

(19)



(11)

**EP 4 467 484 A1**

(12)

## EUROPEAN PATENT APPLICATION

(43) Date of publication:  
**27.11.2024 Bulletin 2024/48**

(51) International Patent Classification (IPC):  
**B65D 81/133** <sup>(2006.01)</sup> **B65D 19/44** <sup>(2006.01)</sup>  
**B65D 81/05** <sup>(2006.01)</sup>

(21) Application number: **23175556.2**

(52) Cooperative Patent Classification (CPC):  
**B65D 81/054; B65D 19/44; B65D 81/053;**  
**B65D 81/133;** B65D 2519/00029;  
B65D 2519/00064; B65D 2519/00273;  
B65D 2519/00293; B65D 2519/00323;  
B65D 2519/00333; B65D 2519/00815;  
B65D 2585/6857

(22) Date of filing: **26.05.2023**

(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 ME MK MT NL**  
**NO PL PT RO RS SE SI SK SM TR**  
Designated Extension States:  
**BA**  
Designated Validation States:  
**KH MA MD TN**

(72) Inventors:  
• **SIEGEL, Christophe**  
**7332 BD Apeldoorn (NL)**  
• **PETRAZOLLER, Thibaut**  
**7332 BD Apeldoorn (NL)**  
• **KESSLER, Alexandre**  
**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) PACKAGING ELEMENT

(57) Packaging element (1, 13, 15) for packaging a heating device or a heating device's component (2), in particular tank, wherein the packaging element has a main body (4) configured to surround at least in part a portion (5, 14, 42) of the heating device or of the heating device's component, in particular tank, the main body (4) comprising at least two first protuberances (6) on a first side (7) of the main body (4), wherein the first protuber-

ances (6) extend in a first direction ( $D_1$ ) facing the heating device or the heating device's component, in particular tank, and are arranged to form a receiving region (11) to receive, at least in part, the portion (5, 14, 42) of the heating device or the heating device's component, in particular tank, and wherein the packaging element (1, 13, 15) is made of molded pulp.

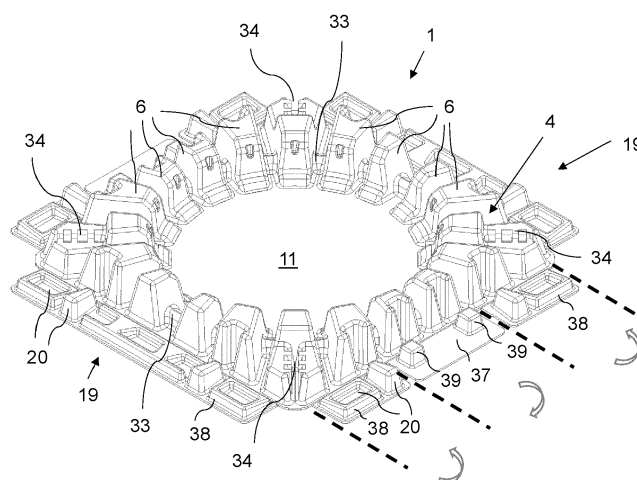


FIG. 3A

## Description

**[0001]** The invention relates to a packaging element and a supporting structure for packaging a heating device, such as a heat pump, a boiler, a heat pump water heater, an electrical water heater, or a heating device's component, such as a tank, preferably a domestic hot water preparation tank or a buffer tank, as well as a packaging assembly for supporting and packaging said heating device or heating device's component, in particular a tank. Also, the invention relates to a method for supporting and packaging a heating device or heating device's component, in particular a tank, and to a use of the packaging element, the supporting structure, or packaging assembly for supporting and packaging a heating device or heating device's component, in particular tank.

**[0002]** Hot water storage devices, especially for heating application or domestical hot water storage application such as hot water tanks are products that do not currently benefit from an efficient and environmentally friendly packaging solution for transportation. Indeed, their general characteristics make them difficult to pack. As a matter of fact, hot water tanks generally consist of a watertight tank (usually enameled steel or stainless steel) covered with a thermal insulation and an aesthetic envelope (usually plastic or painted steel). The tanks are cylindrical or polygonal in shape with a height that is much greater than the other dimensions. In addition, the tank may have protrusions on various sides (for example peripheral or upper sides), notably due to inlet/outlet tubes or elements connected to the tank such as heating elements, sensors, control interfaces etc...

**[0003]** The hot water tanks can be transported horizontally and/or vertically in order to offer both a solution that reduces the footprint and maximizes the loading of a truck (vertical) and also a solution that is compatible with the dimensions of the end-users' utility vehicles (horizontal). Also, the tanks can be stored in such a way that one product rests on top of another, to optimize the warehouse storage or in the truck.

**[0004]** It is noted that during transportation, tanks can be subjected to shocks, e.g. due to acceleration, shocks from neighboring materials that may fall during transport, blows during handling etc. These different conditions and phases of transport are detailed in dedicated standards, such as the ASTM d4169. All these elements can weaken or even break the coating made of enamel inside the tank and drastically reduce its life span. Indeed, enamel is a ceramic and is therefore fragile to breakage. Damages due to transportation can also degrades the aesthetics of the product and could make it unacceptable for the customer. If the product is degraded, it has to be recycled and this leads to excessive energy, resource and economic consumption as well as strong dissatisfaction.

**[0005]** For these reasons, the transport solution common to the field of activity is mainly based on the use of expanded polystyrene wedges which protect the product (lower and/or upper and/or intermediate). Polystyrene is an inexpensive material that can be shaped as required and has good shock absorption/damping qualities. The product (i.e. the tank) together with the polystyrene wedge is then contained in a cardboard box and/or plastic sleeve.

**[0006]** However, the application of single-use plastic for packaging purposes is tending to be prohibited, either by standards or by the requirements of various customers. This is basically due to the fact that it consumes a disproportionate amount of resources and is not environmentally friendly. As a matter of fact, the recycling channels for expanded polystyrene are not enough developed. The use of this polystyrene packaging solution will therefore cease shortly.

**[0007]** Currently, water tanks that are prepared for transport, are positioned on a wooden pallet. The tank is secured to the pallet basically by two different concepts as shown in figures 1A and 1B. With reference to figure 1A, the packaging assembly for packaging a tank 2 consists of two expanded polystyrene (EPS) wedges, i.e. the top EPS wedge 25 and the bottom EPS wedge 30, a transparent plastic film 31 and a pallet 3. The transparent film 31 retracts itself by warming operation and therefore maintains the product 2 on the pallet 3. However, this solution is not environmentally friendly due to the presence of two EPS components. With reference to figure 1B, in order to reduce the quantity of plastic material, a single top EPS wedge 25 is used to package the tank 2 together with the transparent film 31 and the pallet 3. To maintain the product 2 on the pallet 3, the bottom portion of the tank 2 is directly fixed to the pallet 3. This is illustrated in detail in figures 2A and 2B. Specifically, the bottom portion of the tank 2 is secured (screwed) to the pallet 3 through a plurality of washers 27 and screws 28. The fastening occurs by screwing dedicated metal feet 29 of the tank 2 to the slats 24 of the pallet 3. However, this solution still contemplates the employment of EPS material. In addition, it is an expensive, cumbersome and time consuming process. Furthermore, this solution is not satisfying for the customer, who needs to remove screws located in a place of difficult accessibility.

**[0008]** In addition or in alternative to polystyrene, cardboard parts can be introduced for packaging purposes. For example, a cardboard box can be used to cover the lateral portion of the tank 2 between the top and the bottom EPS wedges. To prevent the opening of the box, strapping links can be provided to close the cardboard box. According to another example, to replace polystyrene, a honeycomb cardboard can be used as a top or bottom shim for tanks. Honeycomb board is a set of paper sheets shaped and glued together to form a network structure. This structure offers good mechanical strength in the direction perpendicular to the panel but very low strength in the directions of the panel. This solution is relatively expensive and, although it appears to be environmentally friendly, in reality it requires significant consumption of water and resources, for example in terms of cutting, folding, gluing, shaping, etc.

**[0009]** FR3021305B1 describes a water heater packaging consisting of sides protected by multi-layer cardboard strips

and stretch film. The assembly also has a foamed plastic wedge. The solution aims to make the product visible thanks to the transparent plastic window (to identify the product, to make the handler aware of the risk of shock) while protecting the most shock-sensitive surfaces with layers of cardboard. This solution offers an answer to the side impact, but not to the replacement of the upper and lower wedges which remain in the original design (polystyrene). The proposed invention allows to replace the wedges, to protect the product and also to make the product visible.

**[0010]** FR3117466A1 describes a water heater packaging having a sheath and an upper and lower wedge. At least one of these items is in honeycomb cardboard (especially the sheath). The wedges are preferably in corrugated cardboard, which is an already-known solution as an alternative for polystyrene wedge. The honeycomb cardboard material is used to protect the periphery of the product from radial impact. However, this solution is suitable for only a limited number of geometries. For example, it is not compatible with tanks having protrusions in relation to the cylindrical surface of the tank. In this case, the inlet/outlet tubes and the various elements connected to the tank, such as the electrical resistance, are not protected against impact. As a matter of fact, these are the elements that are most sensitive to impact because they protrude from the general geometry of the product. Moreover, this solution requires the use of many complex parts and therefore significant economic, energy and environmental costs, i.e. two wedges, a sleeve for protection, a dust/intrusion protection sheet, strapping links, a pallet, additional productions for protrusions, and a dust cover. Indeed, this solution is not sufficient for handling since it does not have access for a pallet truck and doesn't provide sufficient stability alone. This solution therefore needs to be combined with a pallet and additional strapping to fix the pallet to this assembly. Although apparently environmentally friendly, this solution actually requires significant consumption of water and resources and generates a large number of scraps. Furthermore, it is expensive, it needs more labor by bending cardboard and it uses a less sustainable cardboard process.

**[0011]** It is therefore desirable to obtain a packaging product and a method for supporting and packaging an article that is efficient and at the same time environmentally friendly. In particular, the support and the packaging need to be suitable for high articles such as water tanks, thereby ensuring protection and stability during transportation. In particular, in the case of a heat pump the aim is to prevent oil in a compressor of the heat pump from flowing into the refrigerant circuit.

**[0012]** The object is solved by a packaging element for packaging a heating device or a heating device's component, in particular a tank, wherein the packaging element has a main body configured to surround at least in part a portion of the heating device or of the heating device's component, in particular tank, the main body comprising at least two first protuberances on a first side of the main body,

wherein the first protuberances extend in a first direction facing the heating device or of the heating device's component and are arranged to form a receiving region to receive, at least in part, the portion of the heating device or of the heating device's component, in particular a tank, and wherein the packaging element is made of molded pulp, in particular a molded cardboard pulp.

**[0013]** Molded pulp - also known as molded fiber or molded cardboard - is a material made from a variety of fibrous components such as recycled paper, cardboard offcuts or natural fibers (sugarcane bagasse, bamboo, wheat straw). In particular, molded pulp is realized by using recycled paperboard to create a paste. Additional elements can be added to offer additional performance: waterproof, improvement of mechanical resistance etc.. The paste is put into a mold (depending of the shape to be obtained), is pressed, vacuumed and dried. Accordingly, by using the molded pulp technology, it is possible to suitably shape the packaging element to accommodate an article or product, such as a heating device or of the heating device's component, by using a non-plastic material. Moreover, molded pulp is fully recyclable and can be re-used for cardboard production such as the re-use as a molded pulp part.

**[0014]** Specifically, compared to other cardboard material, such as the corrugated cardboard or honeycomb cardboard, molded pulp can provide a better protection of the article due to a denser and stronger structure, it is aesthetically more appealing and it is environmentally friendly. In addition, the molded pulp technology allows for a cushioning piece that has mechanical strength in all directions. Differently, the corrugated or honeycomb cardboard technology is very sensitive to the direction of impact, as it is a mesh. The geometry of the mesh therefore has a significant impact and does not allow a mechanical resistance to all types of impact.

**[0015]** Compared to other cardboard technologies, molded pulp makes it possible to obtain the desired shapes and functions: a guide for the product, the creation of a pocket to hold accessories, notices, means of wedging/holding with the product, the pallet or other components of the packaging. This type of geometry is not feasible for example with honeycomb cardboard technology. The honeycomb cardboard technology can only be used to make flat embossed shapes in relation to the original panel. This results in a set of flat steps with simple geometries, thus preventing the integration of many functions. For example, it is not possible with this type of technology to have a guide with surfaces having an angle to facilitate the introduction of the tank on the wedge (or the wedge on the tank).

**[0016]** The present packaging element advantageously reduces the environmental impact due to the absence of EPS wedges, but rather of fully recyclable wedges. In addition, by using the present packaging element, the management of the packaging by the user is facilitated since it avoids the crumbling of parts as is the case for expanded polystyrene (so that the

installation site needs to be cleaned), and allows easy recycling of the material crumbling. It is noted that in some countries the recycling of polystyrene is not free of charge.

**[0017]** A further advantage of the invention is that in case of a heat pump oil in the compressor is prevented from flowing into the refrigerant circuit during transportation in a constructively easy way by ensuring that the product is transported upright or in a predetermined position and kept in said position during transport.

**[0018]** According to an example, the portion of the heating device or of the heating device's component surrounded by the main body is the bottom portion and the packaging element is a base element and is placeable between the heating device or the heating device's component and a pallet and comprises a plurality of second protuberances on a second side of the main body, the plurality of second protuberances extending in a second direction opposite to the first direction and are configured to engage into the pallet.

**[0019]** Advantageously, the present packaging element configured as a base element is a first packaging element and can be used for supporting the lower portion of an article such as a tank or a water pump heater in a more stable and economical way compared to known solutions. As a matter of fact, the main body of the (first) packaging element comprises two types of protuberances or bumps that can be simultaneously employed to support the tank and to fix the tank to a pallet. A first type of protuberances is used to define a receiving region for accommodating the bottom of the tank or of the water pump heater and a second type of protuberances is used to be inserted into the slots of two consecutive slats of a pallet. In this way, the packaging element and the article are prevented from sliding sideways during transportation. It is noted that the pallet can be any standard wooden pallets used for transportation of heavy products. It is also noted that, thanks to a better weight repartition of the product on the pallet and the removal of stress points compared to when screws are used, it is possible to reduce the thickness and the weight of the pallet used. Therefore, the tank or the water pump heater is firmly secured to the pallet without the need of using screws that are also difficult to unscrew when disassembling the article since located in an unfavorable position. It is furthermore pointed out that the present (first) packaging element is compatible with the constraints of transporting hot water tanks and can be easily implemented in several tank designs.

**[0020]** Therefore, the present (first) packaging element improves the assembly process in production so that musculoskeletal issues / bad postures are avoided by eliminating the screwing step under the wooden pallet. Furthermore, the tank or the water pump heater to be centered on the pallet by adding an engagement cone. During transportation, the tank or the water pump heater can be maintained on pallet without fixing by screws and the article unpackaging by the installer is facilitated since the unscrewing step under the pallet is eliminated.

**[0021]** In another example, the receiving region has a circular area having in particular a diameter comprised between 300 mm and 900 mm. In particular, the plurality of first protuberances of the (first) packaging element are arranged to form a circular contour, thereby defining the receiving region. The circular form serves to accommodate the bottom portion of the tank or the water pump heater that usually has a cylindrical shape, for example with a diameter of 300 to 900mm. It is noted that the receiving region can be shaped according to different shapes, i.e. the contour defined by the plurality of first protuberances can be squared, rectangular, elliptic, etc., based on the shape of the article to be accommodated.

**[0022]** In a further example, the main body comprises an external edge surrounding the receiving region. In particular, the external edge can define a polygonal shape, in particular a squared shape, around the receiving region. This external edge is advantageously foldable so that a first portion of the main body of the (first) packaging element (i.e. the internal surface) is used for receiving the article and at least a second portion of the main body is angled to the first portion and is used for holding the packaging element on another surface. According to one configuration, the external edge comprises at least a first section that is foldable downwards. In particular, the at least a first section of the external edge is foldable to block it in the pallet. In this way, the assembly made of the article and the packaging element is prevented from sliding on the pallet. It is noted that the external edge can be foldable to block it in an element different from the pallet, such as another packaging element (a cardboard box for example or another molded pulp packaging element). According to another configuration - that can be combined with the first configuration - the external edge comprises at least a second section that is foldable upwards. For example, the at least a second section of the external edge can comprise recesses and projections configured to be engageable with a portion of the first protuberances. In this way, when folded upwards towards the receiving region, the second section of the external edge can be used to block for example a packaging component such as a packaging film that remains flatten between the recesses and/or projections of the external edge and a portion of the first protuberances. It is noted that some sections (for example one or more than one) of the external edge can be foldable downwards to block the packaging element in the pallet and other sections (for example one or more than one) of the same packaging element can be foldable upwards to be engaged with the first protuberances.

**[0023]** According to an example, the main body has a flat form in the receiving region and a wavy form surrounding the receiving region at the plurality of first protuberances. With the term "wavy form" is intended a shaped form that is not planar and serves to create a counter form to accommodate the article, i.e. a guide to facilitate the positioning of the article and to retain it. In other words, the portion of the main body surrounding the receiving region is shaped by the first protuberances that can have all the same height or can have different levels of height.

**[0024]** In examples, the first protuberances comprise lateral walls forming a deviation angle with the first direction

comprised between 6 degrees and 10 degrees, in particular 8 degrees. Because of the molding process, draft angles are implemented. In this way, the present (first) packaging element is compatible with a mass production mold and in particular is able to be ejected easily from the mold once the pulped cardboard part is implemented. In order to improve the stability of the (first) packaging element, the main body can comprise one or more stiffening ribs arranged between consecutive first protuberances.

**[0025]** Due to the material used, the important thicknesses involved and the dimensions of the different protuberances and ribs, a minimum value of 8 degrees is necessary for the drafts. Therefore, the protuberances, and in particular the first protuberances on the periphery of the flat area, are made with an angle of about 8 degrees. The smaller the angle, the better the product will be held but the more difficult the part will be to make and to assemble (with the article or when the molded parts are stack together during transport). On the contrary, the larger the angle, the simpler the part is to make but the less efficient it is to hold the product.

**[0026]** According to an example, the main body comprises one or more first vertical recesses. These vertical recesses of the (first) packaging element serve to insert reinforcement elements, such as slats.

**[0027]** In another example, the portion of the heating device or of the heating device's component surrounded by the main body is the upper portion of the heating device or of the heating device's component and the packaging element is a covering element or top element. In particular, the covering element is such that the first protuberances facing the heating device or of the heating device's component are arranged to surround at least in part said upper portion.

**[0028]** In addition or in alternative, the covering element comprises a recess for placing tools or accessories. This can be very useful for save space and to place suitable tools or documents in a location easily accessible by the user. In examples, the covering element has a circular shape, in particular a ring shape. Further suitable is a polygonal shape with rounded corner.

**[0029]** In addition or in alternative, the covering element comprises one or more second vertical recesses. These vertical recesses serve to insert reinforcement elements, such as slats.

**[0030]** In particular, in combination with the presence of first vertical recesses, it is possible to insert vertical slats between the covering element and the base element, for example at the corners of the packaging assembly in order to improve the entire stability of the assembly.

**[0031]** Advantageously, the present packaging element configured as a covering element is a second packaging element and can be used for covering and protecting the upper portion of an article such as a tank or a water pump heater in a more stable and economical way compared to known solutions.

**[0032]** In still another example, that the portion of the heating device or of the heating device's component surrounded by the main body is the lateral portion of the heating device or of the heating device's component and the packaging element is a side element, wherein the first protuberances extends along a longitudinal direction of the heating device or of the heating device's component.

**[0033]** Advantageously, the present packaging element configured as a side element is a third packaging element and can be used for covering and protecting the lateral portion of an article such as a tank or a water pump heater in a more stable and economical way compared to known solutions.

**[0034]** In one example, the (first, second and/or third) packaging element has an average thickness of at least 4 mm, in particular of at least 4.5 mm. In this way, it is possible to use the packaging element to support and to transport heavy and bulky articles such as water tanks or water pump heater. It is noted that although the molded pulp technology is a known technology in the field of packaging, it is usually employed for cushioning equipment weighing less than 20 kg in general so that usually the wall thickness is between 1 mm and 3 mm. For example, molded pulp is especially known for egg packaging and other applications such as wine, cosmetic, food protection, etc.... By using articles like tanks or water pump heater having a mass of about 200 kg and more, it has been defined as a suitable thickness of molded pulp material a thickness of at least 4 mm. In order to avoid an excessive weight of the packaging element and to be compliant with industrial feasibility, it has defined that the optimal thickness is comprised between 4 mm and 6 mm.

**[0035]** In another aspect of the invention, a supporting structure, for supporting and packaging the base of a heating device or of a heating device's component, is provided. The supporting structure comprises:

the inventive base element, and

a pallet, in particular made of wood, having a plurality of slats distanced one from the other, wherein the base element is engaged into the pallet.

**[0036]** In an additional aspect of the invention, a packaging assembly for supporting and packaging a heating device or of a heating device's component is provided. The packaging assembling comprises:

the inventive base element or the inventive supporting structure;

the inventive covering element; and

at least one inventive side element.

**[0037]** In other words, the packaging assembly comprises a first packaging element (i.e. the base element) a second packaging element (i.e. the covering element) and at least one third packaging element (i.e. the side element) to support, covering and protect during transportation the lower portion, the upper portion and the lateral portion of a product such as a tank or a water pump heater.

**[0038]** In one example, the packaging assembly further comprises a tubular wrapping sheet surrounding the heating device or the heating device's component and placeable between the base element and the covering element, the tubular wrapping sheet shrinking in the direction from the base element to the covering element.

**[0039]** In another example, the packaging assembly further comprises a bottom covering sheet placeable between the base element and the heating device or the heating device's component and a top covering sheet placeable between the covering element and the heating device or the heating device's component.

**[0040]** It is noted that all the packaging elements, i.e. the base element, the covering element and the lateral element are made of molded pulp. In the configuration where all the packaging elements are made of molded pulp, the packaging assembly is much more environmentally friendly compared to packaging assemblies known in the art.

**[0041]** In a further aspect of the invention, a method for supporting and packaging a heating device or a heating device's component is provided.

**[0042]** The method comprises:

- providing an inventive base element;
- providing a pallet and engaging the base element into the pallet;
- placing the heating device or a heating device's component such that the bottom portion of the heating device or a heating device's component in the receiving region of the base element; and
- providing a covering element and placing said covering element on the top portion of the heating device or a heating device's component, and
- providing at least an inventive side element and placing said side element on the lateral portion of the heating device or of the heating device's component.

**[0043]** According to one example, the main body of the base element comprises an external edge surrounding the receiving region, the external edge being foldable, the method comprising folding the external edge such that at least a first section of the external edge is blocked in the pallet.

**[0044]** In a still further aspect of the invention, a use of the inventive (first, second and/or third) packaging element, or of the inventive supporting structure or of the inventive packaging assembly for supporting and packaging a heating device or a heating device's component is provided. The inventive packaging element, or inventive supporting structure, or inventive packaging assembly is used for supporting and packaging water tanks in the context of heat pumps, domestic hot water tanks and buffer tank, ventilation, and air conditioning.

**[0045]** 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 two different packaging solutions according to prior art.

Figures 2A-B show the detail of the fixing mechanism according to the prior art solution of figure 1A.

Figures 3A-C show a representation of the packaging (base) element according to an example.

Figures 4A-B show a representation of the supporting structure according to an example.

Figures 5A-D show a representation of the packaging (covering) element according to an example.

Figures 6A-D show a front view, a perspective view and exploded view of the packaging assembly according to an example.

Figures 7A-B show a perspective view of the packaging assembly according to an example.

Figures 8A-B show a representation of the packaging assembly according to an example.

Figures 9A-C show a representation of the packaging assembly and details of the top and the bottom of the assembly according to an example.

Figures 10A-C show a representation of the packaging assembly and details of the draft angle of the packaging ele-

ment according to an example.

Figures 11A-C show a representation of the packaging (side) element in a perspective view, top view and lateral view according to an example.

**[0046]** Figures 3A-3C illustrate the first packaging element (i.e. the base element) 1 in a perspective view (Fig. 3A), in a top view (Fig. 3B) and in a lateral view (Fig. 3C). The base element 1 is configured to support the bottom portion of a water tank or a water pump 2 (not shown in the figure). As shown in the figures, the main body 4 of the base element 1 basically has a polygonal (i.e. squared) layout with a central flat region representing the receiving region 11 and a wavy peripheral region surrounding the receiving region 11. The peripheral region comprises a plurality of first protuberances 6 arranged around a circular contour 10. The first protuberances 6 define the receiving region 11 configured to accommodate the bottom of the tank 2. It is noted that the first protuberances 6 are uniformly arranged around the contour and are connected to each other through reinforcing stiffening ribs 33.

**[0047]** As clearly shown in figure 3B, the first protuberances 6 are arranged on a first side 7 of the main body 4. The first side 7 is the side of the base element 1 comprising the receiving region 11 and facing therefore the tank 2. On the other side of the main body 4 (i.e. the second side 9), a plurality of second protuberances 8 is provided. In particular, whereas the first protuberances 6 extend in a first direction  $D_1$ , the second protuberances 8 extend in a second direction  $D_2$ , opposite to the first direction  $D_1$ . The second protuberances 8 have a different purpose compared to the first protuberances 6. As a matter of fact, the first protuberances 6 serve to define the receiving region 11. On the other hand, the second protuberances 8 serve to engage (i.e. to block) the base element 1 with a pallet 3 (not shown in the figure). This is extremely useful during transportation in order to avoid sliding movements between the base element 1 - and therefore the article 2 - and the pallet 3. To increase the blocking effect between the base element 1 and the pallet 3, the main body 4 is provided with an external edge 19 having foldable sections. In particular, the external edge 19 comprises a first section 37 that can be folded up downwards to block any possible movement of the pallet 3. Specifically, the first section 37 can comprise one or more projections 39 that can be inserted in the space between two consecutive laths 24 of the pallet 3, when the first section is completely folded up. The external edge 19 can also comprise a second section 38 that can be folded up upwards. The second section 38 can comprise recesses and projections 20. These serve to eventually engage with portions of the first protuberances 6 in a configuration where the second section 38 of the external edge 19 can be folded upwards. Once folded and engaged, then it procures a good vertical surface to maintain properly any element placed therebetween, for example a plastic sleeve.

**[0048]** As shown in figures 3A and 3B, the external edge 19 is configured as four flaps at the border of the main body 4. One flap comprises for example one first portion 37 placed at the center and two second portions 38 placed at the side of the central first portion 37. In this case, one section of the external edge 19, i.e. the central section (first section 37) is foldable downwards, whereas two sections of the external edge 19, i.e. the lateral sections (second section 38) are foldable upwards. Another flap can comprise one single component, such as the second section 38. At the corners of the main body 4, the base element 1 also comprises four first vertical recesses 34 in the form of slits. These recesses 34 can advantageously be used to insert reinforcing laths.

**[0049]** Figures 4A and 4B illustrate a supporting structure 23. The supporting structure 23 basically comprises a base element 1 as shown in figures 3A-3C coupled to a pallet 3. The pallet 3 can be a standard flat transport structure made of wood consisting of a plurality of stringers (three or four) supporting several deck-boards (slats 24) on top of which goods are placed. The pallet 3 can also be different from a standard pallet. Advantageously, the pallet 3 can be designed with thinner slats 24 compared to standard pallets thanks to the better weight repartition on all available surface. Figure 4B clearly shows in detail the insertion of the second protuberances 8 of the base element 1 into the spaces between two consecutive slats 24 of the pallet 3. As already mentioned, the external edge 19 of the packaging element 1, i.e. the first section 37, can be folded for example downwards by about 90 degrees so that the base element 1 is prevented from sliding. On the other hand, the second section 38 of the external edge 19 can be folded up in the opposite direction of the first section 37. It is noted that figure 4B shows a detail of the supporting structure 23, wherein the external edge 19 is not illustrated. It is noted that the second protuberances 8 can also be used to engage the base element 1 with an element that is eventually different from the pallet 3, for example a cardboard box or another packaging element.

**[0050]** Figures 5A-5D illustrate the covering element 13 in a perspective top view (Fig. 5A), in a perspective bottom view (Fig. 5B), in a top view (Fig. 5C) and in a lateral view (Fig. 5D). It is noted that the illustrated covering element 13 is a circular covering element 40, meaning that it has a circular external border. The covering element 13 (or 40) is configured to cover the top portion of a water tank 2. As shown in the figures, the covering element 13 comprises a plurality of first protuberances 6 that extend in only one direction, i.e. the direction facing the article 2. In other words, the side of the covering element 13 shown in figure 5A is the side facing the article 2 and the protuberances 6 are arranged around a circular contour (for example in the form of a ring or a crown) to define a concave covering region 26. The concave covering region 26 is configured to fit the top portion of the tank 2. On the top, the covering element 13 comprises a recess 22 for placing tools or accessories. It is noted that the central portion of the covering element 13 can be an empty space (i.e., the

covering element 13 has the form of a ring) or can comprise a curved surface that defines the upper wall of the covering region 26..

**[0051]** Figures 6A-6D illustrate the packaging assembly 12 according to one possible example. The assembly 12 basically comprises a base element 1, a pallet 3 (or a supporting structure 23 comprising the base element 1 coupled to the pallet 3), and a covering element 13 as described in figures 5. The article 2, i.e. the water tank, is protected by placing the base element 1 at the bottom portion 5 of the tank 2 and the covering element 13 at the top portion 14 of the tank 2. The base element 1 is advantageously coupled to the pallet 3 to form the supporting structure 23. This configuration allows to stack several articles in pyramid form in warehouse (only static compression).

**[0052]** Figure 7A illustrates a configuration, wherein four vertical slats 36 are used to improve the stability of the packaging assembly 12 and to improve the protection of the article 2. In this case, the covering element 13 is a squared covering element 41 comprising at the corners, four second vertical recesses 35 in the form of slits. These recesses 35 - similar from the construction point of view to the first vertical recesses 34 of the base element 1 shown in figure 3A - can advantageously be used to insert reinforcing laths. As a matter of fact, the vertical slats 36 are placed between the covering squared element 41 and the base element 1, each end of the slats 36 being inserted in the first vertical recesses 34 of the base element 1 and the second vertical recesses 35 of the covering element 41 respectively. This configuration allows to stack several products in a truck (in addition to static compression, it is also provided a dynamic compression). It is noted that a generic covering element is denoted here with the reference number 13, whereas a specific covering element without vertical recesses 35 (for example circular covering element) is denoted with the reference number 40 and a specific covering element with vertical recesses 35 (for example squared covering element) is denoted with the reference number 41. A part the presence of the second vertical recesses 35, any other technical features (e.g. material, shape, etc.) related to the covering element 40 described in figures 5A-D and 6A-D (and figures 8A-B, 9A-B and 10A) also apply to the covering element 41 described in figures 7A-7B.

**[0053]** To further improve the protection, the packaging assembly 12 further comprises a protective sleeve 21, in particular a cardboard box, that is places around the article 2 (Fig. 7B). It is noted that the vertical slats 36 can serve to give more stability to the protective sleeve 21 at the corners.

**[0054]** Figures 8A and 8B illustrate an additional configuration of the packaging assembly 12. In this case, the assembly 12 furthermore comprises a bottom covering sheet 17, a top covering sheet 18, and a tubular wrapping sheet 16. The bottom covering sheet 17 can be placed between the base element 1 and the bottom of the tank 2, whereas the top covering sheet 18 can be placed between the covering element 13 and the top of the tank 2. The tubular wrapping sheet 16 is then placed all around the tank 2. The tubular wrapping sheet 16 can be a shrinkable sleeve covering at least the base element 1, the article 2, covering element 13, and/or the pallet 3. The tubular wrapping sheet 16 is shrinkable upon warming process and therefore it suits the different part and maintains everything together. Preferably, the shrinkable sleeve can have at least 10% of recycled material, preferably at least 20%, even more preferably at least 50%.

**[0055]** The figures 9A-9C illustrate the packaging assembly 12 for packaging a hot water tank 2. It is noted that the present packaging assembly 12 allows the packaging of not only the tank housing, but also the other components of the device, such as the inlet and outlet pipes for the heat exchanger or for the domestic water.

**[0056]** Figures 10A-10C illustrate the structural characteristics of the first protuberances 6 for supporting the bottom portion of the article 2. It is noted that figure 10B is a detail of figure 10A and figure 10C is a detail of figure 10B. Specifically, the figures illustrates the details of one first protuberance 6 in contact with the article 2. The first protuberance 6 comprises lateral walls 32 forming a deviation angle  $\alpha$  with the first direction  $D_1$ . Advantageously,  $6^\circ < \alpha < 10^\circ$ , in particular  $\alpha = 8^\circ$ .

**[0057]** Figures 11A-11C illustrate the employment of a third packaging element 15 configured as a side element 15 to protect and package the lateral portion 42 of the article 2. The article 2 can be a heat pump water heater, in particular a heat pump comprising a tank. The main body 4 of the side element 15 comprises two first protuberances 6 extending both along the longitudinal direction of the article 2 and form a curved receiving region 11 to accommodate a lateral portion of the article 2. The figures only show a single side element 15. It is however clear that several side elements 15 can be used, for example four, to protect all the lateral portions 42 of the article 2. The side element 15 advantageously serves for example as a backrest to support the article 2 when the article 2 (i.e. tank or water heater) is lying down. Figures 11B and 11C show the presence of a protective sleeve 21, for example a cardboard box as an additional packaging element. It is noted that the side element 15 is placed between the article 2 and the protective sleeve 21 in a manner to stabilize the position of the article 2 during for example a transportation.

**[0058]** The described (first, second, third) packaging elements 1, 13, 15, the supporting structure 23, and the packaging assembly 12, provide a solution suitable for the transport tests defined in ASTM d4169 and therefore ensures a high level of performance that limits the risk of breakage of finished article (dissatisfaction, cost, environmental impact, etc.). In addition, storage solution using element made of molded pulp is more compact than the polystyrene or honeycomb board solutions. As a matter of fact, the parts (the base element 1 the covering element 13 (either the covering element 40 or the covering element 41), and the side element 15 can be packed one inside the other thanks to the shapes/containers and the thin thicknesses compared to the other solutions (generally the minimum thickness of extended polystyrene is 18 mm in comparison to the average thickness of the present elements, which is 4.5 mm). This limits the ecological impact of the

transport of the cushioning part alone and the assembled article (it also allows a more compact packaged product and therefore more product per truck). With a multi cavity molded pulp, it is furthermore possible to pack multi finished articles on one single pallet.

5 Reference Signs

**[0059]**

- |    |    |                                                        |
|----|----|--------------------------------------------------------|
|    | 1  | Base element (first packaging element)                 |
| 10 | 2  | Article (heating device or heating device's component) |
|    | 3  | Pallet                                                 |
|    | 4  | Main body                                              |
|    | 5  | First portion (bottom) of the article                  |
|    | 6  | First protuberances                                    |
| 15 | 7  | First side                                             |
|    | 8  | Second protuberances                                   |
|    | 9  | Second side                                            |
|    | 10 | Contour                                                |
|    | 11 | Receiving region                                       |
| 20 | 12 | Packaging assembly                                     |
|    | 13 | Covering element (second packaging element)            |
|    | 14 | Second portion (top) of the article                    |
|    | 15 | Side element (third packaging element)                 |
|    | 16 | Tubular wrapping sheet                                 |
| 25 | 17 | Bottom covering sheet                                  |
|    | 18 | Top covering sheet                                     |
|    | 19 | External edge                                          |
|    | 20 | Recesses and projections                               |
|    | 21 | Protective sleeve                                      |
| 30 | 22 | Recess                                                 |
|    | 23 | Supporting structure                                   |
|    | 24 | Slat                                                   |
|    | 25 | Top EPS wedge                                          |
|    | 26 | Covering region                                        |
| 35 | 27 | Washer                                                 |
|    | 28 | Screw                                                  |
|    | 29 | Metal foot                                             |
|    | 30 | Bottom EPS wedge                                       |
|    | 31 | Plastic film                                           |
| 40 | 32 | Lateral walls                                          |
|    | 33 | Stiffening ribs                                        |
|    | 34 | First vertical recess                                  |
|    | 35 | Second vertical recess                                 |
|    | 36 | Vertical slat                                          |
| 45 | 37 | First section                                          |
|    | 38 | Second section                                         |
|    | 39 | Projections for pallet                                 |
|    | 40 | Covering element without vertical recesses (circular)  |
|    | 41 | Covering element with vertical recesses (squared)      |
| 50 | 42 | Third portion (lateral) of the article                 |

**Claims**

- 55 1. Packaging element (1, 13, 15) for packaging a heating device or a heating device's component, in particular a tank, wherein the packaging element has a main body (4) configured to surround at least in part a portion (5, 14, 42) of the heating device or of the heating device's component, in particular tank, the main body (4) comprising at least two first protuberances (6) on a first side (7) of the main body (4), wherein the first protuberances (6) extend in a first direction (D<sub>1</sub>) facing the heating device or the heating device's component, in particular tank, and are arranged to form a

receiving region (11) to receive, at least in part, the portion (5, 14, 42) of the heating device or the heating device's component, and wherein the packaging element (1, 13, 15) is made of molded pulp, in particular a molded cardboard pulp.

- 5     **2.** Packaging element (1, 13, 15) according to claim 1, **characterized in that** the portion (5, 14, 42) of the heating device or of the heating device's component, in particular tank, surrounded by the main body (4) is the bottom portion (5) and the packaging element is a base element (1) and is placeable between the heating device or the heating device's component, in particular tank, and a pallet (3) and comprises a plurality of second protuberances on a second side of the main body, the plurality of second protuberances (8) extending in a second direction ( $D_2$ ) opposite to the first direction ( $D_1$ ) and are configured to engage into the pallet (3).  
10
- 3.** Packaging element (1) according to claim 2, **characterized in that** the receiving region (11) has
  - 15     a. a circular area having in particular a diameter comprised between 300 mm and 900 mm or
  - b. a polygonal area..
- 4.** Packaging element (1) according to any one of claims 2 to 3, **characterized in that** the main body (4) comprises an external edge (19) surrounding the receiving region (11).
- 20     **5.** Packaging element (1) according to claim 4, **characterized in that** the external edge (19) comprises at least a first section (37) that is foldable to block the supporting element (1) in a pallet (3).
- 6.** Packaging element (1) according to claim 4 or 5, **characterized in that** the external edge (19) comprises at least a second section (38) that is foldable towards the main body (4) and that comprises recesses and projections (20)  
25     configured to be engageable with a portion of the first protuberances (6).
- 7.** Packaging element (1) according to any one of claims 2 to 6, **characterized in that** the main body (4) has a flat form in the receiving region (11) and a wavy form surrounding the receiving region (11) at the first protuberances (6).
- 30     **8.** Packaging element (1) according to any one of claims 2 to 7, **characterized in that**
  - a. the first protuberances (6) comprise lateral walls (32) forming a deviation angle ( $\alpha$ ) with the first direction ( $D_1$ ) comprised between 6 degrees and 10 degrees, in particular 8 degrees; and/or
  - b. the main body (4) comprises one or more stiffening ribs (33) arranged between two consecutive first protuberances (6); and/or  
35     c. the main body (4) comprises one or more first vertical recesses (34).
- 9.** Packaging element (1, 13, 15) according to claim 1, **characterized in that** the portion (5, 14, 42) of the heating device or of the heating device's component, in particular tank, surrounded by the main body (4) is the upper portion (14) of the heating device or of the heating device's component, in particular tank, and the packaging element is a covering element (13), wherein:  
40
  - a. the covering element (13) has a structure such that the first protuberances (6) facing the heating device or of the heating device's component, in particular tank, are arranged to surround at least in part said upper portion (14); and/or
  - 45     b. the covering element (13) comprises a recess (22) for placing tools or accessories; and/or
  - c. the covering element (13) comprises one or more second vertical recesses (35).
- 50     **10.** Packaging element (1, 13, 15) according to claim 1, **characterized in that** the portion (5, 14, 42) of the heating device or of the heating device's component, in particular tank, surrounded by the main body (4) is the lateral portion (42) of the heating device or of the heating device's component and the packaging element is a side element (15), wherein the first protuberances (6) extends along a longitudinal direction of the heating device or of the heating device's component, in particular tank.
- 55     **11.** Packaging element (1, 13, 15) according to any one of claims 1 to 10, **characterized in that** the packaging element (1, 13, 15) has an average thickness of at least 4 mm, in particular of at least 4.5 mm.
- 12.** Supporting structure (23) for supporting and packaging the base of a heating device or of a heating device's

component, in particular tank, the supporting structure (23) comprising:

the base element (1) according to any one of claims 2 to 8, and  
a pallet (3), in particular made of wood, having a plurality of slats (24) distanced one from the other,  
wherein the base element (1) is engaged into the pallet (3).

**13.** Packaging assembly (12) for supporting and packaging a heating device or of a heating device's component, in particular tank, the packaging assembly (12) comprising:

the base element (1) according to any one of claims 2 to 8 or the supporting structure (23) according to claim 12  
and  
the covering element (13) according to claim 9 and/or  
at least a side element (15) according to claim 10.

**14.** Packaging assembly (12) according to claim 13, **characterized in that**

a. the packaging assembly (12) further comprises a tubular wrapping sheet (16) surrounding the heating device or the heating device's component, in particular tank and placeable between the base element (1) and the covering element (13), the tubular wrapping sheet (16) shrinking in the direction from the base element (1) to the covering element (13) and/or enclosing the heating device or the heating device's component, in particular tank, and/or  
b. the packaging assembly (12) comprises at least one vertical slat (36) that is placed between the base element (1) and the covering element (13) and coupled with the base element (1) and the covering element (13).

**15.** Packaging assembly (12) according to any one of claims 13 to 14, **characterized in that** the packaging assembly (12) further comprises a bottom covering sheet (17) placeable between the base element (1) and the heating device or the heating device's component, in particular tank, and a top covering sheet (18) placeable between the covering element (13) and the heating device or the heating device's component, in particular tank.

**16.** Method for supporting and packaging a heating device or a heating device's component, in particular tank, the method comprising:

providing a base element (1) according to any one of claims 2 to 8;  
providing a pallet (3) and engaging the base element (1) into the pallet (3);  
placing the heating device or the heating device's component, in particular tank, such that the bottom portion (5) of the heating device or of the heating device's component, in particular tank, is placed in the receiving region (11) of the base element (1) and providing a covering element (13) according to claim 9 and placing said covering element (13) on the top portion (14) of the heating device or of the heating device's component, in particular tank;  
and/or  
providing at least a side element (15) according to claim 10 and placing said side element (15) on the lateral portion (42) of the heating device or of the heating device's component in particular tank.

**17.** Method according to claim 16, **characterized in that** the main body (4) of the base element (1) comprises an external edge (19) surrounding the receiving region (11), the external edge (19) being foldable, the method comprising folding the external edge (19) such that at least a first section (37) of the external edge (19) is blocked in the pallet (3).

**18.** Use of the packaging element (1, 13, 15) according to any one of claims 1 to 11, of the supporting structure according to claim 12, or of the packaging assembly (12) according to any one of claims 13 to 15 for supporting and packaging a heating device, in particular a heat pump, a boiler, a heat pump water heater, an electrical water heater, or a heating device's component, in particular a tank, preferably a domestic hot water preparation tank or a buffer tank.

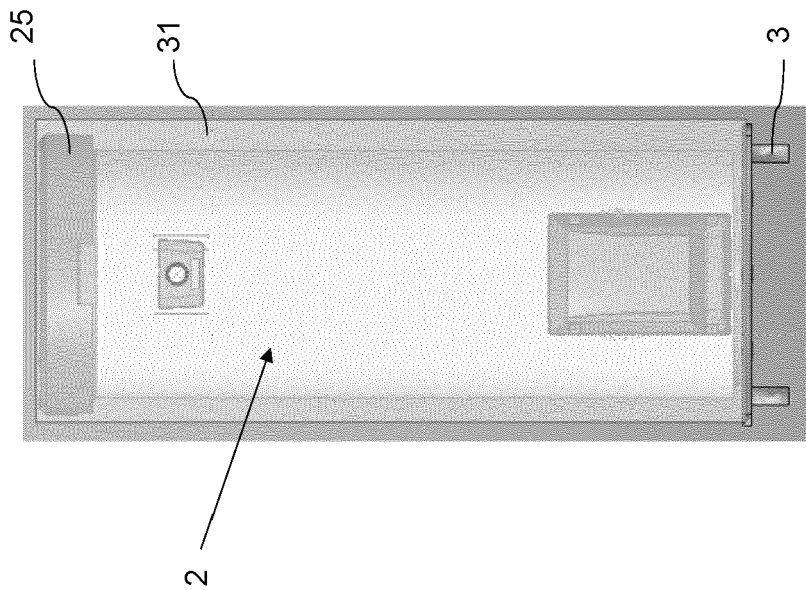


FIG. 1B (prior art)

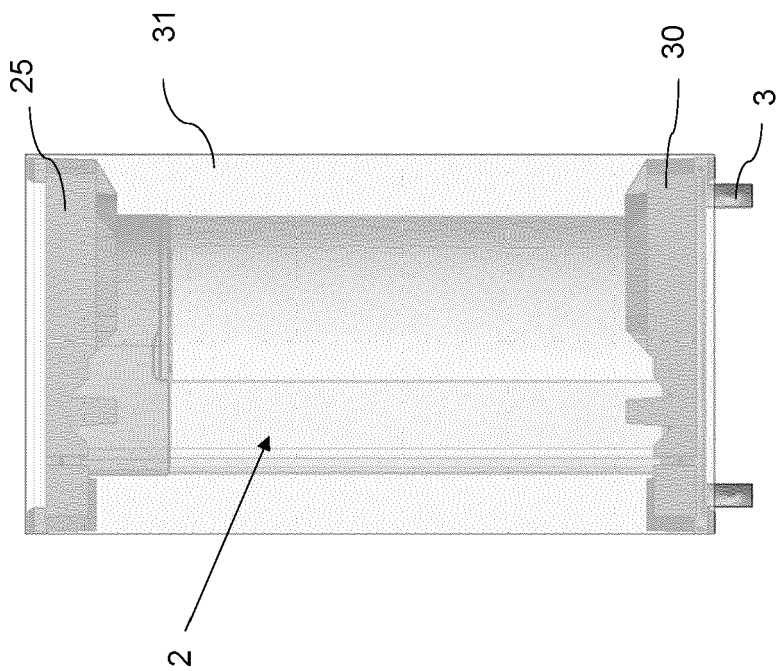


FIG. 1A (prior art)

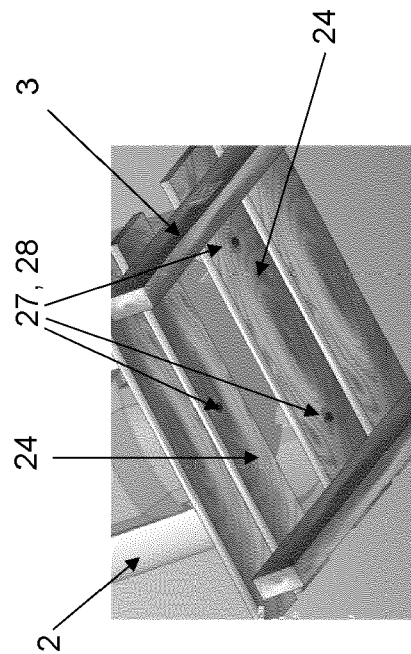


FIG. 2A (prior art)

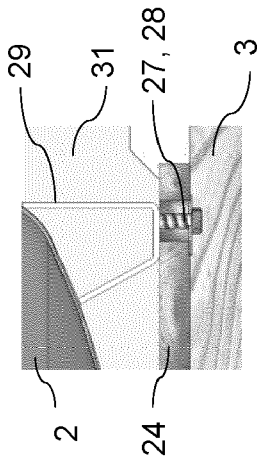


FIG. 2B (prior art)

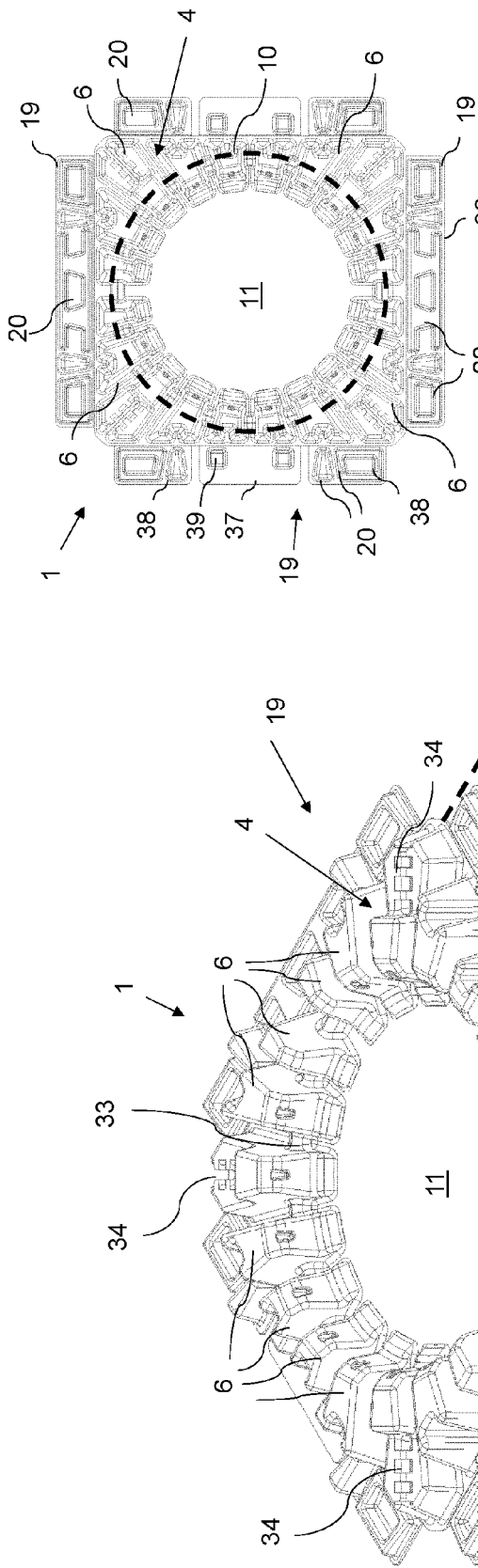


FIG. 3B

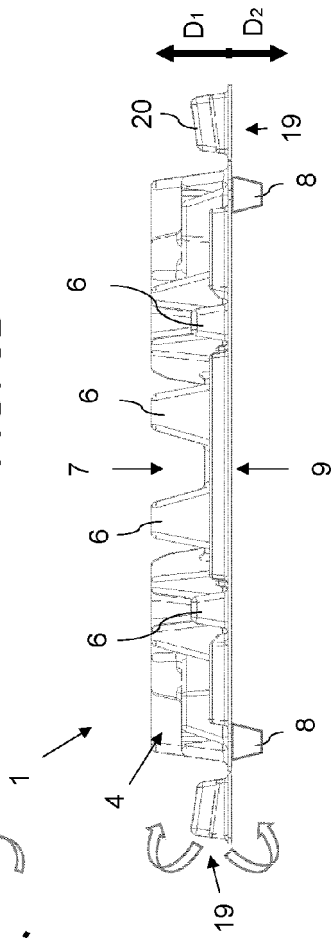
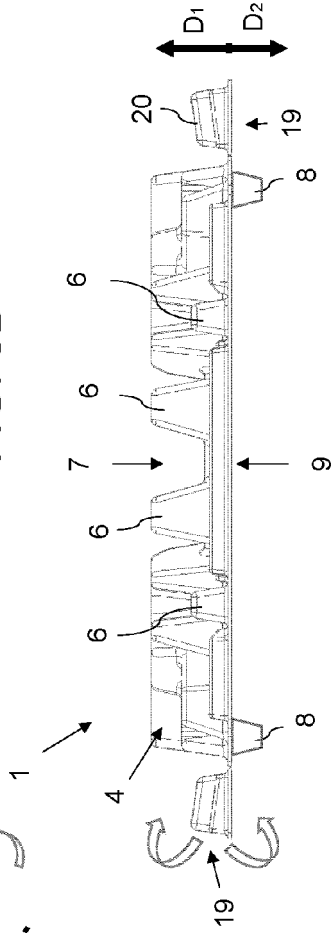


FIG. 3C



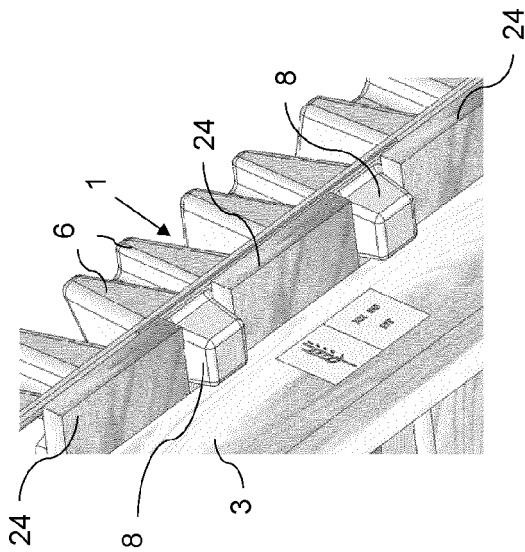


FIG. 4B

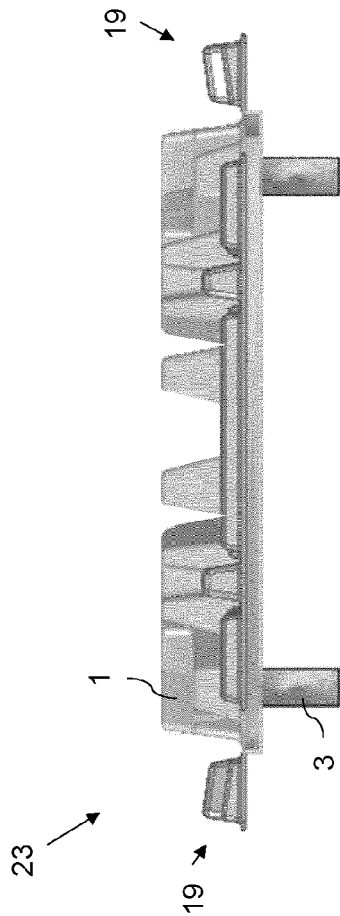


FIG. 4A

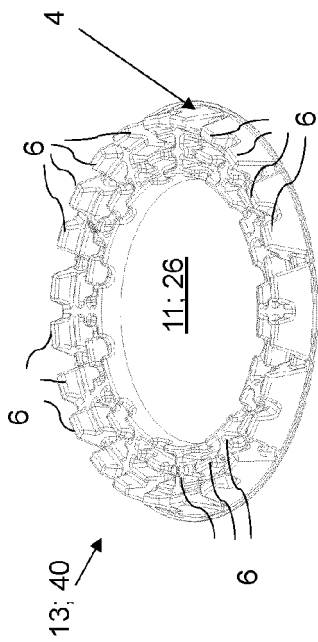


FIG. 5A

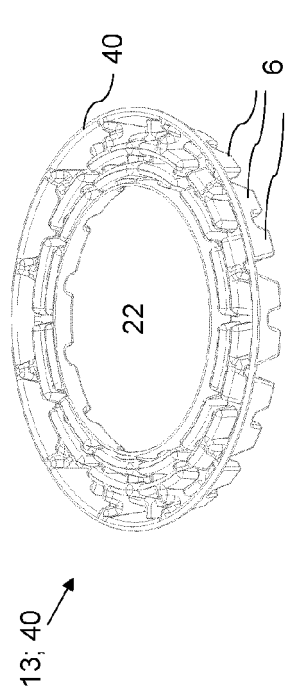


FIG. 5B

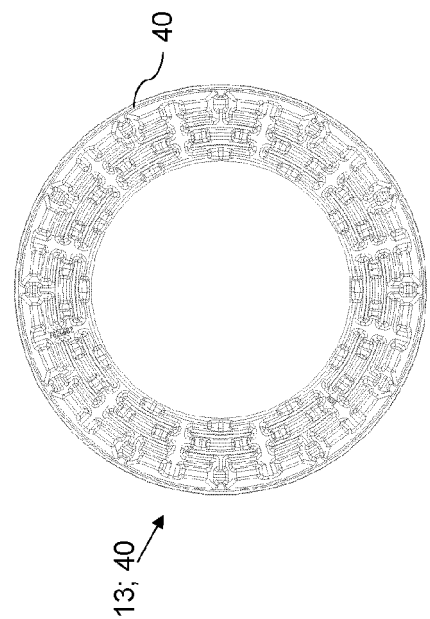


FIG. 5C

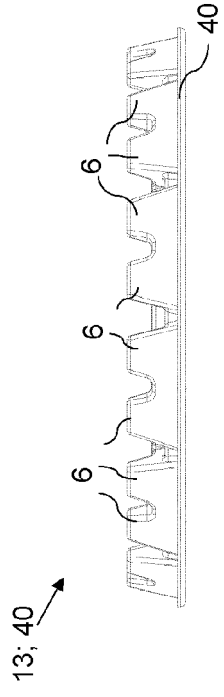


FIG. 5D

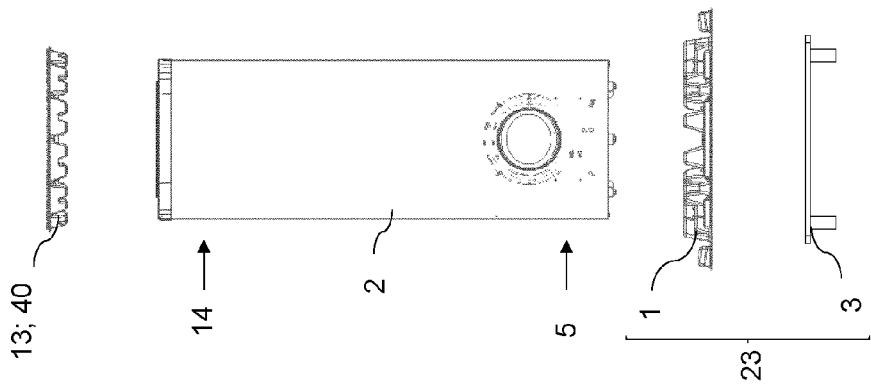


FIG. 6A

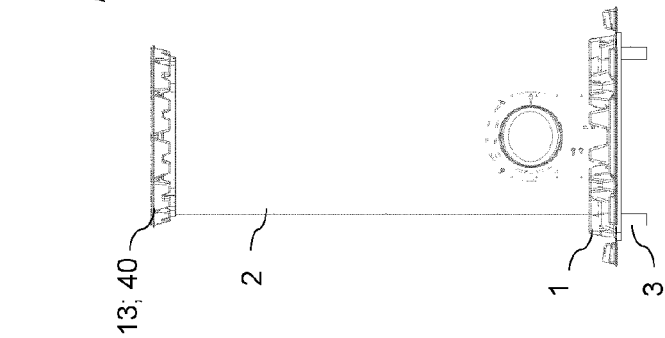


FIG. 6B

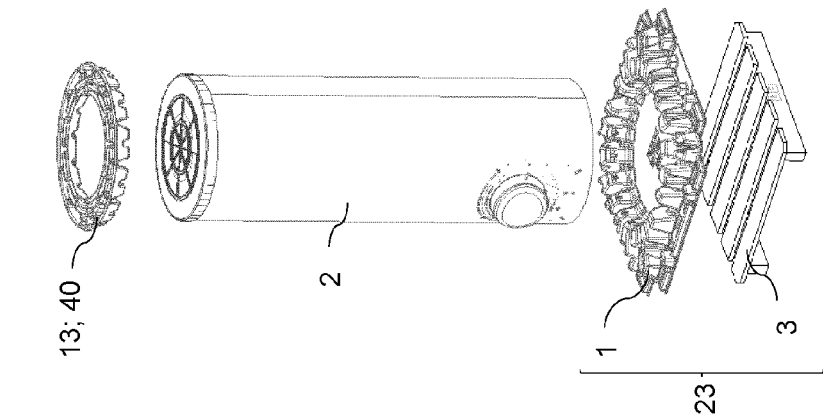


FIG. 6C

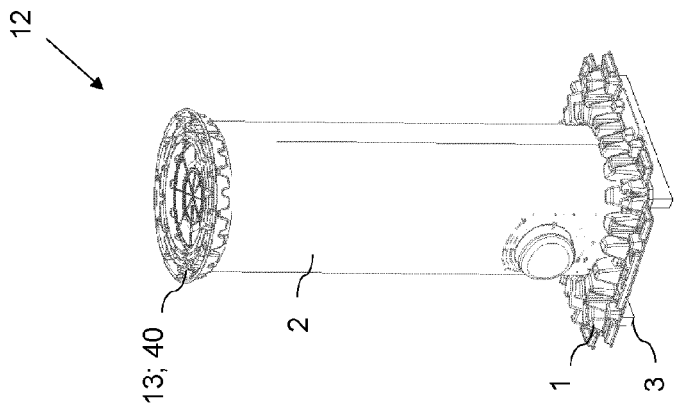


FIG. 6D

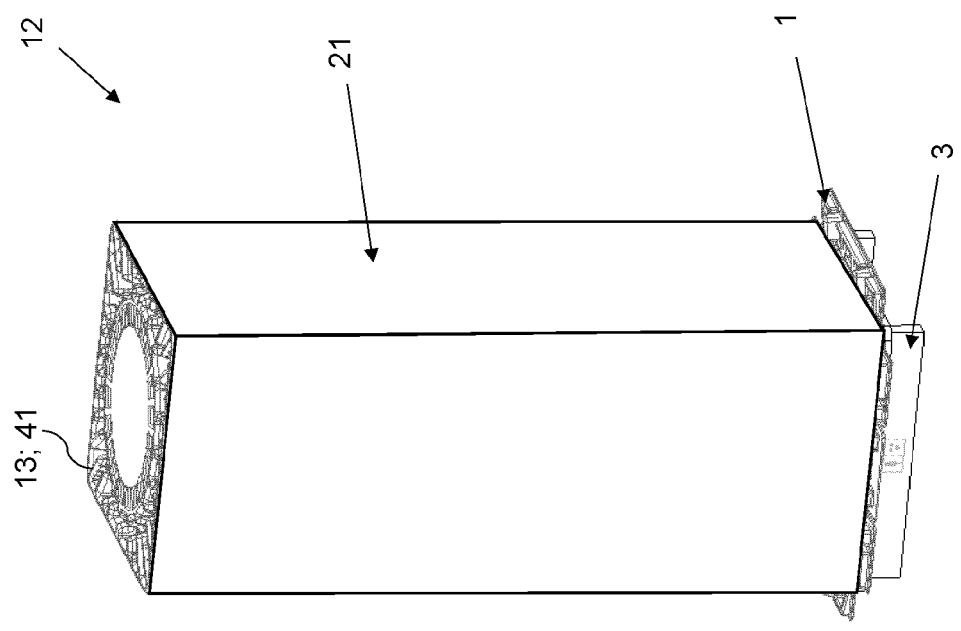


FIG. 7B

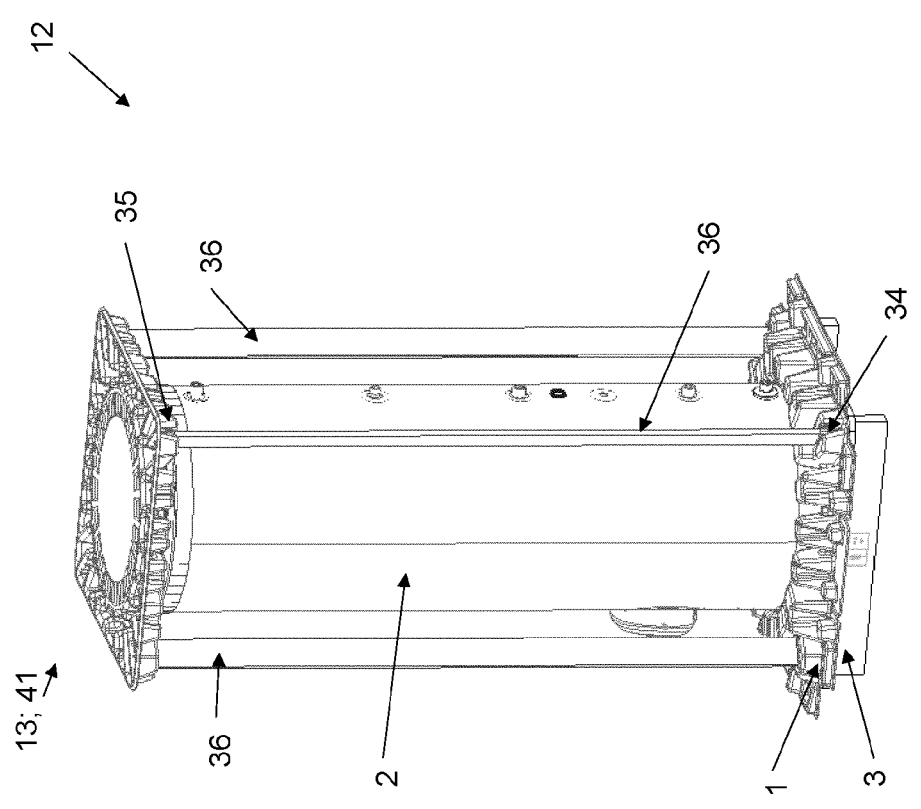


FIG. 7A

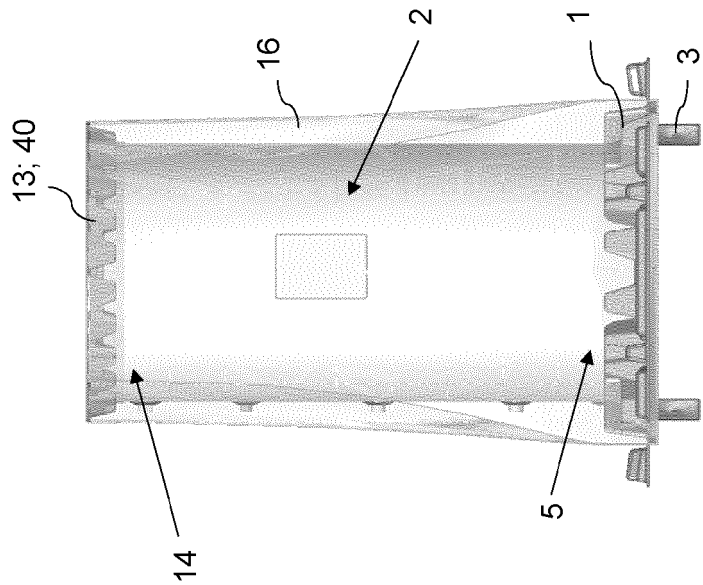


FIG. 8B

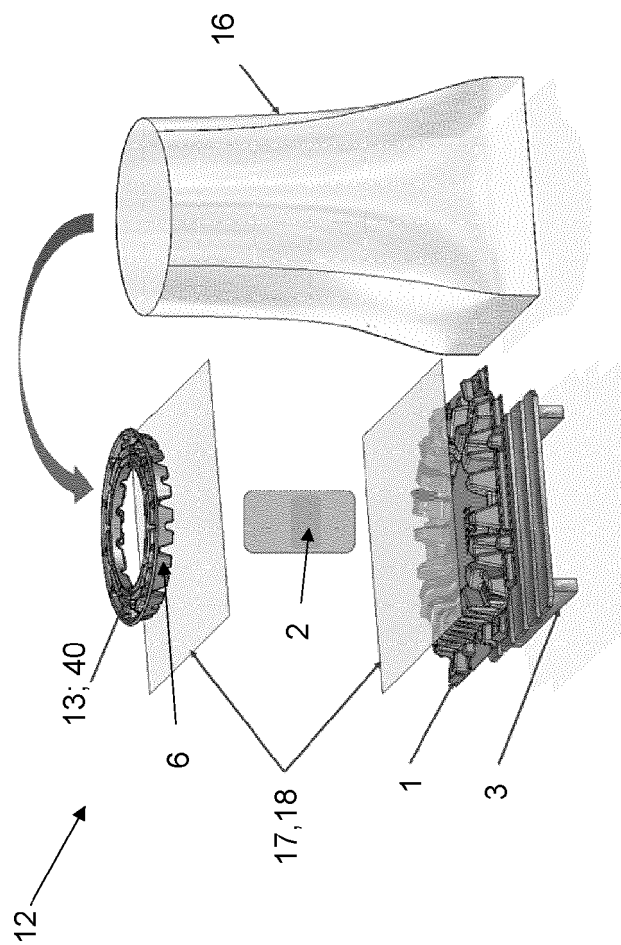


FIG. 8A

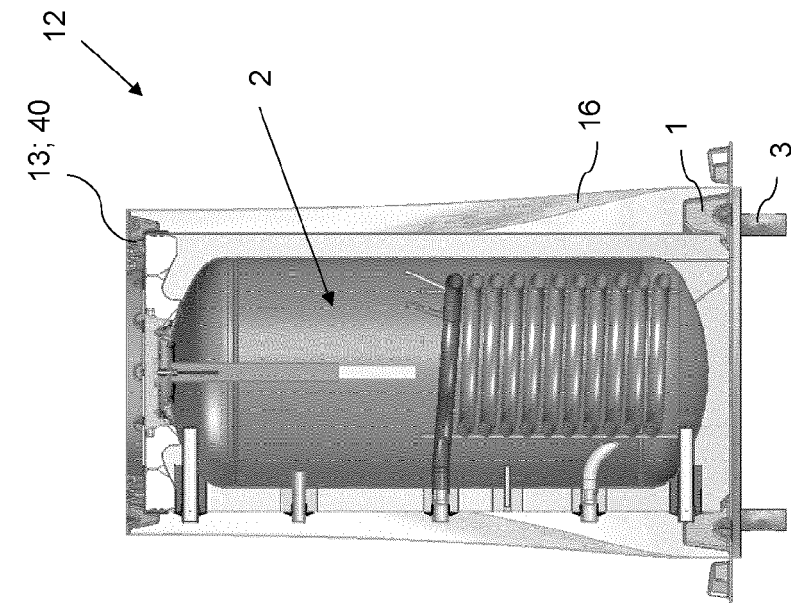


FIG. 9A

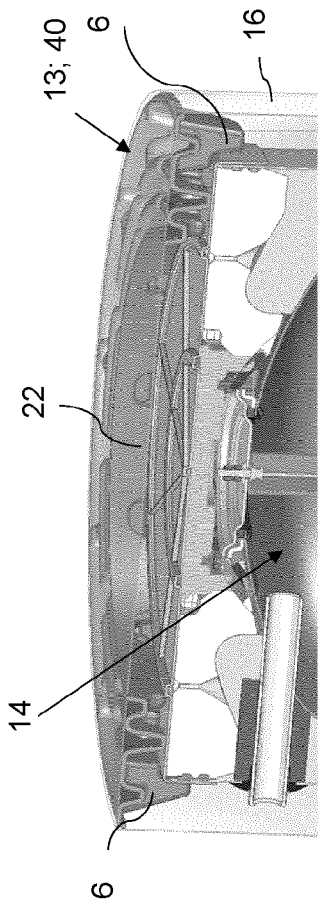


FIG. 9B

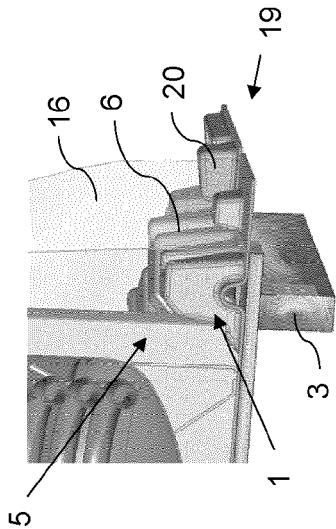


FIG. 9C

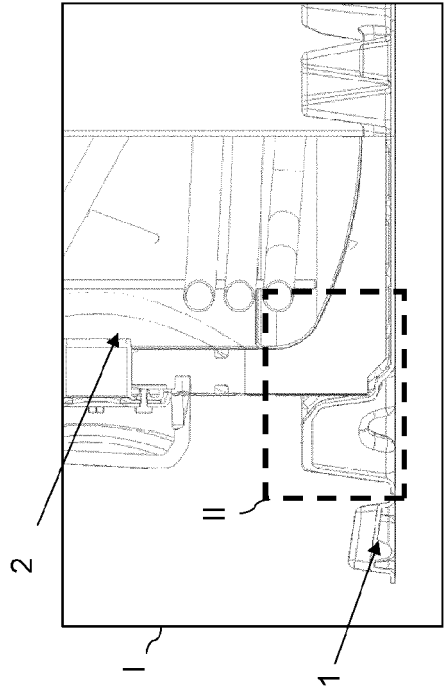


FIG. 10B

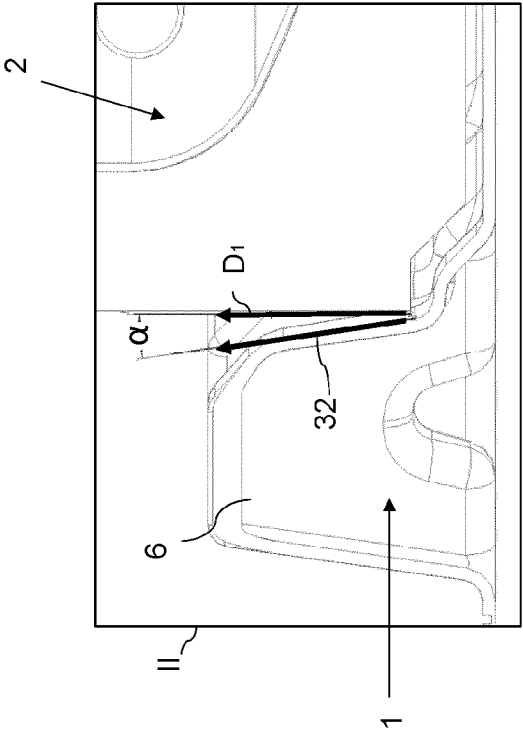


FIG. 10C

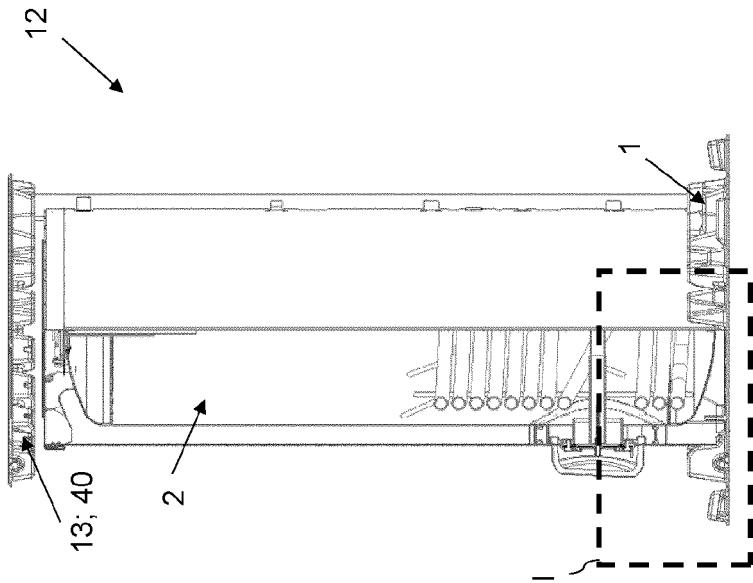
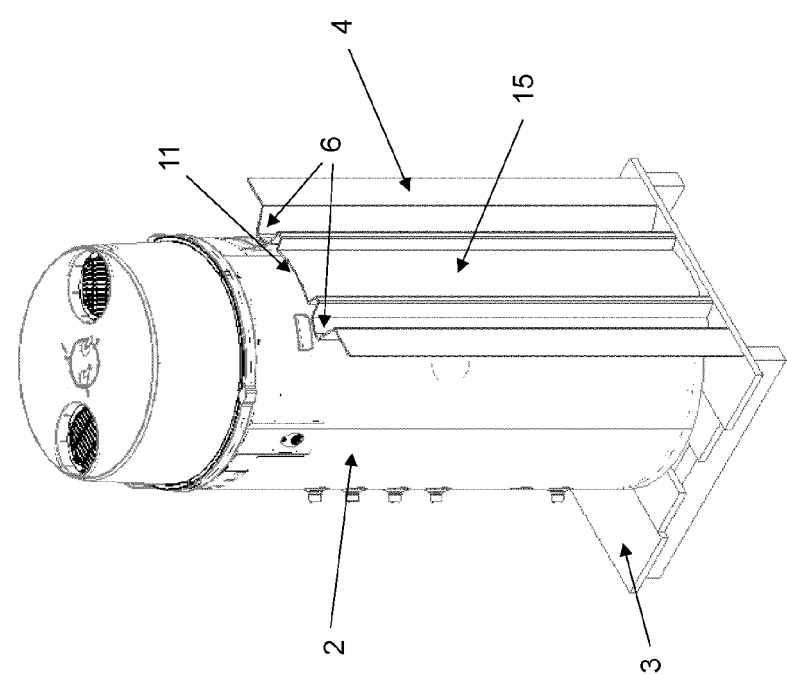
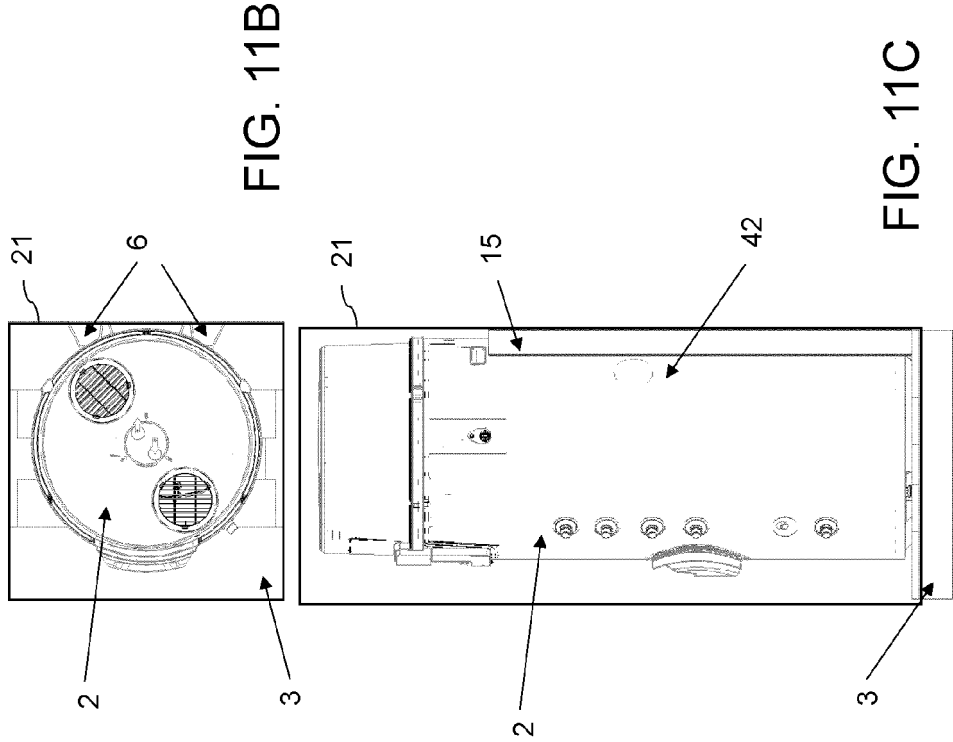


FIG. 10A





## EUROPEAN SEARCH REPORT

Application Number

EP 23 17 5556

## 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                                                                                                                                                                                                                                                                            | US 2023/057585 A1 (PALEY MARCUS DE'SHUNE [US]) 23 February 2023 (2023-02-23)                             | 1, 3, 4, 7-11, 13, 14, 18        | INV.<br>B65D81/133<br>B65D19/44<br>B65D81/05 |
| Y                                                                                                                                                                                                                                                                            | * paragraphs [0035], [0043]; figures 4L-4N, 6A-6D *                                                      | 2, 12, 16                        |                                              |
| Y                                                                                                                                                                                                                                                                            | US 2021/078781 A1 (SPADAVECCHIA JOHN [US] ET AL) 18 March 2021 (2021-03-18)<br>* figures 15-17 *         | 2, 12, 16                        |                                              |
| A                                                                                                                                                                                                                                                                            | EP 4 053 043 A1 (BUHL PAPERFORM GMBH [DE]) 7 September 2022 (2022-09-07)<br>* figure 1 *                 | 1                                |                                              |
| A                                                                                                                                                                                                                                                                            | US 2019/193910 A1 (ZHANG ZI-YAO [CN] ET AL) 27 June 2019 (2019-06-27)<br>* paragraph [0025]; figure 1b * | 8                                |                                              |
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