



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
27.09.2023 Bulletin 2023/39

(51) International Patent Classification (IPC):
F24H 1/18 ^(2022.01) **F24H 4/04** ^(2006.01)

(21) Application number: **22163164.1**

(52) Cooperative Patent Classification (CPC):
F24H 1/181; F24H 1/182; F24H 4/04

(22) Date of filing: **21.03.2022**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
KH MA MD TN

(72) Inventors:
• **KIEFFER, Damien**
7332 BD Apeldoorn (NL)
• **CHASSAGNARD, Benjamin**
7332 BD Apeldoorn (NL)
• **ANTOINE, Florian**
7332 BD Apeldoorn (NL)

(71) Applicant: **BDR Thermea Group B.V.**
7332 BD Apeldoorn (NL)

(74) Representative: **Denнемeyer & Associates S.A.**
Postfach 70 04 25
81304 München (DE)

(54) **CAP ELEMENT WITH CENTERING MECHANISM**

(57) Cap element (5) for a heating device (2), the heating device (2) including a water tank (3) located in a casing (4) and a cap element (5) placeable on or in the casing (4) for closing said casing (4), the cap element (5) comprising a centering mechanism integrated in, or re-

movable from, the cap element (5), the centering mechanism having a deformable structure (6) for causing the cap element (5) to be centered relative to the water tank (3) upon exerting a mechanical pressure on said deformable structure (6).

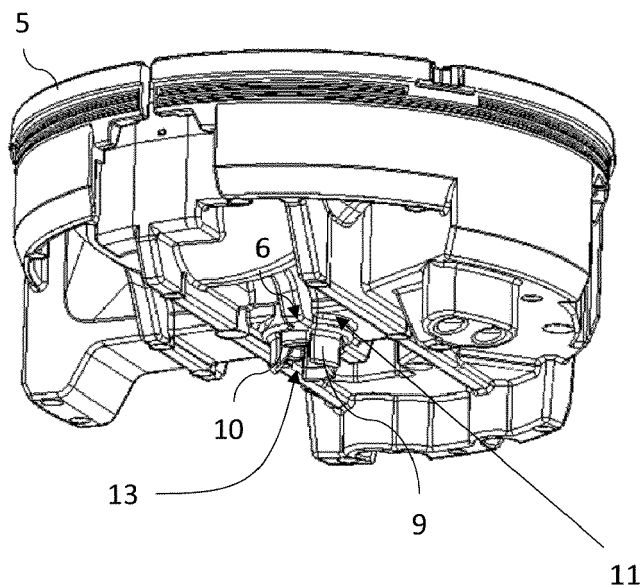


FIG. 5A

Description

[0001] The invention relates to a cap element for a heating device and to a heating device system comprising said cap element. Also, the invention relates to a use of said cap element with a heating device, in particular a heat pump water heater. Additionally, the invention relates to a heating device system.

[0002] A heating device like a heat pump is a device able to warm a closed space of a building or to warm domestic hot water by transferring thermal energy from a source to another. An air-source heat pump water heater is a device using the heat pump technology to use energy from air to heat the domestic water contained in a tank.

[0003] A hot water tank for the production of hot water for heating or domestic hot water is composed of two main elements: a tank and a thermal insulation. The thermal insulation is usually achieved by one of two means: the installation of parts around the tank (adhesive foam parts, adhesive insulation etc.) or the injection of insulating foam into an outer casing. Insulating foam injection is achieved by injecting chemical components that react together via a chemical reaction. This chemical reaction causes the solid produced to expand to such an extent that the volume of foam obtained is much greater than the volume of the components injected separately.

[0004] The injection process is a complex one and many factors create variability in the volume required and the volume injected, i.e., tank geometry tolerance, casing geometry tolerance, ambient air temperature, temperature of the chemical components of the insulation, concentration of the components, nature of the components, precision of the injection machine, temperature of the tank, surface condition of the tubes, etc.

[0005] Among these elements, the tolerance of tank height and casing height are major elements. Indeed, a difference of a few millimeters on one of these heights can lead to a lack of insulation, leaks in the insulation, lifting of the tank or aesthetic defects. Also, it is noted that during the foaming process, the pressure is not exerted evenly all around the tank. This requires to center it on its external circumference in order to maintain the verticality.

[0006] To solve these problems, it is possible to provide a large clearance and allow the tank to rise several millimeters during foam expansion. This can lead to a lack of insulation foam at the bottom and can cause the tank to be out of alignment with the vertical, thereby impacting on a reduction of the thermal performance of the product.

[0007] According to another solution, it is possible to install additional fittings prior to insulation injection by checking the most suitable fitting for each product. This solution requires a control of each product, reduces the standardization of the process and requires a technical analysis for each product. Also, this solution contributes to the risk of a forgotten additional part, resulting in an

unusable product due to an insulation foam leakage.

[0008] In addition, it is possible to add a foam that deforms in compression to compensate tolerance fluctuations. However, if the foam does not deform very much, there is a risk of leakage of the insulation foam during injection. Also, in the case where the foam is strongly compressed, there is a risk of deformation or breakage of the parts on which it lies on.

[0009] None of these solutions give full satisfaction.

[0010] It is therefore desirable to obtain a way to efficiently thermally isolate the water tank with foam injection taking into account possible tolerance fluctuations of the tank and casing height.

[0011] The object is solved by a cap element for a heating device, the heating device including a water tank located in a casing, wherein the cap element is placeable on or in the casing for closing said casing, the cap element comprising:

a centering mechanism integrated in, or removable from, the cap element, the centering mechanism having a deformable structure for causing the cap element to be centered relative to the water tank upon exerting a mechanical pressure on said deformable structure.

[0012] The possibility of removing the centering mechanism from the cap element leads to the possible advantage of replacing the centering mechanism in case of malfunctioning or damage.

[0013] The cap element can be a top element of the casing or can be any other closing element located for example at the base or at the side of the casing. In particular, the cap element can be the aesthetic top cap of a product or the base of other components, in particular the base of an heat pump in the case of a heat pump water heater.

[0014] It is noted that the mechanical pressure can be exerted on the cap element in response to the generation of an insulating material produced in a space between the water tank and the casing. As a matter of fact, the generation of insulating material inside the space can cause a mechanical stress acting on the cap element, and in particular on the centering mechanism, from below. The insulating material expands during the injection process and generates a mechanical stress in all directions, including towards the vertical, from the bottom to the top. In order to prevent the cap element from escaping due to the stress of the insulating material, a mechanical pressure can be applied to the upper surface of the cap element at the beginning of the injection process. This mechanical pressure is greater than the mechanical stress exerted by the insulating material during its chemical reaction and will be in the opposite direction. This is the mechanical pressure that is exerted on the deformable structure and causes the deformation of said structure, thereby centering the cap element. In reality, the pressure exerted on the deformable structure can be considered as the resultant force between the mechanical pressure exerted on the cap element and the mechanical stress generated by the insulating material.

[0015] Advantageously, the centering mechanism in the cap element makes it possible to at least partially compensate for height differences in the tank or casing and thus reduce the associated defects.

[0016] In other words, the presence of the centering mechanism guarantees the correct centering of the tank on the upper part and avoids any misalignment phenomena during the injection process. Furthermore, it makes the assembly of the product functional and compatible with different tank and casing heights. The compatible tolerance range depends on the geometry of the deformable surfaces and the ability of the material to deform without breaking.

[0017] The centering mechanism can be advantageously integrated into molded parts, particularly for injected or expanded parts of the cap element. The dimensions are compatible with the injection molding tools.

[0018] According to an example, the deformable structure can be arranged in a cavity of the cap element. Also, the deformable structure can be attachable to the cap element. In particular, the deformable structure can be directly or indirectly attached to a portion of the cap element. The possibility of attaching to, and therefore detaching from, the cap element leads to the possible advantage of applying the deformable structure (and also the centering mechanism) on a standard cap element for a heating device.

[0019] In another example, the deformable structure comprises a plurality of protruding portions moving away from each other when subjected to the mechanical pressure. In particular, these portions move away when stressed so that the cap element can penetrate further into the casing and thus regain its nominal position, independent of the tank and casing tolerances.

[0020] In one example, the protruding portions are arranged equidistant from each other. Also, the protruding portions can have each an external surface and tapered internal edge surfaces. The external surface can be flat, curve, polygonal, or having any suitable configuration. This particular configuration facilitates the moving away of the protruding portions from each other when a pressure is present. Also, the tapered internal edge surfaces can facilitate and guide the contact with the upper portion of the water tank. The tapered internal edge can be conical, partly conical or have a chamfer.

[0021] In a further example, the deformable structure is located at a central portion of the cap element. The location at the central part of the cap element facilitates the centering of the cap element relative to the water tank and the casing. Alternatively, the deformable structure is not located at a central part of the cap element. For example, the deformable structure can be made of several, in particular three or more, deformable parts which are close from the near the periphery of the casing.

[0022] In an additional example, the deformable structure is made of expanded plastic, in particular expanded polystyrene or expanded polypropylene. It is clear that any deformable material suitable for the purpose of the

present invention can be used.

[0023] In one example, the deformable structure is configured to be in contact with an upper portion of the water tank. This guarantees a correct alignment of the cap element relative to the water tank and the casing. In particular, the deformable structure can be configured to surround a protruding element of the water tank, in particular a tube or a pin. In this way, a more stable contact between the cap element and the water tank can be obtained.

[0024] In another example, the deformable structure is radially deformable in response to the mechanical pressure. This is the case when the deformable structure has a geometry of revolution (i.e. cylindrical). Alternatively, the deformable structure is laterally deformable in response to the mechanical pressure. This is the case when the deformable structure does not have a geometry of revolution.

[0025] In a further another example, the deformable structure is deformable in compression in response to the mechanical pressure. This provide additional flexibility to the deformable structure in order to better compensate the misalignment phenomena during the injection process. Also, the deformable structure can be deformable on the water tank's side or is deformable on a side different to the water tank's side. As a matter of fact, the centering mechanism can be applied on the cap element on a surface different from the surface facing the water tank provided that the deformable structure causes a realignment of the water tank during the injection process, for example based on an indirect mechanical pressure exerted on it.

[0026] In one example, the deformable structure comprises at least a recess. The recess can be used to receive a protruding element of the water tank, in particular a tube or a pin. Advantageously, the recess is formed by the protruding portions suitably arranged along a closed outline. The outline can be circular or polygonal. In particular, between two consecutive protruding portions there is a space in order to allow the free deformation of each protruding portion independently from the deformation of a neighboring protruding portion. It is noted that the insulating material can reach also the recess in order to have insulation foam everywhere (this is extremely important because it's the top of the tank, where the water is the hotter). In particular, the recess can be filed with the insulating material. This limits the heat dissipation due to the protruding portion and improves the thermal performance of the tank.

[0027] In additional examples, the deformable structure can have a circular cross-section or, alternatively, can have a polygonal cross-section. For example, the deformable structure can have a cylindrical structure or a cube-shaped structure.

[0028] In another aspect of the invention, a heating device system is provided. The heating device system comprising:

a heating device, in particular a heat pump water heater; and
 an inventive cap element,
 wherein the heating device comprises a casing and a water tank located in the casing, and wherein the cap element is placeable on or in the casing and closing said casing, the cap element being in particular a support for a heat pump,
 wherein the cap element comprises a centering mechanism integrated in, or removable from, the cap element, the centering mechanism having a deformable structure for causing the cap element to be centered relative to the water tank upon exerting a mechanical pressure on said deformable structure.

[0029] In one example, the heating device further comprises an insulating material arranged in a space between the water tank and the casing, the insulating material causing a direct or indirect mechanical stress on the deformable structure.

[0030] In a further example, the mechanical pressure can be exerted on the cap element in response to the generation of an insulating material produced in a space between the water tank and the casing. In addition, the mechanical pressure can be exerted on the cap element on the opposite direction to a mechanical stress exerted on the cap element by the insulating material. In particular, the mechanical pressure exerted on the cap element is greater than a mechanical stress exerted on the cap element by the insulating material. This prevents the cap element from escaping due to the mechanical stress generated by the insulating material inside the casing.

[0031] In a further aspect of the invention, a use of the inventive cap element is provided. The inventive cap element is used with a heating device, in particular a heat pump water heater.

[0032] According to an aspect of the invention a heating system is provided wherein the heating system comprises:

a heating device, in particular a heat pump water heater, wherein the heating device comprises a casing and a water tank located in the casing, and a cap element that is placeable on or in the casing and closing said casing, the cap element being in particular a support for a heat pump,
 and
 wherein the water tank comprises a centering mechanism which has a deformable structure for causing the cap element to be centered relative to the water tank upon exerting a mechanical pressure on said deformable structure.

[0033] By provision of a water tank with the centering mechanism the same advantages can be achieved like by providing the cap element with the centering mechanism.

[0034] The water tank can comprise a centering part.

The centering part can be a tube that is fixedly connected to a water tank wall. For example, the centering part can be welded to the water tank wall. The centering mechanism can be mounted on the centering part. In particular, it can be mounted such that the centering mechanism is releasably connected to the centering part.

[0035] The centering mechanism can comprise several protruding portions. The protruding portions can be in contact with a water tank wall.

[0036] The cap element can comprise a recess for receiving the centering mechanism. In particular, the centering mechanism enters the recess when a force is exerted to the cap element. The force exerted on the cap element is greater than the force resulting by the insulating material during its chemical reaction.

[0037] In the figures, the subject-matter of the invention is schematically shown, wherein identical or similarly acting elements are usually provided with the same reference signs.

Figures 1A-B show a schematic representation of the heating device according to an example.

Figures 2 shows a detail of the heating device and cap element according to an example.

Figures 3A-C show a schematic representation of the alignment of the cap element relative to the tank and casing according to an example.

Figures 4 shows a detail of the heating device and cap element according to two different configurations.

Figures 5A-B show a perspective representation of the cap element with the centering mechanism according to an example.

Figure 6 shows a detail of heating device and cap element according to another example.

Figures 1A-1B illustrate a heating device system comprising a heating device 2. The heating device 2, in particular an insulated heat pump water heater, has a heat pump (not shown in the figure) located on the top of a casing 4 and a water tank 3 located inside the casing 4 below the heat pump. In particular, the heat pump is supported by a cap element 5 of the heating device system. The cap element 5 serves as top closing element of the casing 4. Figure 1B is a longitudinal cross section of figure 1A.

[0038] The insulated heat pump water heater 2 has a water tank 3 located in the casing assembly 4 and an insulating material 14 injected in the space 7 between the tank 3 and the casing 4. The casing assembly 4 con-

sists of at least a top, a bottom and a periphery, the positions being at the time of the injection station of an insulating material (e.g. foam) 14. The upper part of the casing 4 is provided with a cap element 5 with a centering mechanism 1 (not shown in the figure). The cap element 5 (and the centering mechanism 1) is made of a flexible material, preferably an expanded plastic, preferably expanded polystyrene or expanded polypropylene. The insulating material (foam) is a thermal insulator, preferably polyurethane. The tank 3 can have a tube or pin or any other element on its upper portion 12 that is suitable to be coupled with the cap element 5, in particular with the centering mechanism 1. This is better clarified in figure 2.

[0039] Figure 2 illustrates a detail of figure 1B. In particular, figure 2 shows the upper region of the casing 4, where the cap element 5 is coupled to the upper portion 12 of the water tank 3 through the centering mechanism 1. The centering mechanism 1 comprises a deformable structure 6 made of a plurality of protruding portions 8. The deformable structure 6 is configured to surround and is housed around a tube 15 of the upper portion 12 of the tank 3. Accordingly, the deformable structure 6, and in particular each protruding portion 8, is capable of radial deformation when a mechanical pressure is exerted from top to bottom on this element, directly or indirectly. The mechanical pressure originates from the generation of the insulating material 14 in the space 7 between the tank 3 and the casing 4. It is noted that the centering mechanism can be integrated into an existing seat, such as a seat of the cap element 5, or it can be in a separate and dedicated seat.

[0040] With reference to figures 3A-3C, the alignment of the cap element 5 relative to the water tank 3 and the casing 4 is illustrated. The cap element 5 is provided with a centering mechanism 1 on the surface facing the water tank 3, i.e., in the internal surface of the cap element 5. The centering mechanism 1 comprises a deformable structure 6 having a plurality of protruding portions 8, each having an external surface 9 and tapered internal edge surfaces 10. The cap element 5 is inserted in the casing 4 to close the casing from the top. The cap element 5 can advantageously be the support surface for one or more electromechanical devices, for example the components of a heat pump. Fluctuations in the tank 3 and casing 4 heights as well as a not homogeneous pressure exerted on the tank 3 or the internal parts of the casing 4 during the foaming process can determine lack of insulation, lifting of the tank 3 and a misalignment of the cap element 5 relative to the tank 3 and casing. Figures 3A-3C schematically describe the application of the centering mechanism 1 to avoid or reduce these problems, in particular the misalignment between the cap element 5 and the water tank 3 and also the management of height tolerance, mainly visible in Fig 3C.

[0041] It is noted that figures 3A-3C illustrate an exemplification of what concretely could happen during an injection process, these figures only showing a rotation of the cap element 5 and an upwards shift of the tank 3. As

a matter of fact, during the injection, the water tank 3 can be subjected to other movements. For example, the tank 3 can be laterally shifted and can also rotate relative to the cap element 5 and the casing 4. The present centering mechanism 1 is configured to cope with all these issues.

[0042] In figure 3A, the cap element 5 is originally not aligned with the casing 4 and water tank 3. As mentioned above, this can be due to a different height between casing 4 and water tank 3 and to a not optimal pressure distribution exerted by the insulating material 14 on the tank 3, the casing 4 and the cap element 5. By increasing the quantity of the insulating material 14 in the space 7 between the tank 3 and the casing 4, the water tank 3 can be pushed upwards towards the cap element 5. In other words, during this injection process, the insulating material 14 exerts a mechanical stress in all directions inside the casing 4 and in particular upward. In response to this mechanical stress, a mechanical pressure can be exerted on the cap element 5 downward. This determines a coupling between a protruding element 15 on the upper portion 12 of the water tank 3, for example a tube, and the deformable structure 6 of the centering mechanism 1. In particular, the deformable protruding portions 8 touch the protruding element 15 of the water tank 3. Accordingly, the cap element 5 starts to shift and/or rotate. Since the centering mechanism 1 is located in the center portion 11 of the cap element and the protruding element 15 of the water tank 3 is located on a center region of the upper portion 12 of the tank 3 as well, the cap element 5 starts to align relative to the water tank 3 and the casing 4. By completely filling the space 7 with the insulating material 14 (figure 3C), the water tank 3 is further pushed upwards. It is noted that the deformable protruding portions 8 of the centering mechanism 1 are further deformed radially and the water tank 3 is completely aligned relative to the cap element 5 (and the casing 4). In this way, the water tank 3 is located inside the casing in the correct position relative to the casing 4 and relative to the cap element 5 after the foam injection process despite possible fluctuations in tank and casing height. Advantageously, is always possible to have the same heights between the bottom of the heating device 2 and the top of the cap element 5. Even if the dimensions of the tank 3 and the casing 4 are not fitting, it is possible to keep the same height of the product thanks to the management of the tolerance. Indeed, the mechanical pressure on the top of the cap element 5 is exerted until the optimal height of the product is reached, i.e. between bottom of the device 2 and the top of the cap element 5. By doing so, the product is at the optimal height and the customer is sure that it will fit into his installation.

[0043] Figure 4 illustrates in detail the deformation of the centering mechanism 1 based on the height fluctuations of the water tank 3 and/or the casing 4. In particular, figure 4 compares two situations where the top of the cap element 5 is always at the same level. On the left side of the figure, the water tank 3 is smaller than nominal and/or

the casing 4 is larger than nominal. In this case, there is a low deformation of the centering mechanism 1, and in particular of the protruding portions 8 of the deformable structure 6. On the right side of the figure, the water tank 3 is higher than nominal and/or the casing 4 is smaller than nominal. In this case, there is a high deformation of the centering mechanism 1, and in particular of the protruding portions 8 of the deformable structure 6.

[0044] Figures 5A and 5B illustrate a perspective view of the cap element 5. As shown in the figures, the centering mechanism 1 is provided on the central portion 11 of the cap 5 and in particular on a side of the cap element 5 facing the water tank 3 when inserted in the casing 4. The centering mechanism 1 has a circular shape formed by a plurality of protruding portions 8 arranged along a circular outline to create a central recess 13. Between a protruding portion 8 and the neighboring surface 8, there is a space to allow an independent movement of each single protruding portion 8. Each protruding portion 8 has an external surface 9 and tapered internal edge surfaces 10. This particular configuration of the deformable structure 6 allows the centering mechanism 1 to surround a tube or pin 15 of the water tank 3 and determining the centering of the cap element 5 relative to the tank 3 through the deformation action of the protruding portions 8 as described above. In particular, the deformable structure 6 has a cylindrical cross-section suitable for receiving a cylindrical protruding element 15 of the water tank, such as a tube or a pin. In order to properly function as centering device, the cross sectional area of the deformable structure 6 needs to be almost equal to (or at least not extremely larger than) the dimensions of the protruding element 15 of the water tank 3 that is received in the recess 13.

[0045] Figure 6 shows a detail of heating device 2 and cap element 1 according to another example. The embodiment differs from the embodiments discussed above in that the water tank 3 comprises the centering mechanism 1. A centering part 16 extends from the water tank 3 along a length direction of the water tank 3. The centering part 16 is welded to a water tank wall.

[0046] The centering mechanism 1 is mounted on the centering part 16. The centering mechanism 1 comprises a deformable structure 6. Additionally, the centering mechanism 1 comprises protruding portions 8 that are arranged distant to each other along a circumference direction of the centering mechanism 1. The protruding portions 8 are at one end in contact with the water tank wall.

[0047] The cap element 5 comprises a recess 17. The cap element 5 is arranged such, in particular the recess 17 is arranged such at the cap element 5, that the centering mechanism 1 enters into the recess 17 during the manufacturing process. The technical function of the protruding portions 8 is the same as for the embodiment discussed above so that it is referred to said explanations.

Reference Signs

[0048]

5	1	Centering mechanism
	2	Heating device
	3	Water tank
	4	Casing
	5	Cap element
10	6	Deformable structure
	7	Space
	8	Protruding portion
	9	External surface
	10	Tapered internal edge surface
15	11	Central portion of the cap
	12	Upper portion of the tank
	13	Recess
	14	Insulating material
	15	Tube
20	16	Centering part
	17	Recess

Claims

- 25 1. Cap element (5) for a heating device (2), the heating device (2) including a water tank (3) located in a casing (4), wherein the cap element (5) is placeable on or in the casing (4) for closing said casing (4), the cap element (5) comprising:
 - 30 a centering mechanism integrated in or removable from the cap element (5), the centering mechanism having a deformable structure (6) for causing the cap element (5) to be centered relative to the water tank (3) upon exerting a mechanical pressure on said deformable structure (6).
- 35 2. Cap element (5) according to any one of claim 1, **characterized in that:**
 - 40 a. the deformable structure (6) is arranged in a cavity of the cap element (5); and/or
 - b. the deformable structure (6) is attachable to the cap element (5).
- 45 3. Cap element (5) according to any one of claims 1 to 2, **characterized in that** the deformable structure (6) comprises a plurality of protruding portions (8) moving away from each other when subjected to the mechanical pressure.
- 50 4. Cap element (5) according to claim 3, **characterized in that**
 - 55 a. the protruding portions (8) are arranged equidistant from each other; and/or
 - b. the protruding portions (8) have each an external surface (9) and tapered internal edge sur-

- faces (10).
5. Cap element (5) according to any one of claims 1 to 4, **characterized in that** the deformable structure (6) is located at a central portion (11) of the cap element (5). 5
 6. Cap element (5) according to any one of claims 1 to 5, **characterized in that** the deformable structure (6) is made of expanded plastic, in particular expanded polystyrene or expanded polypropylene. 10
 7. Cap element (5) according to any one of claims 1 to 6, **characterized in that** 15
 - a. the deformable structure (6) is configured to be in contact with an upper portion (12) of the water tank (3); and/or
 - b. the deformable structure (6) is configured to surround a protruding element (13) of the water tank (3), in particular a tube or a pin. 20
 8. Cap element (5) according to any one of claims 1 to 7, **characterized in that** 25
 - a. the deformable structure (6) is radially deformable in response to the mechanical pressure; or
 - b. the deformable structure (6) is laterally deformable in response to the mechanical pressure. 30
 9. Cap element (5) according to any one of claims 1 to 8, **characterized in that**
 - a. the deformable structure (6) is deformable in compression in response to the mechanical pressure; and/or 35
 - b. the deformable structure (6) is deformable on the water tank's (3) side or is deformable on an opposite side to the water tank's (3) side. 40
 10. Cap element (5) according to any one of claims 1 to 9, **characterized in that** the deformable structure (6) comprises at least a recess (13).
 11. Cap element (5) according to any one of claims 1 to 10, **characterized in that**
 - a. the deformable structure (6) has a circular cross-section; or 50
 - b. the deformable structure (6) has a polygonal cross-section.
 12. Heating device system comprising: 55
 - a heating device (2), in particular a heat pump water heater; and
 - a cap element (5) according to any one of claims

- 1 to 11,
 - wherein the heating device (2) comprises a casing (4) and a water tank (3) located in the casing (4), and wherein the cap element (5) is placeable on or in the casing (4) and closing said casing (4), the cap element (5) being in particular a support for a heat pump,
 - wherein the cap element (5) comprises a centering mechanism (1) integrated in, or removable from, the cap element, the centering mechanism (1) having a deformable structure (6) for causing the cap element (5) to be centered relative to the water tank (3) upon exerting a mechanical pressure on said deformable structure (6).
13. Heating system according to claim 12, **characterized in that** the heating device (2) further comprises an insulating material (14) arranged in a space (7) between the water tank (3) and the casing (4), the insulating material (14) causing a direct or indirect mechanical stress on the deformable structure (6).
14. Heating system according to any one of claims 12 to 13, **characterized in that:**
 - a. the mechanical pressure is exerted on the cap element (5) in response to the generation of an insulating material (14) produced in a space (7) between the water tank (3) and the casing (4); and/or
 - b. the mechanical pressure is exerted on the cap element (5) on the opposite direction to a mechanical stress exerted on the cap element (5) by the insulating material (14); and/or
 - c. the mechanical pressure exerted on the cap element (5) is greater than a mechanical stress exerted on the cap element (5) by the insulating material (14).
15. Use of the cap element (5) according to one of claims 1 to 11 with a heating device (2), in particular a heat pump water heater.
16. Heating device system comprising:
 - a heating device (2), in particular a heat pump water heater, wherein the heating device (2) comprises a casing (4) and a water tank (3) located in the casing (4), and
 - a cap element (5) that is placeable on or in the casing (4) and closing said casing (4), the cap element (5) being in particular a support for a heat pump,
 - and
 - wherein the water tank (3) comprises a centering mechanism (1) which has a deformable structure (6)

for causing the cap element (5) to be centered relative to the water tank (3) upon exerting a mechanical pressure on said deformable structure (6).

17. Heating device system according to claim 16, **characterized in that** 5

- a. the water tank (3) comprises a centering part (16), wherein the centering mechanism is mounted on the centering part and/or **in that** 10
- b. the cap element (5) comprises a recess (17) for receiving the centering mechanism (1)

15

20

25

30

35

40

45

50

55

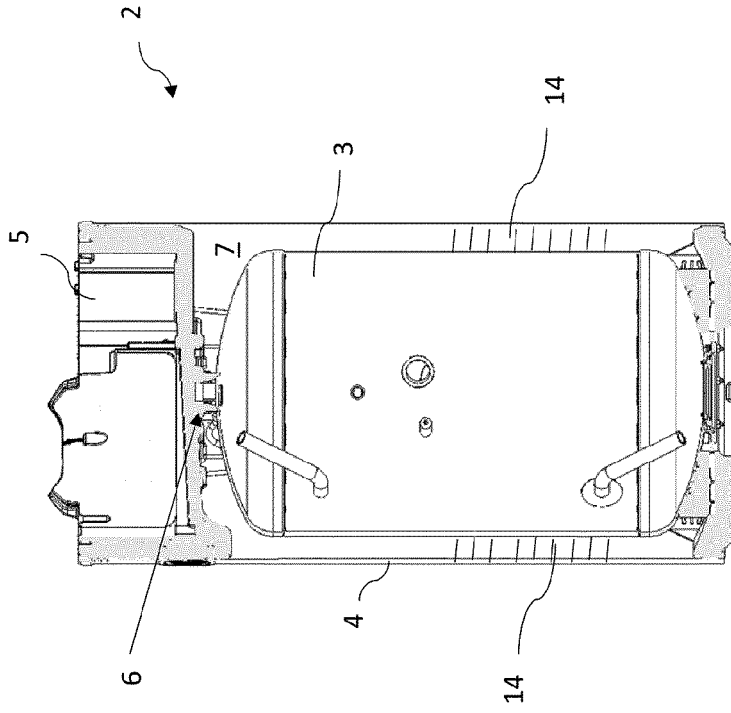


FIG. 1B

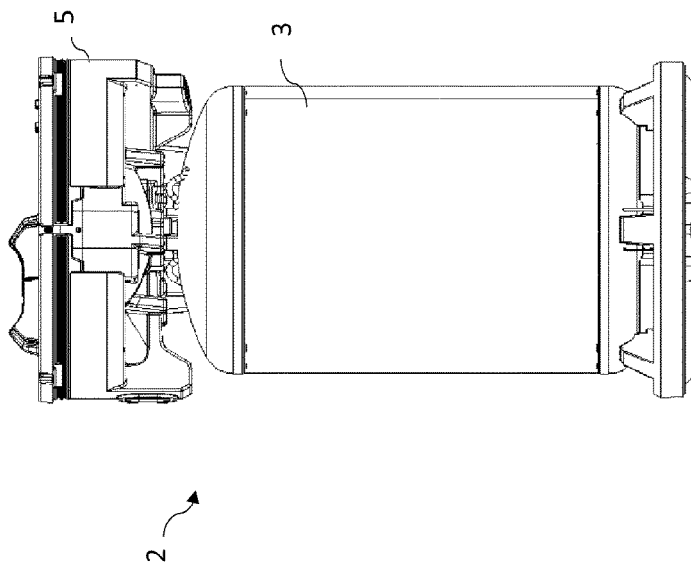


FIG. 1A

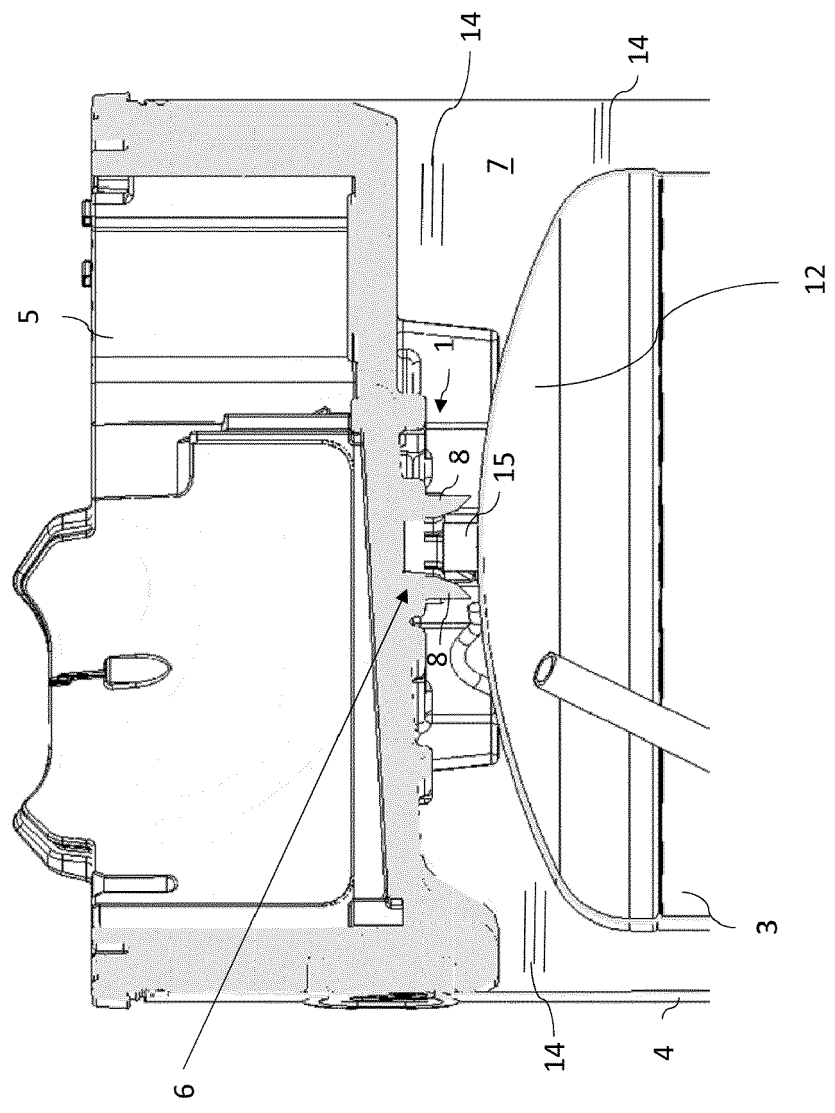


FIG. 2

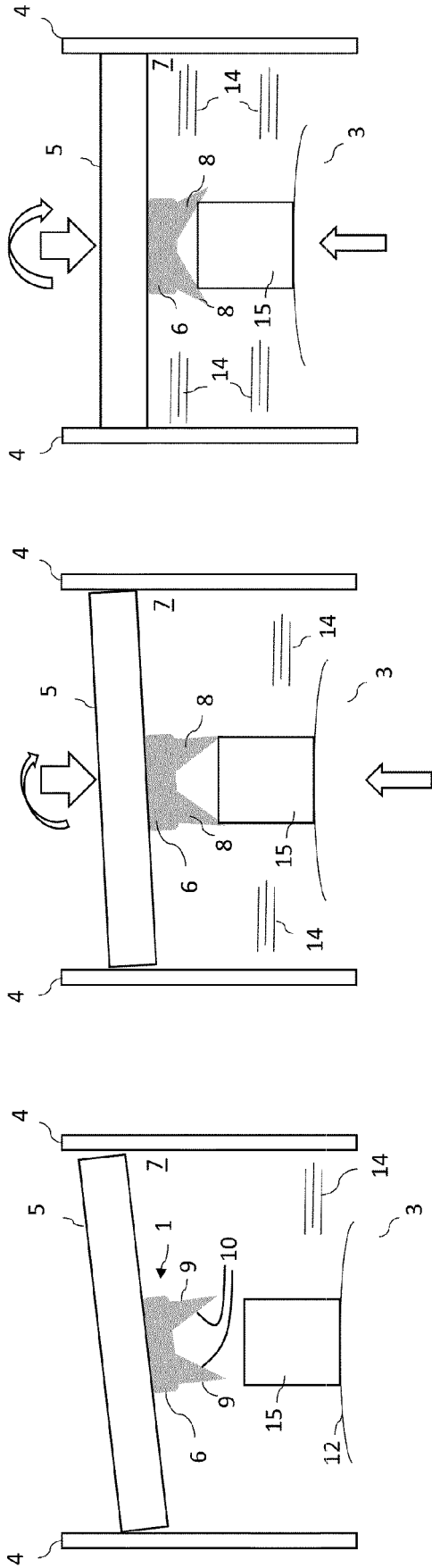


FIG. 3A

FIG. 3B

FIG. 3C

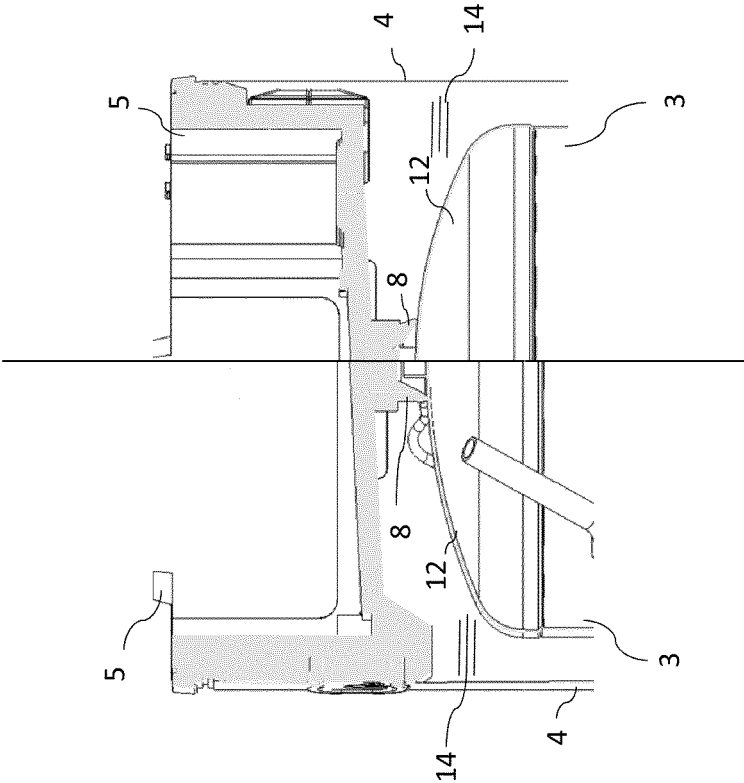


FIG. 4

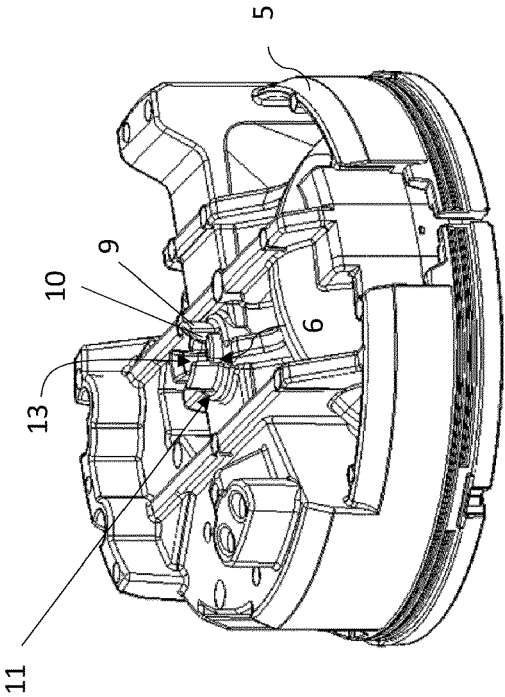


FIG. 5A

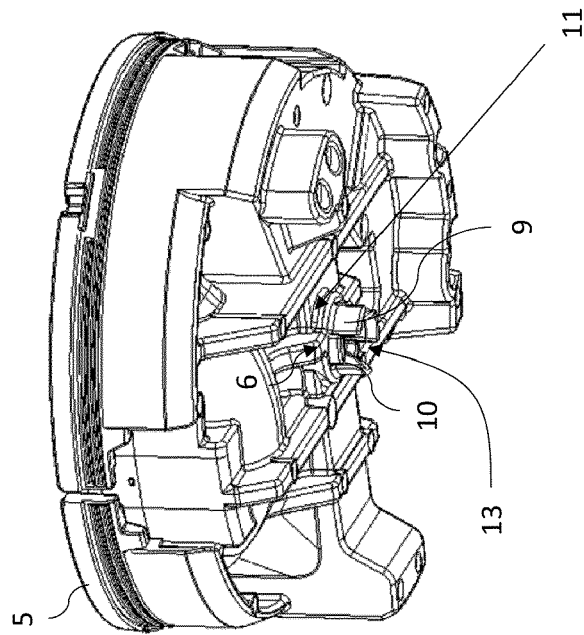
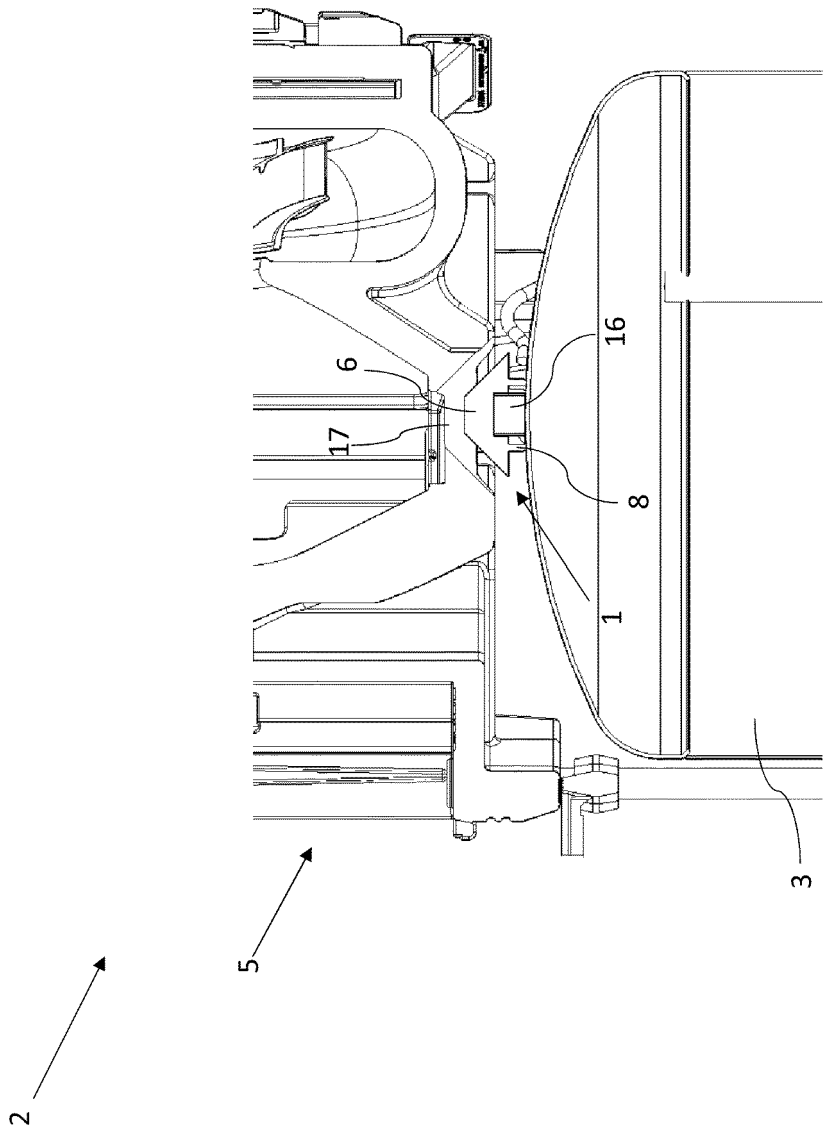


FIG. 5B





EUROPEAN SEARCH REPORT

Application Number

EP 22 16 3164

5

10

15

20

25

30

35

40

45

50

55

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	DE 12 99 832 B (SIEMENS ELEKTROGERAETE GMBH) 24 July 1969 (1969-07-24) * paragraph [0008] - paragraph [0012]; figures 1-3 *	1-17	INV. F24H1/18 F24H4/04
X	EP 2 110 619 A2 (CHOI SANG PIL [KR]) 21 October 2009 (2009-10-21) * paragraph [0105] - paragraph [0124]; figures 16-18 *	1,15,16	
X	EP 3 462 103 A1 (DAIKIN IND LTD [JP]; DAIKIN EUROPE NV [BE]) 3 April 2019 (2019-04-03) * paragraph [0091] - paragraph [0096]; figures 10-11 *	1,15,16	
X	DE 19 34 770 U (STIEBEL WERKE GMBH & CO DR [DE]) 17 March 1966 (1966-03-17) * the whole document *	1,15,16	
X	DE 94 19 611 U1 (VIESSMANN WERKE KG [DE]) 26 January 1995 (1995-01-26) * paragraph [0020] - paragraph [0039]; figures 1-3 *	1,15,16	TECHNICAL FIELDS SEARCHED (IPC) F24H

The present search report has been drawn up for all claims

1

Place of search

Munich

Date of completion of the search

6 September 2022

Examiner

Ast, Gabor

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03/82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 22 16 3164

5

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

06-09-2022

10

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
DE 1299832	B	24-07-1969	NONE

EP 2110619	A2	21-10-2009	BR PI0901361 A2
			18-05-2010
			CA 2639260 A1
			18-10-2009
			EP 2110619 A2
			21-10-2009
			JP 2009257729 A
			05-11-2009
			TR 200903026 A2
			23-11-2009
			US 2009260583 A1
			22-10-2009

EP 3462103	A1	03-04-2019	NONE

DE 1934770	U	17-03-1966	NONE

DE 9419611	U1	26-01-1995	NONE

15

20

25

30

35

40

45

50

55

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82