in Fig. 5A and Fig. 5B, the discharge opening 20D of the cold water inlet 20 is positioned higher (in a vertical direction, which is along the extension of the hot water tank) than the top edge 441 of the main outlet opening 44. A vertical difference d between the discharge opening 20D of the cold water inlet 20 and the top edge 441 of the main outlet opening 44 is ≥ 0 mm (Fig. 5A and Fig. 5B). As illustrated in Fig. 4A, Fig. 4B and Fig. 4D, the front 43 of the baffle 40 does not extend to the bottom edge 422 of the sides 42 of the baffle. As illustrated in Fig. 5A and Fig. 5B, the front 43 of the baffle 40 does not extend to the internal bottom surface 131 of the tank 1. The front 43 of the baffle 40 is distant to the internal bottom surface 131 of the tank, so that the main outlet opening 44 is formed. As illustrated in Fig. 5B, the top edge 441 of the main outlet opening 44 is positioned lower than the discharge opening 20D of the cold water inlet 20.

[0054] Each bottom edges 422 of the sides 42 of the baffle follows a profile of an internal bottom surface of the tank 131. The baffle, as illustrated in Fig. 4A to Fig. 4D, has a rectangular shaped top plate 41 and sides 42 with bottom edges 422. Each bottom edge 422 has a curved shape. In the installed state, as illustrated in Fig. 3 for example, each bottom edge 422 has a curved shape which follows a profile of an internal bottom surface of the tank 131. The curved bottom edge 422 follows the curvature of the internal bottom surface 131 of the tank. As illustrated in Fig. 6, each of the bottom edges 422 of the sides 42 of the baffle 40 is parallel to an internal bottom surface 131 of the tank. The baffle top plate 41 has a rectangular shape (Fig. 4C). An upper surface of the top

plate 41 is inclined towards the centre of the tank.

[0055] A cross section of the main outlet opening 44 of the baffle 40 has a rectangular shape. As illustrated in Fig. 6, the main outlet opening 44 of the baffle 40 has a rectangular shape and is formed by a cut out in the baffle front 43. As illustrated in Fig. 4A, the baffle front 43 has a rectangular opening in the lower section. The main outlet opening 44 of the baffle 40 is formed during the manufacturing process by bending the front of the baffle at 90° from the baffle top plate, so that a space with no material remains in the lower section. The length of the front 43 is shorter than the length of the baffle sides 42, as illustrated in Fig. 4A.

[0056] The baffle 40 is made from stainless steel sheet metal. Preferably, the baffle 40 is bent from a single stainless steel sheet metal. As illustrated in Fig. 4A to Fig. 4D, the baffle 40 is produced by bending a mould out metal sheet. For example, the baffle front 43 and the baffle sides 42 are bent by 90° from the baffle top plate 41 to receive the baffle 40 as illustrated in Fig. 4A. Alternatively, the baffle 40 may be made from a different metal than stainless steel and may have an anti-corrosion coating.

[0057] Each of the sides 42 of the baffle 40 comprises a sub outlet opening 423. The sub outlet opening 423 is illustrated in Fig. 6. The sub outlet opening 423 is formed between the bottom edge 422 of the sides of the baffle and the internal bottom surface 131 of the hot water tank. The small protrusions 61 of the fixation points 60 form a spacer, so that the bottom edge 422 of each side 42 does not come into contact with the internal bottom surface 131 of the tank 1 and the sub outlet openings 423 are formed. The small protrusions 61 as spacers are illustrated in Fig. 4A to Fig. 4D. The distance of the bottom edge 422 of the sides 42 of the baffle 40 to the internal bottom surface 131 of the tank is illustrated in Fig. 6.

[0058] A sum of a cross section of the main outlet opening 44 and of cross sections of the sub outlet openings 423 is greater than a cross section of the cold water inlet 20. A cross section of the main outlet opening 44 is greater than a cross section of the sub outlet openings 423. As illustrated in Fig. 6, the sum of a cross section of the main outlet opening 44 and of cross sections of the sub outlet openings 423 is the sum of the cross section of the main outlet opening 44, the cross section of the sub outlet opening 423 on one side, the cross section of the sub outlet opening 423 on an other side, and the cross section of the sub outlet opening between the baffle top plate 41 and the internal bottom surface 131 of the tank 1 on a side of the top plate 41 opposite to another side of the top plate 41 where the baffle front 43 is located. Thus, cold water is discharged from the baffle 40 in nearly every direction (360°). The cross section of the cold water inlet 20 is the cross section of the discharge opening 20D of the cold water inlet 20, as illustrated for example in Fig. 5A. In Fig. 5A and Fig. 6 it is shown that the sum of a cross section of the main outlet opening 44 and of cross sections of the sub outlet openings 423 is at least 15 times

larger than a cross section of the cold water inlet 20.

[0059] The bottom 13 of the tank further comprises a shoulder 132 protruding outward and having a surface, the surface being parallel to a tangent 13T passing through the centre of the bottom 13C of the tank 1, wherein the cold water inlet 20 passes through the surface of the shoulder 132. As illustrated in Fig. 7, the bottom 13 of the tank has a shoulder 132 protruding outward in a convex dome shape and having in a section of the convex dome shape a flat surface where the cold water inlet 20 is provided. The tangent 13T of the centre of the bottom 13C of the tank 1 is illustrated in Fig. 5B and Fig. 7. However, in Fig. 5B, the shoulder 132 is only partly visible. The centre of the bottom 13C of the tank is a vertical axis in this context which pass through the centre of the bottom 13C of the hot water tank 1. The tangent 13T passing through the centre of the bottom 13C of the tank is parallel to the surface of the shoulder 132 to which the cold water inlet 20 is connected. The shoulder 132 has an outwardly convex dome shape, wherein in one section of the outwardly convex dome shape one flat surface is provided where the cold water inlet 20 is connected (Fig. 7).

Further embodiments and Modifications

[0060] In modifications of the first embodiment, the shape of the bottom edge 422 of the sides 42 of the baffle 40 is only modified. In a first modification of the first embodiment, each of the bottom edges 422 of the sides 42 of the baffle 40 has a constant distant to the internal bottom surface 131 of the tank 1. In a second modification of the first embodiment, each of the bottom edges 422 of the sides 42 of the baffle 40 is at a constant angle to an internal bottom surface 131 of the tank 1.

[0061] The second embodiment is distinguished over the first embodiment by the fixation of the baffle 40 to the hot water tank 1. In the second embodiment, the baffle 40 is fixed to the tank 1 by a screw connection (not illustrated). The at least three screws are connected to the bottom of the tank by welding.

[0062] In a modification of the second embodiment (not illustrated), the baffle 40 is fixed to the tank 1 by connecting the at least three fixation points 60 to stud bolts connected at the bottom 13 of the tank. The stud bolts are welded to the bottom 13 of the tank 1.

Manufacturing Process

[0063] The baffle 40 is produced by punching a mould out of a metal sheet. This punched-out mould already has the small protrusions 61 on the sides 42, which protrude from the sides 42 as small protrusions when the sides are bent. As illustrated in Fig. 4A to Fig. 4D, the baffle 40 is produced by bending a mould out metal sheet. The baffle front 43 and the baffle sides 42 are bent by 90° from the baffle top plate 41 to receive the baffle 40 as illustrated in Fig. 4A. Since the baffle front 43 has a shorter length than

the baffle sides 42, the main outlet opening 44 is formed at the baffle front 43. The small protrusions 61 protrude out from the bottom edge of the sides 422 of the baffle 40, so that the sub outlet opening 423 is formed.

REFERENCE LIST

[0064]

1	hot water tank
1C	centre of the tank
11	top of hot water tank
12	cylindrical side wall
13	bottom of hot water tank
13C	centre of the bottom of the bottom of the tank
13T	tangent passing through the centre of the bottom of the tank
131	internal bottom surface of the tank
132	shoulder of the bottom of the tank
20	cold water inlet
20C	central axis of the cold water inlet
20D	discharge opening of the cold water inlet
30	hot water outlet
40	baffle
41	baffle top plate
42	baffle sides
422	bottom edge of the sides of the baffle
423	sub outlet opening
43	baffle front
44	main outlet opening
441	top edge of main outlet opening
50	heat exchanger
60	fixation point
61	small protrusions

Claims

1. A hot water tank (1) comprising:

- a top (11), a bottom (13) and a cylindrical side wall (12) ;
 - a heat exchanger (50) positioned in the tank;
 - a cold water inlet (20) for introducing cold water, the cold water inlet being positioned in the bottom (13) of the tank;
 - a hot water outlet (30) for discharging hot water,
- characterized in that**
- the bottom (13) of the tank has an outwardly convex dome shape, and the cold water inlet (20) is positioned in the bottom (13) of the tank between a centre of the bottom (13C) and the cylindrical side wall (12),
 - the hot water tank (1) further comprising
 - a baffle (40) that is position in the tank covering the cold water inlet (20) so that the flow of water discharged from the cold water inlet is redirected to a flow along the bottom (13);
 - wherein the baffle (40) comprises a top plate

- (41) facing the cold water inlet (20) and onto which water is discharged from the cold water inlet (20), a front (43), and sides (42), wherein a main outlet opening (44) is defined in the front (43), the main outlet opening (44) being directed towards the centre of the tank. 5
2. The hot water tank according to claim 1, wherein the baffle (40) is fixed to the tank (1), optionally fixed to the bottom (13) of the tank, by at least three fixation points (60), optionally by welding. 10
 3. The hot water tank according to claim 1 or 2, wherein the top plate (41) of the baffle (40) is positioned at an angle of 70° to 110°, preferably perpendicular, to a central axis of the cold water inlet (20C). 15
 4. The hot water tank according to any one of claims 1 to 3, wherein a top edge (441) of the main outlet opening (44) is positioned in a vertical direction at the same height or lower than a discharge opening of the cold water inlet (20). 20
 5. The hot water tank according to any one of claims 1 to 4, wherein each bottom edge (422) of the sides (42) of the baffle follows a profile of an internal bottom surface of the tank (131). 25
 6. The hot water tank according to any one of claims 1 to 5, wherein a cross section of the main outlet opening (44) of the baffle (40) has a rectangular shape. 30
 7. The hot water tank according to any one of claims 1 to 6, wherein the baffle top plate (41) has a rectangular shape. 35
 8. The hot water tank according to any one of claims 1 to 7, wherein the baffle (40) is made, preferably bent, from stainless steel sheet metal. 40
 9. The hot water tank according to any one of claims 1 to 8, wherein each of the sides (42) comprises a sub outlet opening (423). 45
 10. The hot water tank according to claim 9, wherein a sum of a cross section of the main outlet opening (44) and of cross sections of the sub outlet openings (423) is greater than a cross section of the cold water inlet (20). 50
 11. The hot water tank according to claim 9 or 10, wherein a cross section of the main outlet opening (44) is greater than a cross section of the sub outlet openings (423). 55
 12. The hot water tank according to any of claims 1 to 11, wherein an upper surface of the top plate (41) is inclined towards the centre of the tank.
 13. The hot water tank according to any of claims 1 to 12, wherein the bottom (13) of the tank further comprises a shoulder (132) protruding outward and having a surface, the surface being parallel to a tangent (13T) passing through the centre of the bottom (13C) of the tank (1), wherein the cold water inlet (20) passes through the surface of the shoulder (132) .

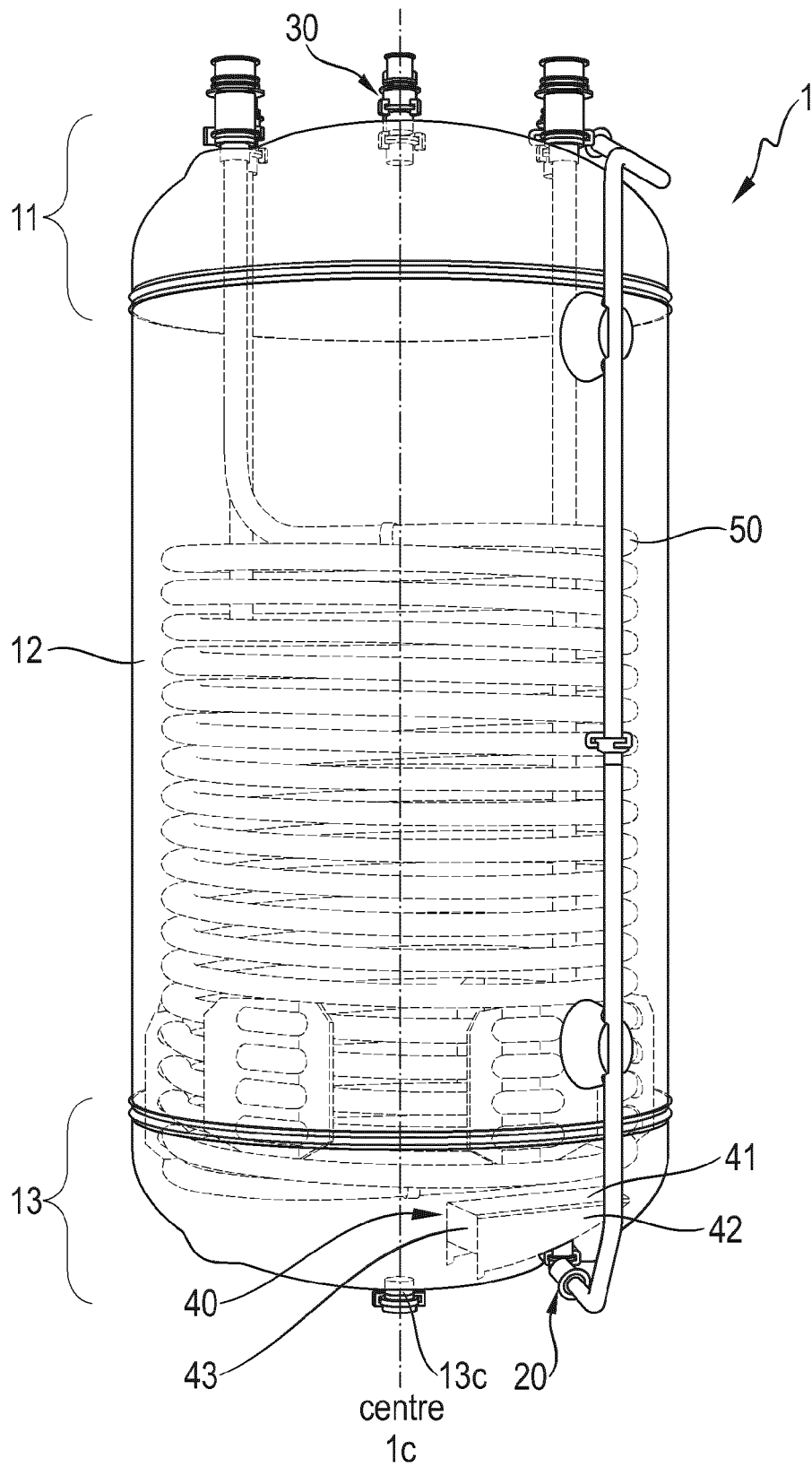


Fig. 1

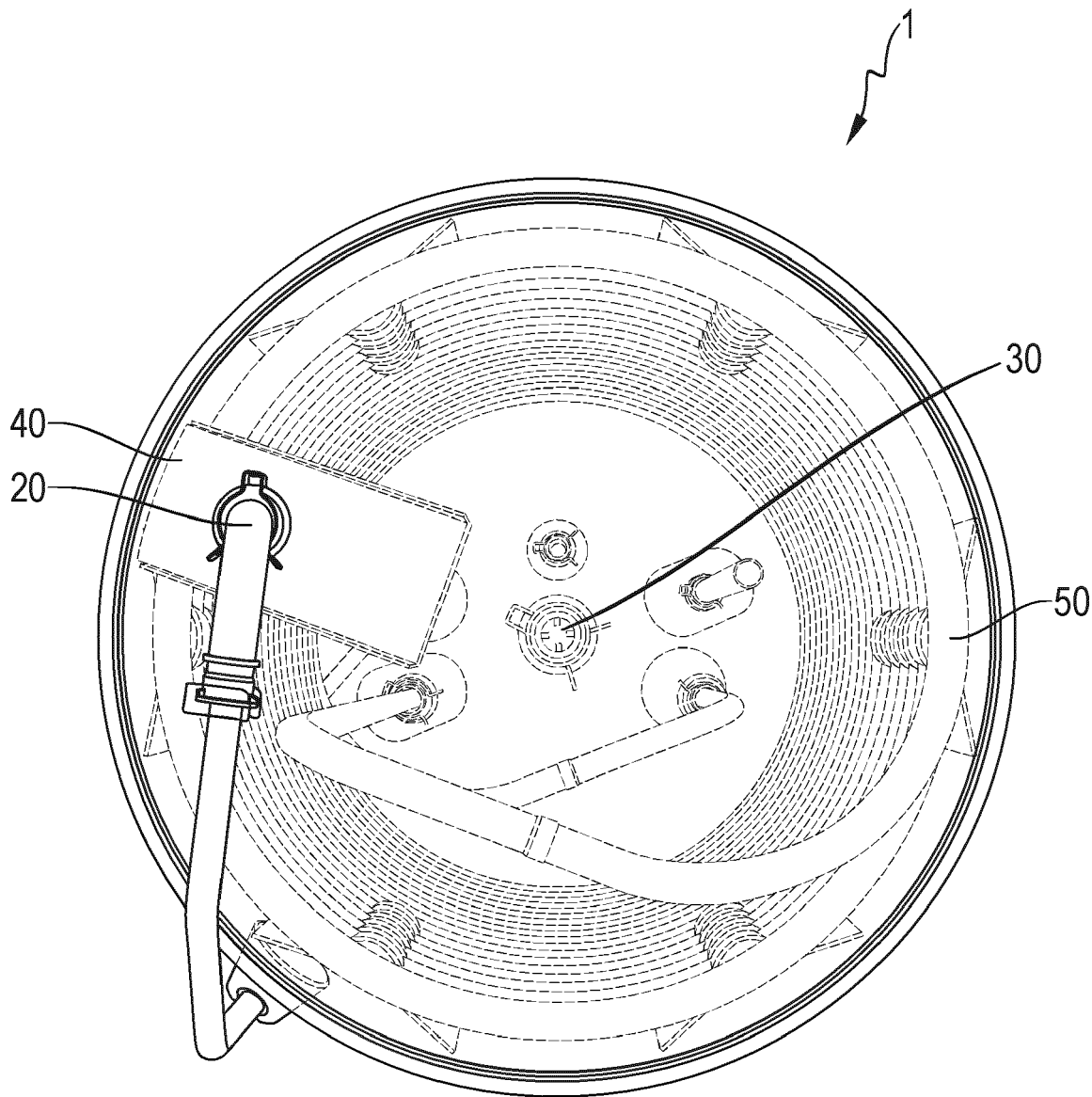


Fig. 2

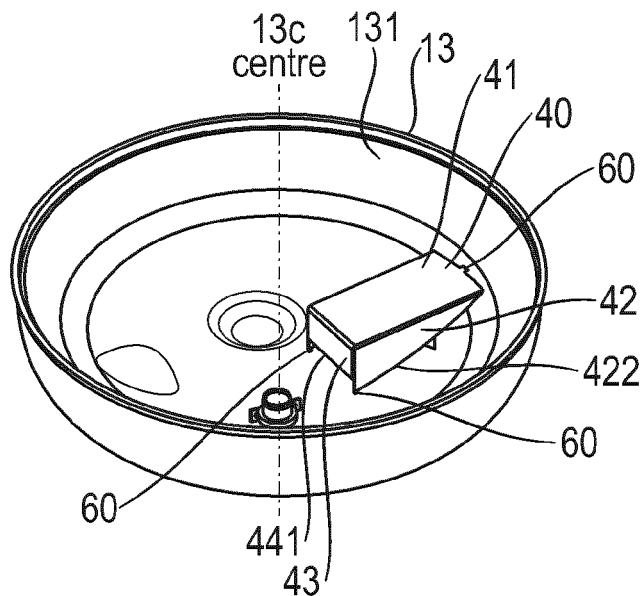


Fig. 3

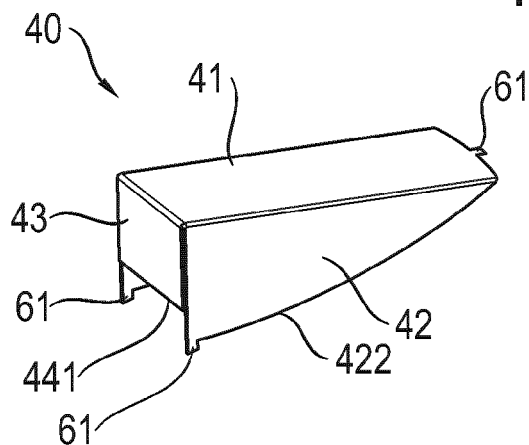


Fig. 4A

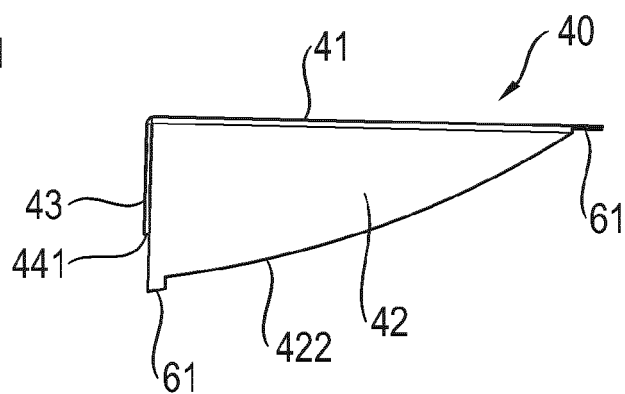


Fig. 4B

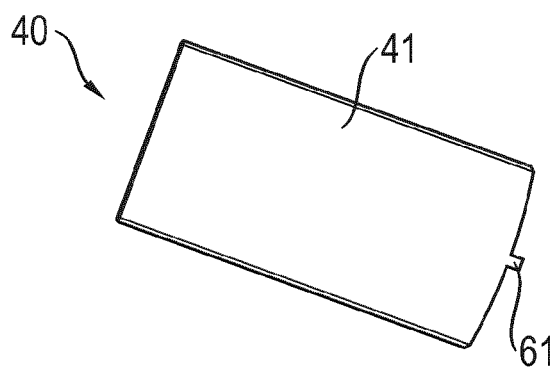


Fig. 4C

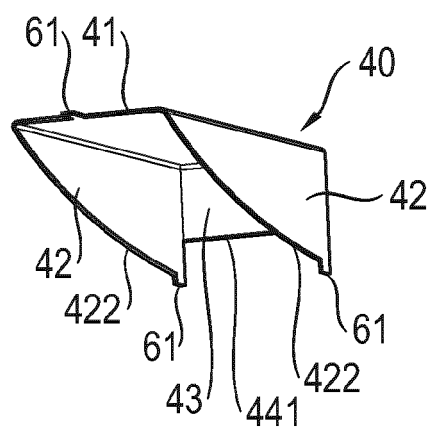
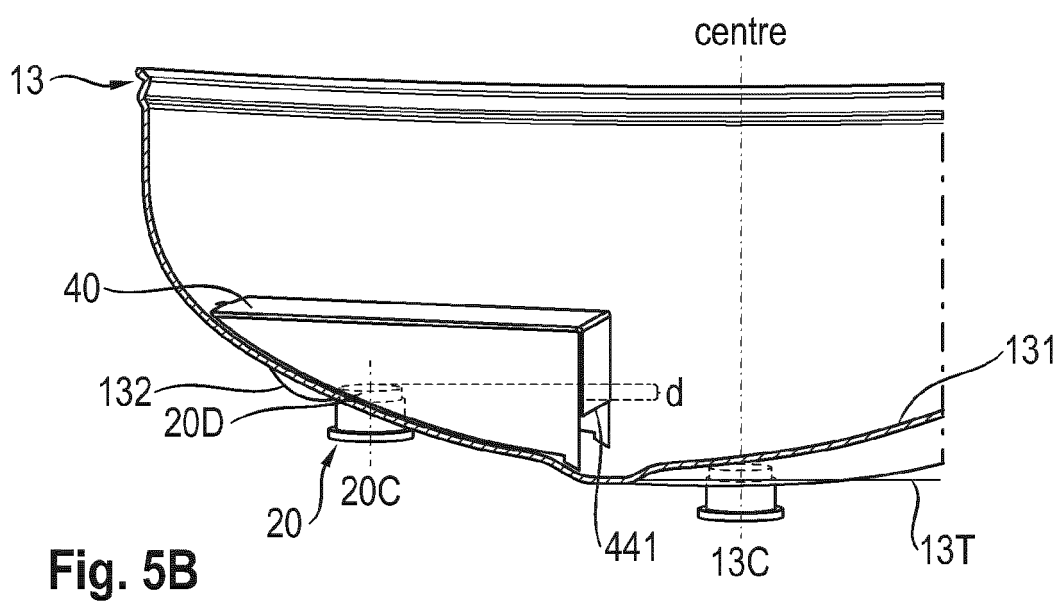
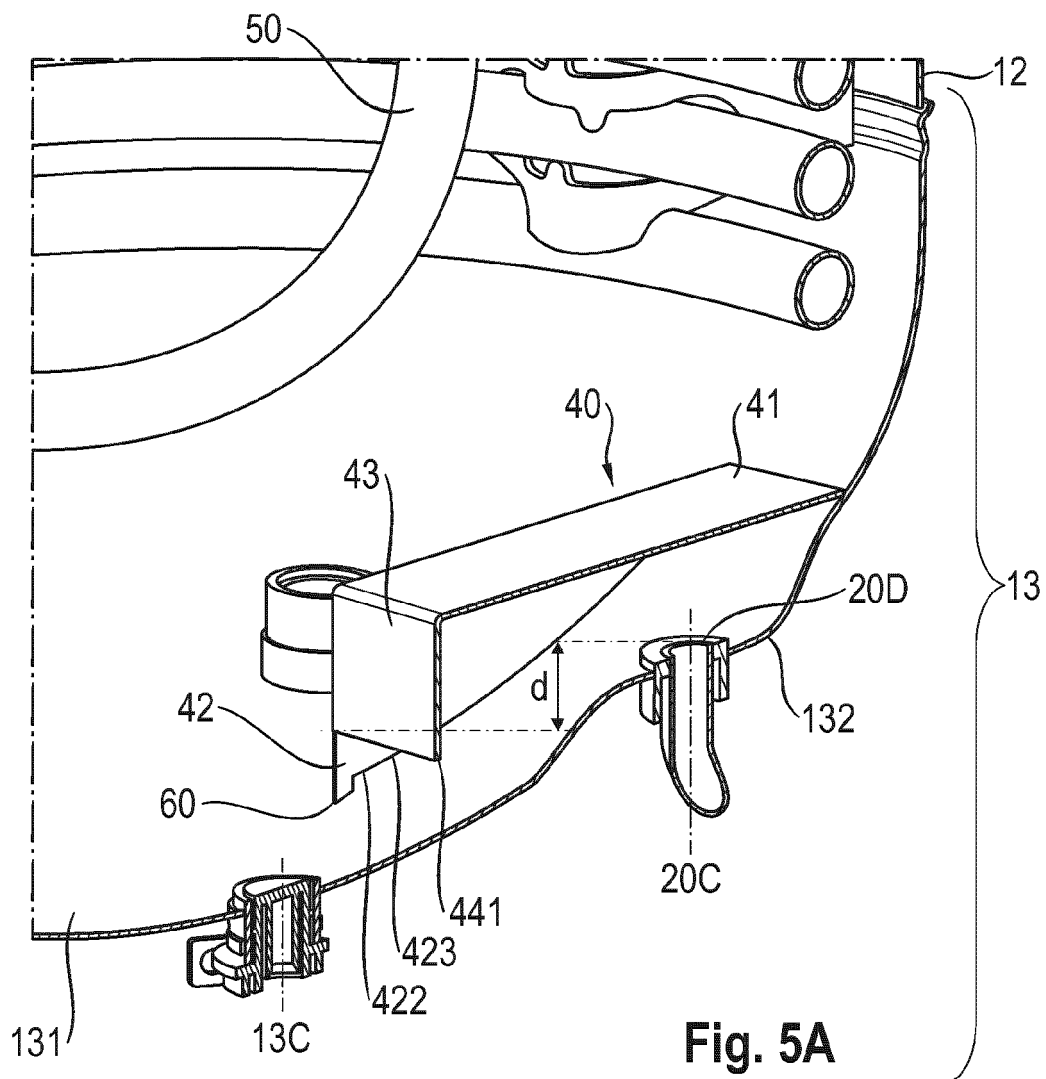


Fig. 4D



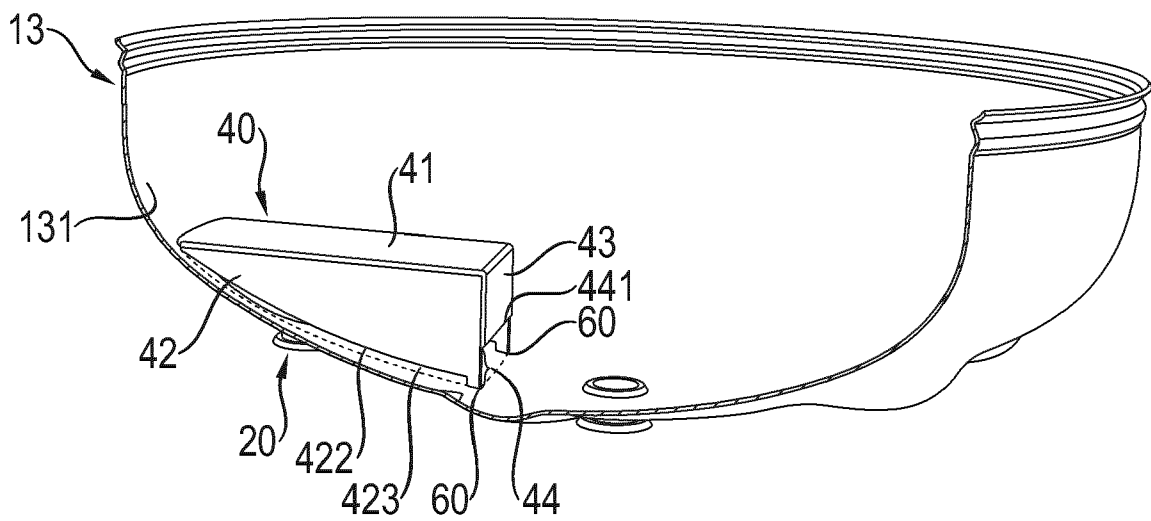


Fig. 6

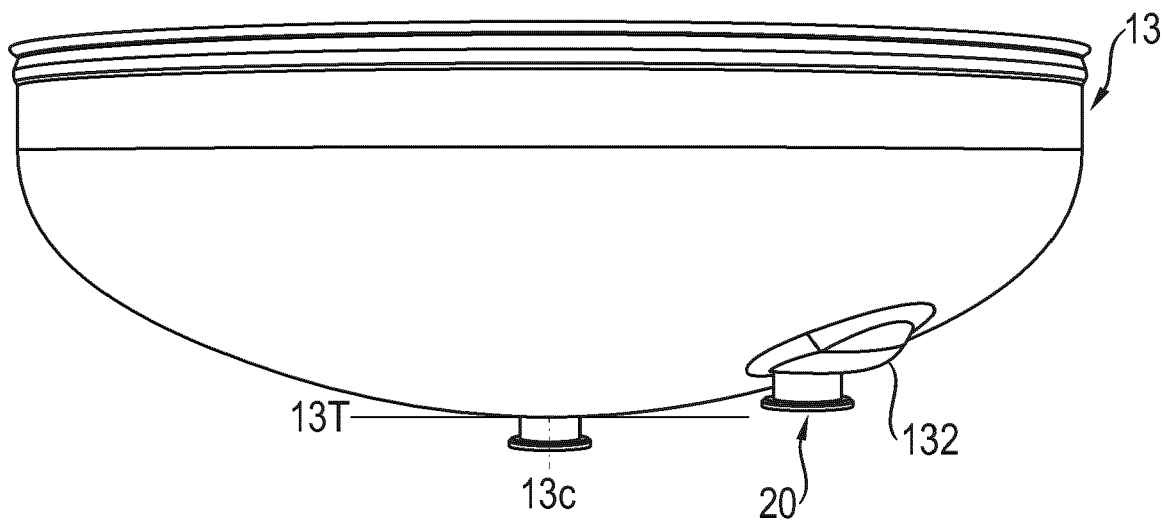


Fig. 7



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Place of search Munich		Date of completion of the search 2 May 2024	Examiner Riesen, Jörg
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