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Battery container.

(57)

A battery container having at least one compartment suitable for receiving one or more cell elements or plate packs. The at least one compartment has a pair of opposing sidewalls and at least one guide or rib arranged on a surface of at least one of the sidewalls. Each guide or rib extends from a respective sidewall and defines at least one curved portion. A floor extends between a lower end of the sidewalls. At least a portion of a lower end or edge of each guide or rib does not extend the planar floor

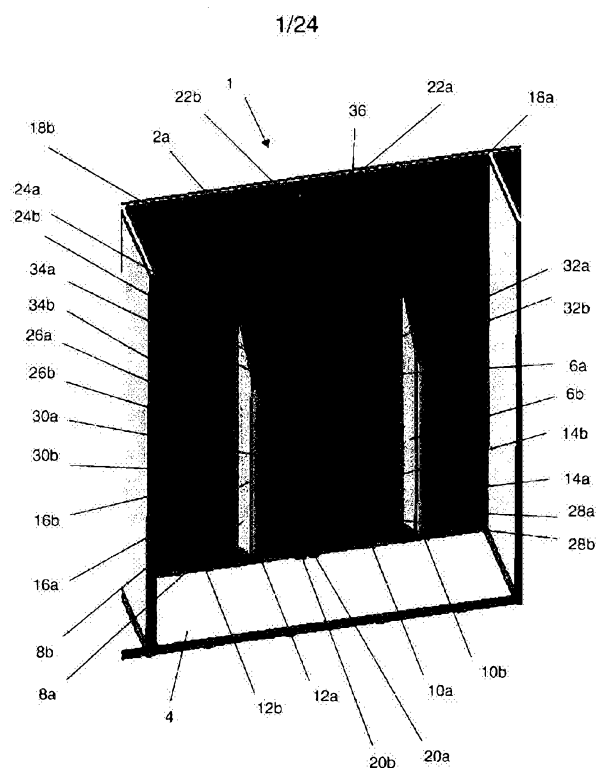


Figure 1

BATTERY CONTAINER

FIELD OF INVENTION

The present invention relates to a battery container suitable for accumulator
5 batteries.

BACKGROUND OF INVENTION

Batteries, such as accumulator batteries, are known to comprise a plurality of
plates arranged to form at least one cell, and wherein the plurality of plates is contained
10 within a container. The plurality of plates are typically organized within the container in
an aligned and stacked or consecutive arrangement, and with adjacent plates
separated by a separator. The plates may be submersed in an electrolytic liquid or gel
within the container.

For example, such an arrangement may typically be used to form a lead-acid
15 battery. Such batteries may be used in a range of environments and industries. A
common use for such battery is as a component for an automotive vehicle. Other
possible applications include industrial accumulator batteries as a temporary or
permanent alternative to electrical generators.

Within an automotive application, batteries may be subject to extreme
20 environmental conditions and charge cycles. Batteries may be subject to vibrations or
other mechanical stresses, extremes of temperature and/or exposure to water, dirt or
other chemicals such as abrasive fluids or chemicals. Batteries may also be subject to
automotive life-cycles, which may span daily use over a period of several years.

As such, the containers are designed to be robust. The manufacturing process
25 of such batteries requires assembly and/or insertion of the plurality of plates into the
container. The plates may be fragile and/or malleable, relative to the container and, as
such, may be prone to damage during the manufacturing process or during use in one
of the aforementioned applications.

Containers, or packing/wrapping elements of the cell elements or plate packs
30 generally comprise features or components suitable for holding the plates in a fixed
position within the container, in use, to minimize the likelihood of damage to either the
plates or the container. Such features must, however, also permit efficient assembly of
a battery system.

Some of the abovementioned problems are exhibited in the invention described
35 in US Patent No 7,816,028 B2 (Cesare Rivetta, Inzago), wherein an accumulator

battery container is constituted by a box-like structure that comprises internally at least one containment cell for at least one plate and adaptable guides provided for inserting and fixing in position the at least one plate.

It is an object of at least one embodiment of at least one aspect of the present invention to seek to address one or more problems and/or disadvantages of the prior art.

SUMMARY OF INVENTION

According to a first aspect of the present invention, there is provided a battery container having at least one compartment suitable for receiving one or more cell elements or plate packs, wherein the at least one compartment has a pair of opposing sidewalls and at least one guide or rib arranged on a surface of at least one of the sidewalls, wherein the at least one guide or rib extends from a respective sidewall and defines at least one curved portion.

A surface of the at least one of the sidewalls may comprise or may be provided with at least two ribs, e.g. a pair of ribs

Advantageously, each guide or rib has at least one curved portion in a direction extending from a respective sidewall to a distalmost region or edge of each guide or rib. That is, when viewed along an axis that extends orthogonal to a substantially planar floor, each guide or rib has at least one curved portion in a direction extending from a respective sidewall to a distalmost region or edge of each rib.

Without wishing to be bound by theory, it is believed that the provision of a pair of ribs which extend from a respective sidewall and define at least one curved portion offers improved mechanical properties to the guides or ribs, in use, particularly when the guides or ribs are flexed and/or subjected to stress. In particular, the curved portions may allow the guides or ribs to deform under stress over an increased area of the guides or ribs, thus reducing the force applied on a specific location of the guides or ribs, and/or reducing the likelihood of failure of the ribs. Further, in use, the provision of a curved portion, e.g. at a distalmost edge of the guides or ribs relative to a respective wall, may help minimise the risk of damage to one or more cell elements contacting the ribs.

Hereinafter, the terms "guide" and "guides" are used in reference to "guide or rib" and "guides or ribs" respectively.

Hereinafter, the term "cell elements" is used in reference to "cell elements or plate packs".

The use of the terms "lower" and "upper" are intended to indicate general positions of features of the battery container for example relative to a bottom/floor portion thereof or relative to a top portion thereof, as would be interpreted by one of skill in the art, and are not intended to be limiting in a strict geometric sense. For example, depending upon the position of the battery container, an upper portion may be below a lower portion.

Typically, the at least one compartment may have a floor which may extend between a lower end of the sidewalls. In one embodiment, the floor may be substantially planar and/or continuous/solid. At least a portion of a lower end or edge of each guide or rib may not extend the planar floor.

Typically, each guide extends in a direction orthogonal to the floor.

The floor may be connected to or may extend to a lower edge of each of the opposite sidewalls of the at least one compartment.

The guides may be attached to, connected to or fixed to a respective sidewall. The guides may be detachably attached to, connected to or fixed to a respective sidewall by mechanical means such as screws, rivets, interference connections, push fits, clips or the like. The guides may be permanently attached to, connected to or fixed to a respective sidewall by chemical means such as an adhesive or glue, or by fusion of the guides with a respective sidewall. The guides may be formed unitary with a respective sidewall during manufacture of the container, for example by injection moulding.

The at least one compartment may comprise a plurality of pairs of guides. Advantageously, the at least one compartment may have two pairs of guides, one pair of guides being located on a respective sidewall and the other pair of guides being located on an opposing sidewall. By such provision, in use, a battery unit may be placed within the at least one compartment and may be held in place between both pairs of guides.

The at least one compartment may comprise a plurality of guides or ribs. At least one guide or rib may be located on a respective sidewall and the other at least one guide or rib may be located on an opposing sidewall.

In some embodiments, the at least one compartment may have one or more pairs of guides on one or more sidewalls, e.g. on each of two opposite sidewalls. The sidewalls may collectively define an inner surface of the at least one compartment. A container or compartment may comprise four sidewalls. The surface of one of the four sidewalls may form an inner surface of the at least one compartment. The sidewalls

may be substantially planar. The sidewalls may be arranged at right angles to one another, such that the container is substantially square or rectangular when viewed in a plan view from above. The container may form a substantially cuboid shape. An exterior surface of the container may comprise additional fixings, flanges, ribs, rims and/or attachments. The external shape of the container may be standardized. That is, the external shape may be arranged, configured or adapted to conform to a standard, such as an industry standard or common or generally accepted standard. The external shape of the container may be configured or optimized for stacking and/or packing of a plurality of containers together and/or in close proximity. The battery container may further comprise at least one partition arranged to partition the battery container into at least two compartments. The partition may form an inner surface or sidewall of the at least two compartments. The battery container may further comprise one or a plurality of partitions. The battery container may comprise a plurality of partitions arranged such that battery container comprises six compartments. The at least one partition may be formed as part of the container, or the at least one partition may be a separate component that, in use, is attached, affixed and/or located within the container.

The container may be at least partially constructed from a material comprising at least one of: a polymeric material; a plastics material; and/or a composite material. The material may be selected to withstand mechanical stresses, such as impacts, vibrations, internal pressures or the likes. The material may be selected to withstand exposure to fluids, such as water or other chemicals such as abrasive fluids or oils. The material may be a thermoplastic, or a thermosetting plastic. The material may be chemically inert.

The container may comprise at least one further rib. The at least one further rib may be located on at least one sidewall of the container. The at least one further rib may be located on at least one partition. The at least one further rib may be located between each guide of a pair of guides. The at least one further rib may be located between two pairs of guides. A plurality of further ribs may be located at intervals along at least one of the four sidewalls. At least two further ribs may be arranged in pairs. A plurality of pairs of further ribs may be located at intervals along at least one of the four sidewalls. The at least one further rib may be arranged to protrude from and/or extend from the inner surface. The at least one further rib may extend in a direction orthogonal to the planar floor. A lower end of the at least one further rib may extend to the planar floor. An upper end of the at least one further rib may not extend to an upper edge of the container or of the inner surface. An upper end of the at least one further rib may

be tapered, curved or chamfered. An upper end of the at least one further rib may taper or curve inwards towards the inner surface.

At least a pair of further ribs may be arranged to accommodate an element to be integrated into the battery container for the purposes of stabilizing at least one battery or cell, or a plurality of plates, positioned within the container.

Each guide, e.g. each guide of a pair of guides, may be adapted to flex or undergo elastic deformation upon insertion of at least one cell element and/or plate and/or cell into the container.

At least a portion of a lower end or edge of each guide may not extend to the planar floor

Each guide may be arranged to protrude from and/or extend from the inner surface. At least one guide may be arranged to protrude from and/or extend from the inner surface at an angle of between 90 degrees and 45 degrees from the surface e.g. at the point of contact/connection between the guide(s) and the inner surface. At least one guide may be arranged to protrude from and/or extend from the inner surface at an angle of between 80 degrees and 60 degrees from the surface. Beneficially, such an arrangement serves to direct a general direction of deformation each guide.

In use, each guide of a pair of guides may be adapted to flex or undergo elastic deformation in a direction opposite to the direction of flexing or elastic deformation of the other of the pair of guides. Each guide of the pair of guides may be adapted to curve away from the other guide of the pair of guides. Such an arrangement also prevents one guide of the pair of guides from coming into contact with the other guide of the pair of guides. Additionally, as the guides flex or deform upon insertion of a cell element or the likes, into the container, the points of contact between the pair of guides and the battery or the likes tend away from one another. Such an arrangement decreases the likelihood that a cell element with a substantially planar surface may not remain parallel to the inner surface.

Alternatively, or additionally, each guide of a pair of guides may be adapted to curve towards the other guide of the pair of guides. As such, each pair of guides may be adapted such that, as the guides flex or deform upon insertion of a cell element or the likes, the points of contact between the pair of guides and the battery tend towards one another.

A straight edge of each guide may be a base of each guide, and may adjoin the inner surface or sidewall. The straight edge of each guide may be the longest straight edge of each guide of the pair of guides.

Each guide may be substantially thicker at the base than at a distalmost edge e.g. relative to a/the inner surface. As such, a position of a primary point of flexing or deformation of the/a guide may be selected to be toward a distalmost edge and/or away from the base of the guide. Alternatively, or additionally, the thickness of each guide may be varied such that a degree of flexing or deformation of each is distributed across a length of the guide in a defined and predetermined manner, for example, uniformly.

An upper end of each guide may be tapered, curved or chamfered. An upper end of each guide may taper, slope or curve inwards towards the inner surface. An upper end of each guide may be adapted to not extend to an upper edge of the container or of the inner surface. Such an arrangement eases the positioning of a cell element, or the likes, into the container, and serves to guide the cell element or the likes towards a desired location within the container during insertion of the batter or the likes into the container.

Each container may comprise a ridge associated with each guide. Each ridge may extend from the planar floor to the portion of the lower end or edge of each guide that does not extend the planar floor. Such ridges may provide structural integrity and/or serve to stiffen each guide. Advantageously, such an arrangement may result in a force applied to each guides, for example a force exerted upon each guide by insertion of a cell element or the likes into the battery container, being more evenly distributed in the sidewalls of the container. Further, such a force may also be guided towards the floor of the container. Thus the force may be distributed over a larger area than if the ridges were not present.

The at least one curved portion may be arranged at the distalmost edge of each guide. The at least one curved portion may be arranged at a base of each guide. The at least one curved portion may be arranged at a point between the base and the distalmost edge of each guide. Each guide may comprise a plurality of curved portions arranged at at least one of: a distalmost edge of each guide; a base of each guide; and a point between the base and a distalmost edge of each guide. The at least one curved portion may be curved to an extent that an angular change in a direction of extension of each guide from the inner surface is between 30 and 120 degrees. The at least one curved portion may be curved to an extent that an angular change in a direction of extension of each guide from the inner surface is between 50 and 90 degrees.

Beneficially, the provision of at least one curved portion on each guide and/or a lower edge of each guide that does not extend to the planar floor may result in a guide

that is more flexible and exhibits a greater degree or amount of flexing and/or deformation than a comparable guide without at least one curved portion over a defined ranges of applied forces. For example, when subjected to forces of up to approximately 300 to 500N, two pairs of guides with the at least one curved portion on each guide may deform by approximately 2 to 8mm. A comparable arrangement of guides without the at least one curved portion and/or wherein a lower edge of each guide of each pair of guides does extend to the planar floor may require application of forces in the region of 300 to 600N to deform by approximately 2 to 8mm.

Further, the provision of at least one curved portion on each guide may permit a greater degree or amount of flexing and/or deformation of each in response to a defined range of applied forces due to insertion of a cell element or the likes into the container. For example, a force required to deform two pairs of guides by approximately 10mm may be in the region of 2000N. A comparable arrangement of guides without the at least one curved portion and/or wherein a lower edge of each guide of each pair of guides does extend to the planar floor may require application of considerably greater forces, such as forces in excess of 5000N, to achieve a similar degree of deformation. As such, the provision of at least one curved portion on each guide of the pair of guides permits a tighter packing of plates, cell element(s) or the likes into the container, without requiring undue forces to be applied.

As such, an active damping function of the guides may be improved, especially when installing large cell elements that generate a high compression rate of the guides.

Each guide may comprise at least one substantially straight portion.

A guide may be arranged symmetrically along an axis which is orthogonal to the planar floor relative to another guide, For example one guide of the/a pair of guides may be arranged symmetrically with the other guide of the pair of guides along an axis which is orthogonal to the planar floor. One guide of the pair of guides may be arranged asymmetrically with the other guide of the pair of guides along an axis which is orthogonal to the planar floor. Each guide of the pair of guides may be arranged to extend or curve away from the other guide of the pair of guides. Each guide of the pair of guides may be arranged to extend or curve towards the other guide of the pair of guides.

A lower edge of each guide may not extend to the planar floor. Beneficially, such an arrangement permits a greater degree of flexibility of a lower portion in the vicinity of the lower edge of each guide than if the lower edge of each guide extends, and is attached, to the planar floor. Further, such an arrangement makes is easier to

implement a guide exhibiting a relatively uniform degree of flexibility towards a lower edge of the guide.

5 A guide may be arranged to be opposite another guide within the at least one compartment. A pair of guides may be arranged to be opposite another pair of guides within the at least one compartment. A plurality of pairs of guides may be arranged on the inner surface.

10 According to a second aspect of the present invention, there is provided a battery container having at least one compartment suitable for receiving one or more cell elements, wherein the at least one compartment has a pair of opposing sidewalls, a floor which extends between a lower end of the sidewalls, and at least one guide or rib arranged on a surface of one of the sidewalls, wherein at least a portion of a lower end or edge of the at least one guide or rib does not extend the planar floor.

15 Advantageously, such an arrangement allows the at least one guide or rib to deform, e.g. elastically deform, such that the deformation is substantially uniform along a full length of the guide. Further, such an arrangement may result in a guide that is more flexible and exhibits a greater degree or amount of flexing and/or deformation than a guide wherein all of the lower end or edge extends to and/or is attached to the planar floor. Beneficially, the provision of at least one guide or rib arranged such that at
20 least a portion of a lower end or edge of each guide or rib does not extend the planar floor permits a tighter packing of plates, cell element(s) or the likes into the container, without requiring undue forces to be applied.

Each guide or rib may extend from a respective sidewall and define at least one curved portion. Each guide or rib may have at least one curved portion in a direction
25 extending from a respective sidewall to a distalmost region or edge of each rib.

According to a third aspect of the present invention, there is provided a method of constructing a battery container according to the first or second aspects, the method comprising forming the battery container within or over a mould.

30 The container may be manufactured as a monolithic structure. The manufacturing method may comprise at least one of: injection moulding; printing; casting; vacuum forming; blow moulding; or rotational moulding.

BRIEF DESCRIPTION OF DRAWINGS

These and other aspects will now be described, by way of example only, with reference to the accompanying drawings, which:

- 5 **Figure 1** an isometric view of a portion of a battery container according to a first embodiment of the present invention;
- Figure 2** a further isometric view of another portion of the embodiment shown in figure 1;
- Figure 3** a plan view of the embodiment shown in figure 2;
- Figure 4** a cross-sectional view of the battery container of figure 2;
- 10 **Figure 5** a partial cut-away view of the battery container of figure 2, viewed from an end of the container;
- Figure 6** a perspective view of the rear of the living accommodation of the embodiment shown in figure 2;
- Figure 7** a further plan view of the embodiment shown in figure 2;
- 15 **Figure 8** a magnified portion of the further plan view of figure 7;
- Figure 9** a cross-sectional view of the first embodiment of the present invention, with plates inserted;
- Figure 10** a cross-sectional view of the first embodiment of the present invention, with plates partially inserted;
- 20 **Figure 11** a further cross-sectional view of the first embodiment of the present invention, with plates partially inserted;
- Figure 12** a cross-sectional view of the first embodiment of the present invention, with plates inserted and the guides deformed;
- Figure 13** a cross-sectional view of an embodiment of the present invention, with plates partially inserted and the guides deformed;
- 25 **Figure 14** a further cross-sectional view of an embodiment of the present invention, with plates partially inserted and the guides deformed;
- Figure 15** a plan view of the first embodiment of the present invention, with plates inserted;
- 30 **Figure 16** a plan view of the first embodiment of the present invention, with plates inserted and the guides deformed;
- Figure 17** a photo of the process of compression testing the guides according to an exemplary embodiment of the present invention;
- 35 **Figure 18** data resultant from the compression test shown in the photo of Figure 17;

Figure 19 an isometric view of a portion of a battery container according to another embodiment of the present invention;

Figure 20 a plan view of the embodiment shown in figure 19;

Figure 21 an isometric view of a portion of a battery container according to another embodiment of the present invention;

Figure 22 a plan view of the embodiment shown in figure 21;

Figure 23 an isometric view of a portion of a battery container according to another embodiment of the present invention; and

Figure 24 a plan view of the embodiment shown in figure 23.

DETAILED DESCRIPTION OF DRAWINGS

Referring firstly to Figure 1 of the accompanying drawings, there is shown an isometric view of a portion of a battery container 1 according to a first embodiment of the present invention. The container 1 has a sidewall 2a and a substantially planar floor 4. On the sidewall 2a, two pairs of guides 6a, 6b, 8a, 8b are arranged on an inner surface of the sidewall 2a. The substantially planar floor 4 extends to a lower edge of the sidewall 2a to form a compartment. Each guide 6a, 6b, 8a, 8b extends in a direction orthogonal to the planar floor 4. A portion of a lower end 10a, 10b, 12a, 12b of each guide 6a, 6b, 8a, 8b does not extend to the planar floor 4. Each guide 6a, 6b, 8a, 8b comprises a curved portion 14a 14b, 16a, 16b.

There is also shown a pair of further ribs 18a, 18b. The pair of further ribs 18a, 18b are located on the sidewall 2a of the container. The pair of further ribs 18a 18b is located between two pairs of guides 6a, 6b, 8a, 8b. The further ribs protrude from the inner surface of the sidewall 2a and the further ribs 18a, 18b extend along the sidewall 2a in a direction orthogonal to the planar floor 4. Lower ends 20a, 20b of the pair of further ribs extend to the planar floor 4. Upper ends of the pair of further ribs 22a, 22b do not extend to an upper edge 36 of the container 1. The upper end 22a, 22b of the pair of ribs tapers inwards towards the inner surface of the sidewall 2a. One of skill in the art would understand that in other embodiments encompassing the present inventive concept, the further ribs may not be present.

In the exemplary embodiment shown in figure 1, the two pairs of guides 6a, 6b, 8a, 8b are arranged to extend from an inner surface of the sidewall 2a at an acute angle of approximately 60 to 70 degrees from the surface. It will be appreciated by one of skill in the art that in other embodiments encompassing the same inventive concepts, the acute angle may be greater or smaller.

A straight edge of each guide of the pair of guides 6a, 6b, 8a, 8b is a base 24a, 24b, 26a, 26b of each guide, and adjoins the inner surface. The straight edge/base of each guide of the pair of guides 6a, 6b, 8a, 8b is the longest straight edge of each guide of the pair of guides 6a, 6b, 8a, 8b.

5 Although in the embodiment shown the guides are of uniform thickness, it will be appreciated by one of skill in the art that in other embodiments encompassing the same inventive concepts, each guide of the pair of guides 6a, 6b, 8a, 8b may be substantially thicker at the base 24a, 24b, 26a, 26b than at a distalmost edge 28a, 28b, 30a, 30b. As such, a position of a primary point of flexing or deformation of the pair of
10 guides 6a, 6b, 8a, 8b can be selected to be toward a distalmost edge 28a, 28b, 30a, 30b and/or away from the base of the guide 24a, 24b, 26a, 26b. Similarly, it will be appreciated that in other embodiments of the present invention, the thickness of each guide of the pair of guides 6a, 6b, 8a, 8b can be varied such that a degree of flexing or deformation of each guide of the pair of guides is distributed across a length of the
15 guide in a defined and predetermined manner, for example uniformly.

 An upper end 32a, 32b, 34a, 34b of each guide of the pair of guides 6a, 6b, 8a, 8b is tapered. An upper end 32a, 32b, 34a, 34b of each guide of the pair of guides 6a, 6b, 8a, 8b tapers inwards towards the inner surface. An upper end 32a, 32b, 34a, 34b of each guide of the pair of guides 6a, 6b, 8a, 8b is adapted to not extend to an upper
20 edge 36 of the container. Such an arrangement eases the positioning of a battery, or the likes, into the container, and serves to guide one or more cell elements or the likes towards a desired location within the container during insertion of the cell element(s) or the likes into the container.

 Referring to Figure 2 of the accompanying drawings, there is shown a further
25 isometric view of another portion of the embodiment shown in figure 1. It can be seen that the sidewalls 2a, 2b, 2c, 2d are arranged at right angles to one another, such that the container is substantially rectangular when viewed in a plan view from above.

 The container forms a substantially cuboid shape. The battery container comprises a plurality of partitions 50a-g, the partitions 50a-g arranged such that, in this
30 embodiment, the battery container comprises six compartments.

 Referring to Figure 3 of the accompanying drawings, there is shown a portion of a plan view of the embodiment shown in figure 2. Each compartment comprises a total of 8 guides 6a, 6b, 8a, 8b, 56a, 56b, 58a, 58b and 4 further ribs 18a, 18b, 60a, 60b. Each guide comprises a curved portion. The curved portions 14a, 14b, 16a, 16b, 74a,
35 74b, 76a, 76b are arranged towards the distalmost edge of each guide of each pair of

guides 6a, 6b, 8a, 8b, 56a, 56b, 58a, 58b. One of skill in the art would recognise that in other embodiments encompassing the inventive concept of the present invention, the curved portions 14a, 14b, 16a, 16b, 54a, 54b, 56a, 56b can be arranged at a point between the base and the distalmost edge of each guide of the pair of guides 6a, 6b, 8a, 8b, 56a, 56b, 58a, 58b. Further, in further embodiments, each guide of the pair of guides 6a, 6b, 8a, 8b, 56a, 56b, 58a, 58b may comprise a plurality of curved portions arranged at a distalmost edge of each guide of the pair of guides or at a point between the base and a distalmost edge of each guide of the pair of guides.

The degree of curvature each curved portion 14a, 14b, 16a, 16b, 74a, 74b, 76a, 76b of each guide of each pair of guides 6a, 6b, 8a, 8b, 56a, 56b, 58a, 58b is approximately 60-70 degrees. A radius of curvature of each curved portion 14a, 14b, 16a, 16b, 74a, 74b, 76a, 76b of each guide of the pair of guides 6a, 6b, 8a, 8b, 56a, 56b, 58a, 58b is between 0.5 and 10 millimetres. Each curved portion 14a, 14b, 16a, 16b, 74a, 74b, 76a, 76b is curved to an extent that an angular change in a direction of extension of each guide of the pair of guides 6a, 6b, 8a, 8b, 56a, 56b, 58a, 58b from the inner surface is designed to exhibit a curved portion in contact with the cell elements preferably parallel to the inner surface. One guide 6a, 8a, 56a, 58a of each pair of guides is arranged to extend or curve away from the other guide 6b, 8b, 56b, 58b of each pair of guides.

Also, each guide of each pair of guides 6a, 6b, 8a, 8b, 56a, 56b, 58a, 58b comprises a substantially straight portion located between the curved portion 14a, 14b, 16a, 16b, 74a, 74b, 76a, 76b and a base of each guide.

Each pair of guides is arranged to be directly opposite another pair of guides. By such provision, a tendency for a battery, plates or the likes to pivot or rock on the guides in use is reduced. Further, such an arrangement ensures a correct orientation of the battery, plates or the likes, such as parallel to a sidewall of the container, is maintained in use.

Referring to Figure 4 of the accompanying drawings, there is shown a cross-sectional view of the battery container of figure 2. One guide 6a, 8a, 106a, 108a, 206a, 208a of each pair of guides is arranged symmetrically with the other guide 6b, 8b, 106b, 108b, 206b, 208b of each pair of guides along an axis X1-6 which is orthogonal to the planar floor 4.

A lower edge 82a, 82b, 84a, 84b, 86a, 86b, 88a, 88b, 90a, 90b, 92a, 92b of each guide of the pair of guides 6a, 6b, 8a, 8b, 106a, 106b, 108a, 108b, 206a, 206b, 208a, 208b does not extend to the planar floor 4.

As can be seen in the exemplary embodiment of figure 4, a ridge extends from the lower edge 82a, 82b, 84a, 84b, 86a, 86b, 88a, 88b, 90a, 90b, 92a, 92b of each guide of the pair of guides 6a, 6b, 8a, 8b, 106a, 106b, 108a, 108b, 206a, 206b, 208a, 208b to the planar floor 4, as will be described in more detail with reference to figure 6.

5 Figure 5 shows a partial cut-away view of the battery container of figure 2, viewed from an end of the container, wherein a lower edge 90b, 290b does not extend to the substantially planar floor 4.

Figure 6 shows a perspective view of the embodiment shown in figure 2, and more clearly shows the ridges 300a, 300b. The ridges 300a, 300b extend from the planar floor 4 to the portion of the lower end or edge 302a, 302b of each guide the pair of guides 6a, 6b that does not extend the planar floor 4.

10 The ridges 300a, 300b provide structural integrity and/or serve to stiffen the guide. Advantageously, such an arrangement results in a force applied to the guides, for example a force exerted upon the guides by insertion of a battery into the battery container, being more evenly distributed in the sidewall of the container. Further, such a force is also guided towards the floor of the container. Thus the force is distributed over a larger area than would be if the ridges were not present.

15 Advantageously, such ridges 300a, 300b also increase an overall stiffness of the sidewalls of the container.

20 Further, during a moulding process, the provision of such ridges 300a, 300b improve the filling of the guide with material, because material may flow into a space within a mould defining the guides from a floor of the container, wherein the floor of the container comprises injection points.

25 Figures 7 and 8 show a further a further plan view of the embodiment shown in figure 2 and a magnified portion of the further plan view of figure 7 respectively.

Figure 9 shows a cross-sectional view of the first embodiment of the present invention, with plates 400 inserted. Although figure 9 shows 18 plates, one of skill in the art would recognise that a lesser or greater quantity of plates may be present. Similarly, the dimensions of the plates relative to the container are provided for example purposes only. In the embodiment shown, the guides 90b, 290b are in contact with an outer surface 401, 402 of the outmost plates. Figure 15 shows a plan view of the embodiment of figure 9. Figures 10 and 11 show the embodiment of figure 9, with the plates 400 at different stages of insertion/removal.

30 Figure 12 shows a cross-sectional view of the first embodiment of the present invention, with plates 500 inserted. Similarly, although figure 12 shows 21 plates, one

of skill in the art would recognise that a lesser or greater quantity of plates may be present. In the embodiment shown, the guides 92b, 292b are in contact with an outer surface 501, 502 of the outmost plates. Each guide of the pair of guides 92b, 292b has undergone elastic deformation upon insertion of the plates 500. Figure 16 shows a plan view of embodiment of figure 12.

Figure 13 shows an exemplary embodiment of the present invention, wherein the plates 500 are partially inserted into the container. At least a portion of each guide 90b, 290b has undergone elastic deformation to accommodate the plates within the container. In an alternative embodiment shown in figure 14, each guide 300a, 300b is adapted to deform such that the deformation is substantially uniform along a full length of the guide.

Figure 17 shows a photo of the process of compression testing the guides 411a, 411b, 412a, 412b according to an exemplary embodiment of the present invention; and figure 18 shows the data resultant from the compression test shown. The label "Old Flexrib" corresponds to 'standard' guides that are known in the art, wherein the guides are substantially straight and do not comprise at least one curved portion and a lower edge of each guide does extend to the planar floor. The label "New FlexRib" corresponds to the present invention.

It can be seen that, the features of the guides interact synergistically to result in a guide that is more flexible and exhibits a greater degree or amount of flexing and/or deformation than a comparable guide without at least one curved portion over a defined ranges of applied forces. For example, when subjected to forces of up to approximately 300 to 500N, two pairs of guides with the at least one curved portion on each guide deform by a distance of approximately 2 to 8mm towards the planar floor. A comparable arrangement of guides without the at least one curved portion and/or wherein a lower edge of each guide of each pair of guides does extend to the planar floor may require application of forces in the region of 300 to 600N to deform by approximately 2 to 8mm towards the planar floor.

It can be seen in the graph of force versus distance that the present invention results in a knee in the force versus distance curve. The effect of this knee, in the specific embodiment shown, is that a force required to deform two pairs of guides by approximately 10mm towards the planar floor is in the region of 2000N. A comparable arrangement of guides without the at least one curved portion and/or wherein a lower edge of each guide of each pair of guides does extend to the planar floor, requires application of considerably greater forces, such as forces in excess of 5000N, to

achieve a similar degree of deformation. As such, the provision of at least one curved portion on each guide of the pair of guides permits a tighter packing of plates, cells, cell elements or the likes into the container, without requiring undue forces to be applied.

5 Referring to figure 19 of the accompanying drawings, there is shown an isometric view of a portion of a battery container according to another embodiment of the present invention. Figure 20 shows a plan view of the embodiment shown in figure 19. In this embodiment, each compartment comprises a single pair of guides 501a, 501b on each sidewall/partition of a pair of opposing sidewalls/partitions. The guides
10 501a, 501b are adapted such that each guide of the pair of guides 501a, 501b is adapted to curve towards the other guide of the pair of guides 501a, 501b. As such, the pair of guides 501a, 501b is adapted such that, as the guides flex or deform upon insertion of a battery or the likes, the points of contact between the pair of guides 501a, 501b and the battery or the likes will tend towards one another.

15 Figures 21 and 22 show a further embodiment of the present invention. This further embodiment comprises a single pair of guides 601a, 601b on each sidewall/partition of a pair of opposing sidewalls/partitions. A spacing between each guide 601a, 601b is greater than the spacing between each guide 6a, 6b, 8a, 8b in the embodiments shown in figure 1. By spacing the guides 601a, 601b further apart, a
20 tendency for a battery, plates or the likes to pivot or rock on the guides in use is reduced.

Figures 23 and 24 show a further embodiment of the present invention. This further embodiment comprises two pairs of guides 701a, 701b, 702a, 702b on each sidewall/partition of a pair of opposing sidewalls/partitions. The guides 701a, 701b,
25 702a, 702b are adapted such that each guide of the pair of guides 701a, 701b, 702a, 702b is adapted to curve towards the other guide of the pair of guides 701a, 701b, 702a, 702b.

A spacing between each guide of a pair of guides 701a, 701b, 702a, 702b is greater than the spacing between each guide of a pair of guides 6a, 6b, 8a, 8b in the
30 embodiments shown in figure 1. By spacing the guides further apart, a tendency for one or more cell elements, plates or the likes to pivot or rock on the guides in use is reduced.

It will be understood by one of skill in the art that any of the described embodiments will not be limited to a single pair or two pairs of guides on a sidewall of a

compartment and that a greater quantity of pairs of guides may be implemented without deviating from the inventive concept described herein.

5 It will be understood by one of skill in the art that the specific forces and dimensions given are exemplary, and that other embodiments or configurations of the present embodiment would produce different results. However, the

It will be appreciated that the embodiments of the invention herebefore described are given by way of example only and are not meant to limit the scope of thereof in any way.

REVENDECATIONS

1. Conteneur de batterie comportant au moins un compartiment accommodé pour recevoir un ou plusieurs éléments cellulaires ou jeux de plaques, ledit au moins un compartiment comportant une paire de parois latérales opposées et au moins un guide ou
5 une nervure disposé(e) sur une surface d'au moins une des parois latérales, le/la au moins un guide ou une nervure s'étendant à partir d'une paroi latérale respective et définissant au moins une portion incurvée dans une direction s'étendant depuis une paroi latérale respective vers un bord le plus distal dudit au moins un guide ou de ladite au moins une nervure.
- 10 2. Conteneur de batterie selon la revendication 1, dans lequel le au moins un compartiment a un fond substantiellement plan qui s'étend entre une extrémité inférieure des parois latérales.
3. Conteneur de batterie selon l'une quelconque des revendications précédentes, dans lequel au moins une partie d'une extrémité ou d'un bord inférieur(e) de chaque guide ou
15 nervure ne s'étend pas sur le fond.
4. Conteneur de batterie selon l'une quelconque des revendications précédentes, dans lequel chaque guide ou nervure s'étend dans une direction perpendiculaire au fond ; ou dans lequel les guides ou nervures sont attachés, connectés ou fixés à ou formés de manière solidaire avec une paroi latérale respective ; ou dans lequel le au moins un
20 compartiment comporte une pluralité de guides ou de nervures, ou dans lequel au moins un guide ou au moins une nervure est situé sur une paroi latérale respective et l'autre au moins un guide ou au moins une nervure est situé(e) sur une paroi latérale opposée.
5. Conteneur de batterie selon l'une quelconque des revendications précédentes, dans lequel les parois latérales sont essentiellement planes, et dans lequel les parois latérales
25 sont disposées à des angles droits les unes par rapport aux autres, de sorte que le au moins un conteneur est essentiellement de forme carrée ou rectangulaire lorsqu'il est vu du dessus.
6. Conteneur de batterie selon l'une quelconque des revendications précédentes, dans lequel chaque guide ou nervure est adapté(e) pour fléchir ou subir une déformation
30 élastique après l'insertion d'au moins une batterie et/ou d'une plaque et/ou d'une cellule dans le conteneur, et dans lequel chaque guide ou nervure est disposé(e) de façon à faire saillie et/ou de s'étendre d'une surface interne à un angle entre 90 degrés et 45 degrés à partir de la surface.
7. Conteneur de batterie selon l'une quelconque des revendications précédentes, dans lequel chaque guide ou nervure d'une paire de guides ou nervures est adapté(e) pour se
35 courber en s'éloignant de l'autre guide ou nervure de la paire de guides ou nervures, ou dans lequel chaque guide ou nervure d'une paire de guides ou de nervures est adapté(e) pour se courber en direction de l'autre guide ou nervure de la paire de guides ou nervures.
8. Conteneur de batterie selon l'une quelconque des revendications précédentes, dans

lequel un bord droit de chaque guide ou nervure est une base de chaque guide ou nervure et rejoint la surface interne ou la paroi latérale, et dans lequel chaque guide ou nervure est essentiellement plus épais(se) au niveau de la base qu'au niveau d'un bord le plus distal.

5 9. Conteneur de batterie selon l'une quelconque des revendications précédentes, dans lequel l'épaisseur de chaque guide ou nervure varie de sorte qu'un degré de flexion ou de déformation de chaque guide ou nervure est distribué sur une longueur du guide ou de la nervure d'une manière prédéterminée.

10 10. Conteneur de batterie selon l'une quelconque des revendications précédentes, dans lequel une extrémité supérieure de chaque guide ou nervure est effilée, incurvée ou chanfreinée vers l'intérieur vers la surface interne et dans lequel la au moins une partie incurvée est disposée au niveau d'au moins un parmi :

le bord le plus distal de chaque guide ou nervure,

une base de chaque guide ou nervure, et/ou

un point entre la base et le bord le plus distal de chaque guide ou nervure.

15 11. Conteneur de batterie selon l'une quelconque des revendications précédentes, dans lequel un degré de courbure de la au moins une partie incurvée de chaque guide ou nervure est entre 30 et 120 degrés, et/ou dans lequel un radius de courbure de la au moins une partie incurvée de chaque guide ou nervure est entre 0,5 et 10 millimètres.

20 12. Conteneur de batterie selon l'une quelconque des revendications précédentes, dans lequel, lorsqu'ils sont assujettis à des forces jusqu'à approximativement 300N à 500N, deux paires de guides ou nervures avec la au moins une partie incurvée sur chaque guide ou nervure se déforment d'approximativement 2mm à 8mm.

25 13. Conteneur de batterie selon l'une quelconque des revendications précédentes, dans lequel un guide ou une nervure d'une paire de guides ou nervures est disposé(e) symétriquement avec l'autre guide ou nervure de la paire de guides ou nervures le long d'un axe qui est orthogonal au fond, ou dans lequel chaque guide ou nervure d'une paire de guides ou de nervures est disposé(e) asymétriquement le long d'un axe qui est perpendiculaire au fond ; ou dans lequel une paire de guides ou nervures est disposée pour être directement opposée à une autre paire de guides ou de nervures à l'intérieur du au
30 moins un compartiment ; ou dans lequel une pluralité de paires de guides ou de nervures est disposée sur la surface interne.

14. Procédé de construction d'un conteneur de batterie selon l'une quelconque des revendications précédentes, le procédé comprenant l'étape de formation du conteneur de batterie dans ou sur un moule.

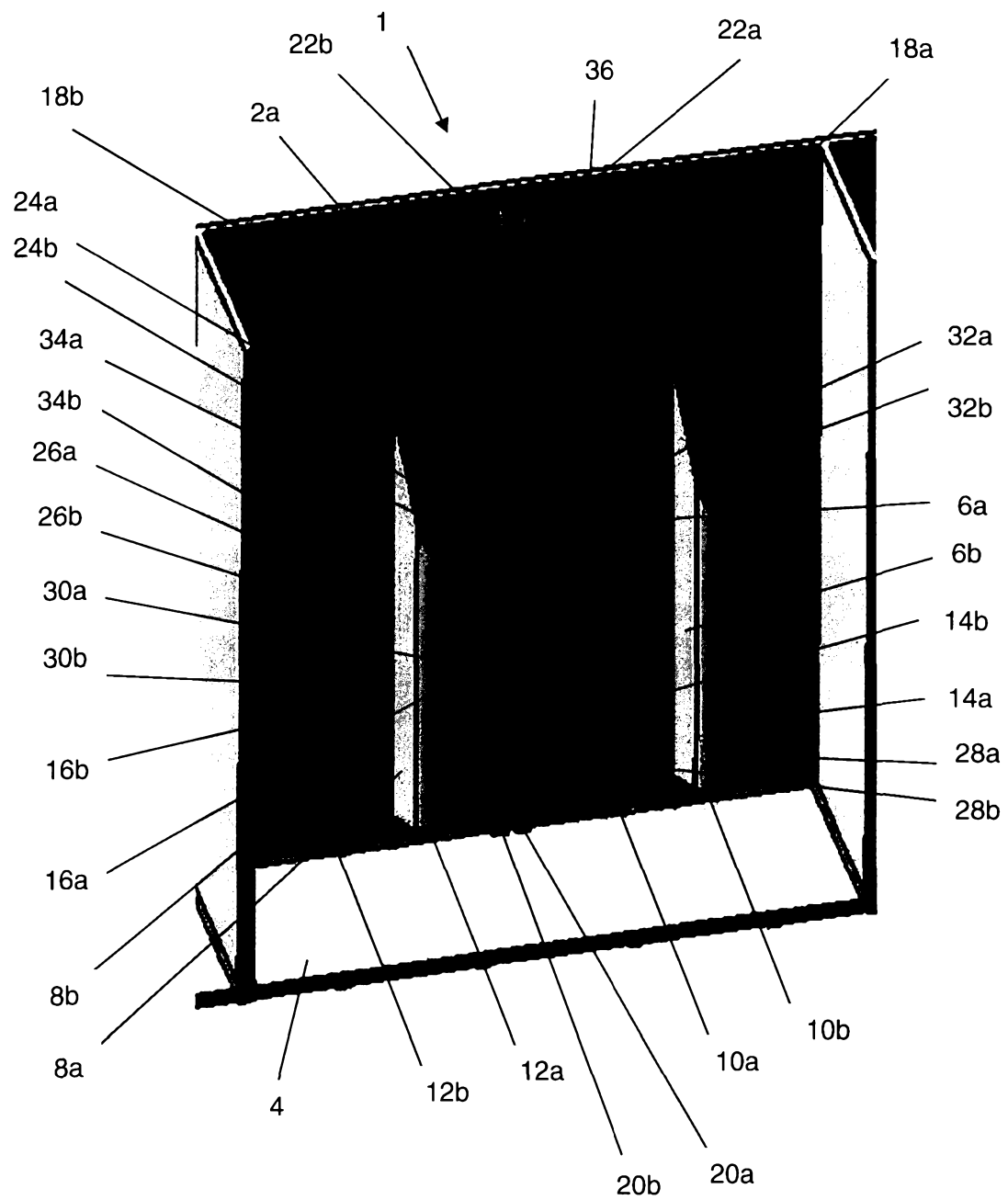


Figure 1

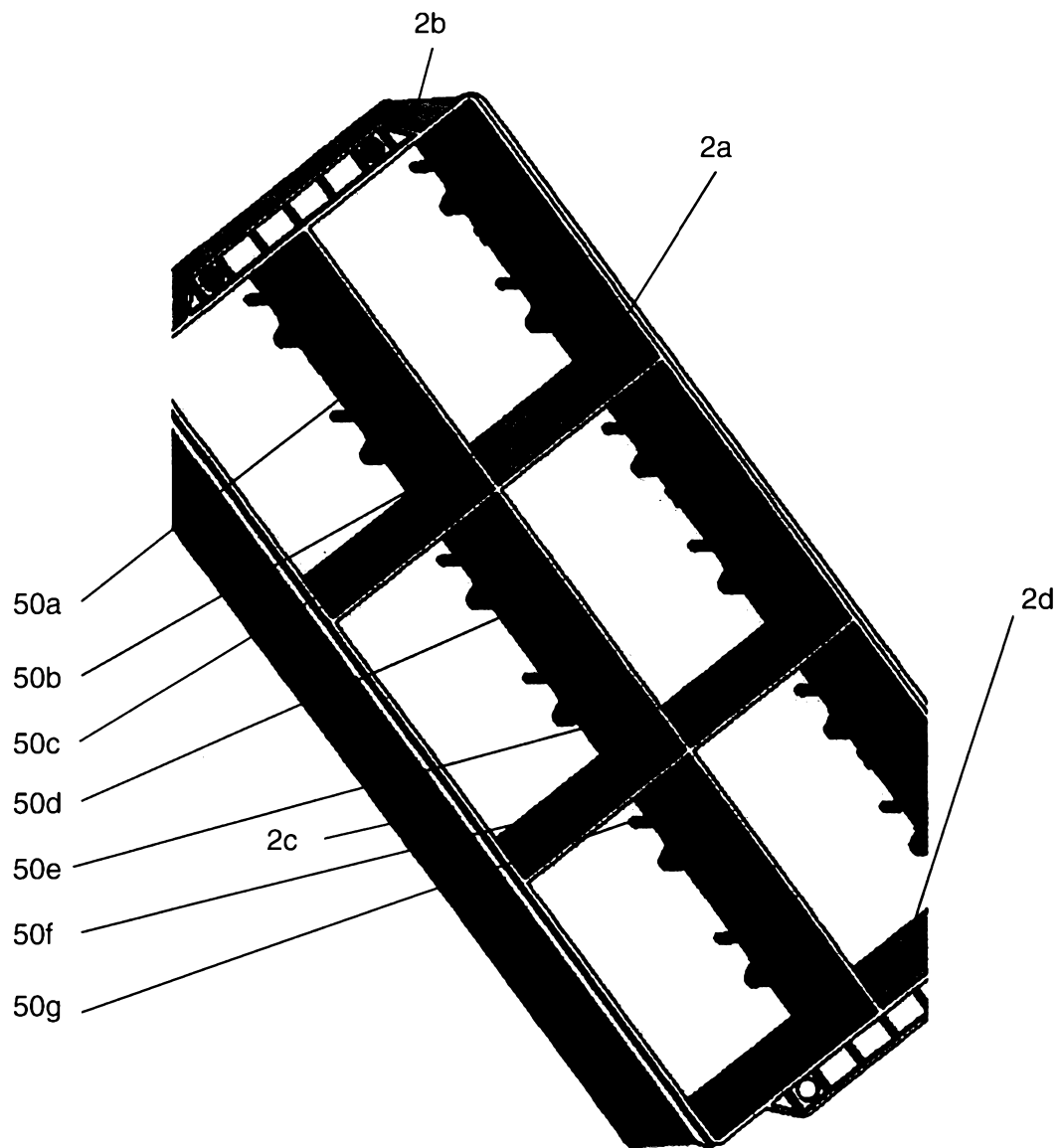


Figure 2

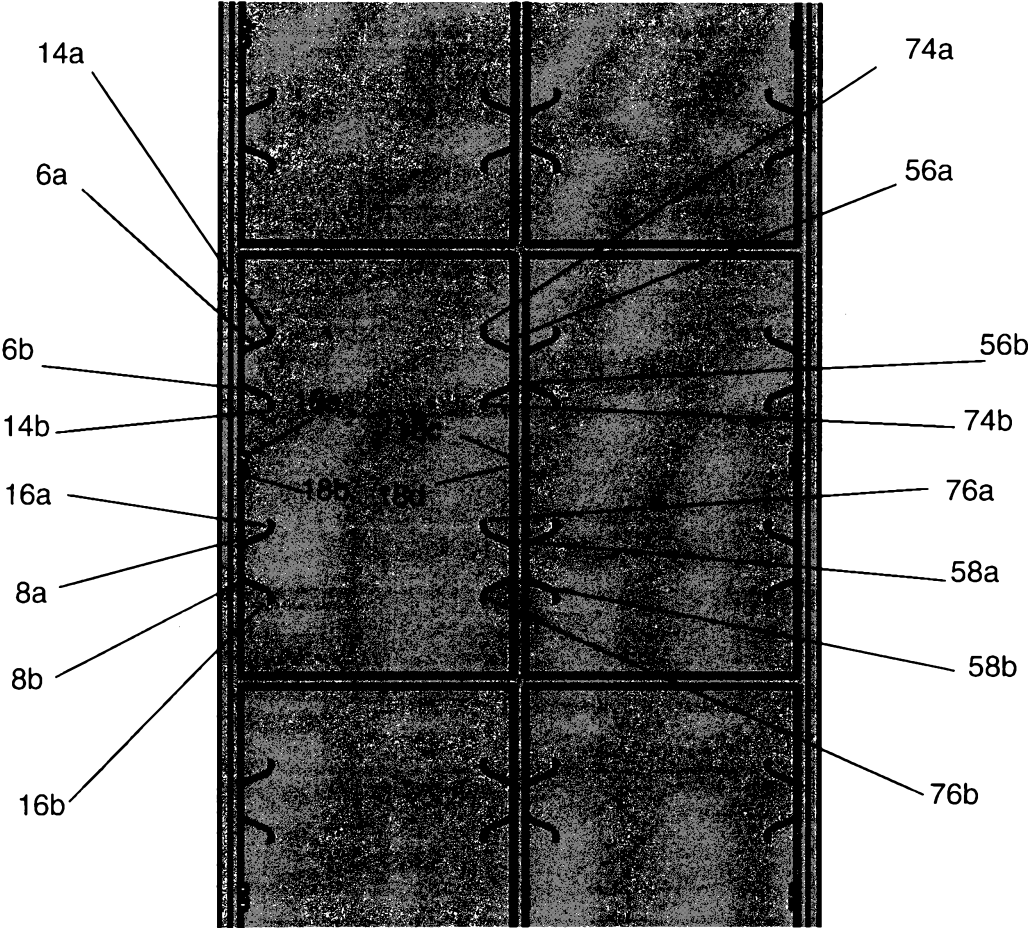
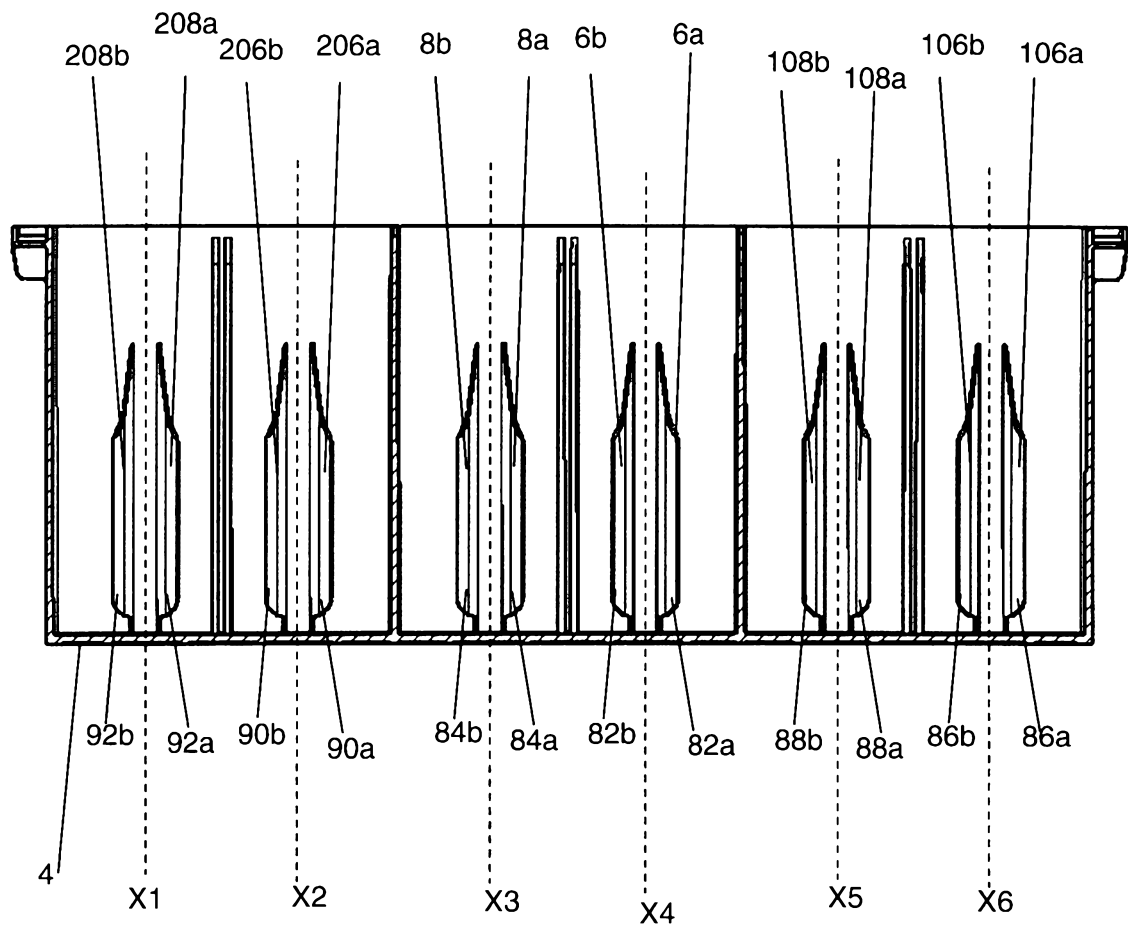


Figure 3

**Figure 4**

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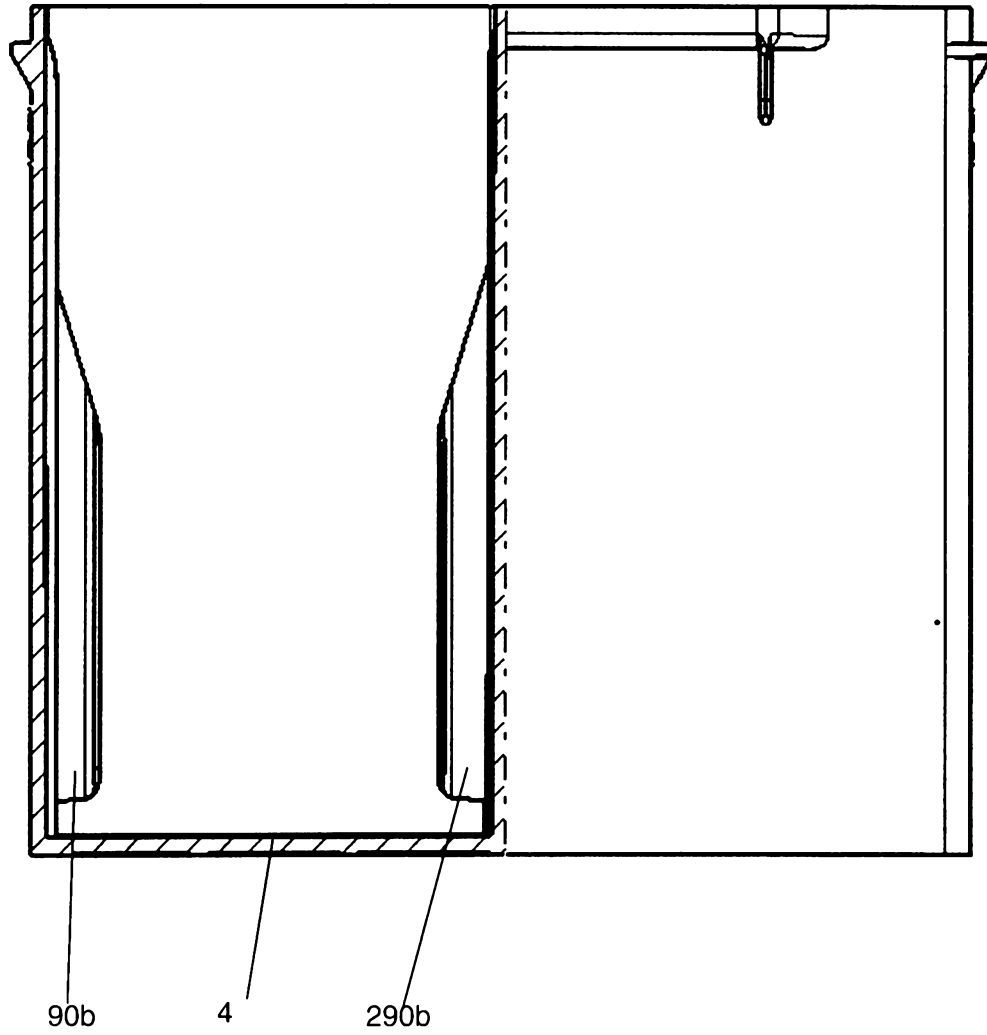


Figure 5

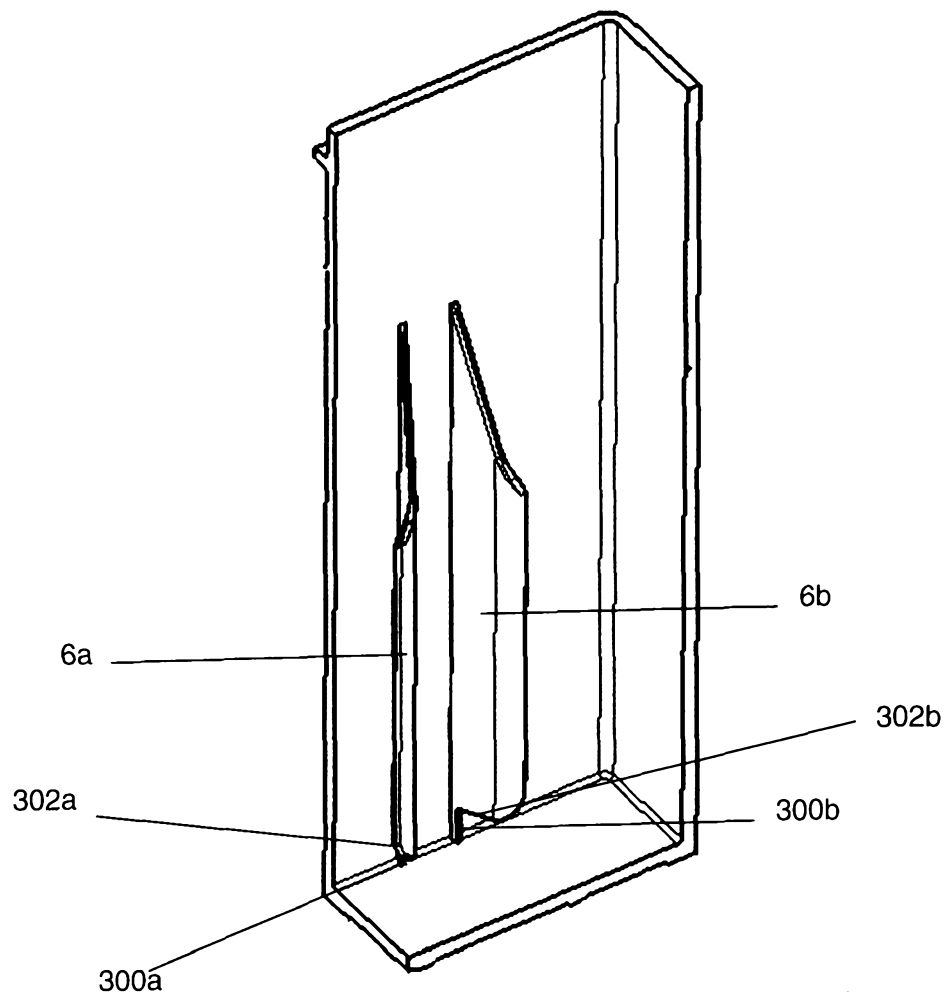


Figure 6

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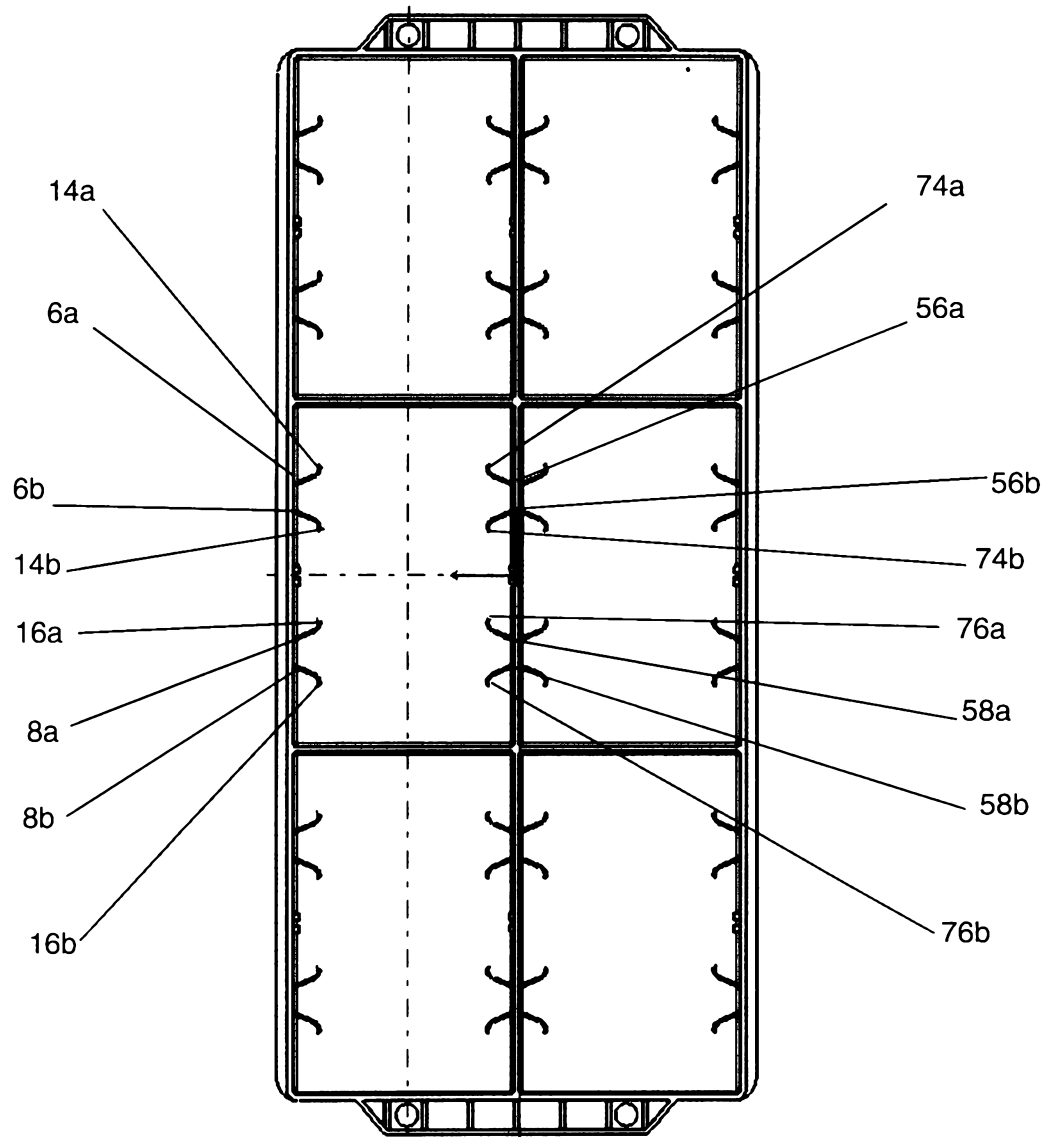


Figure 7

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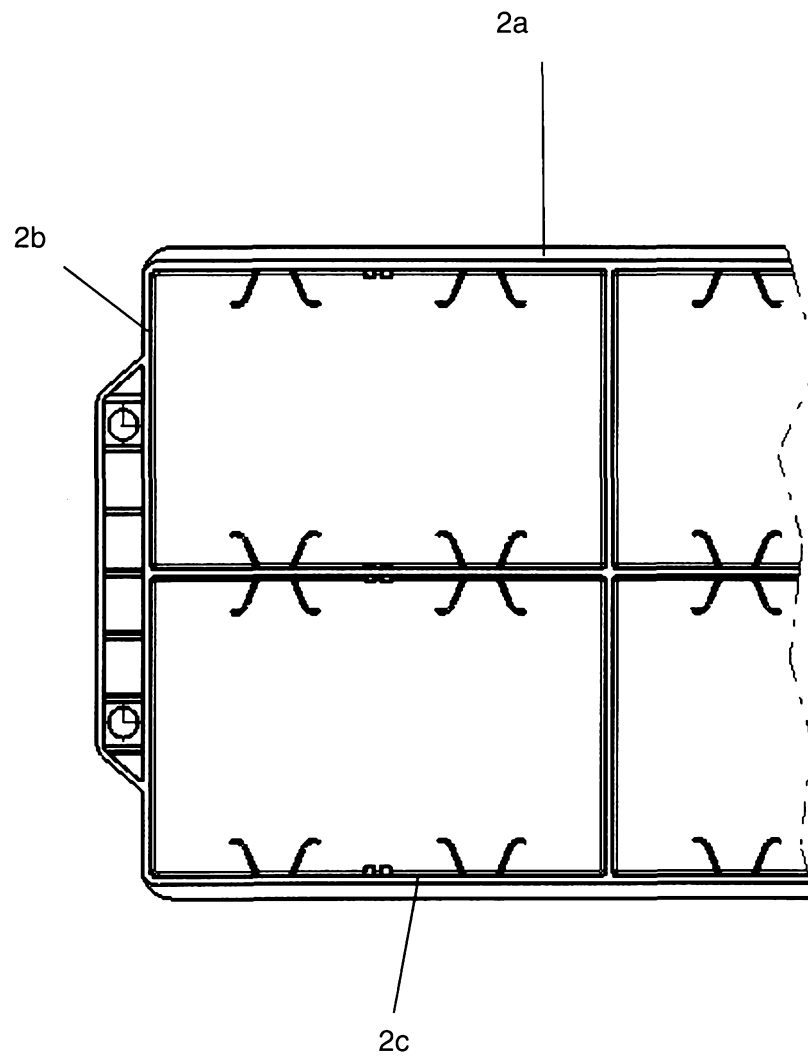


Figure 8

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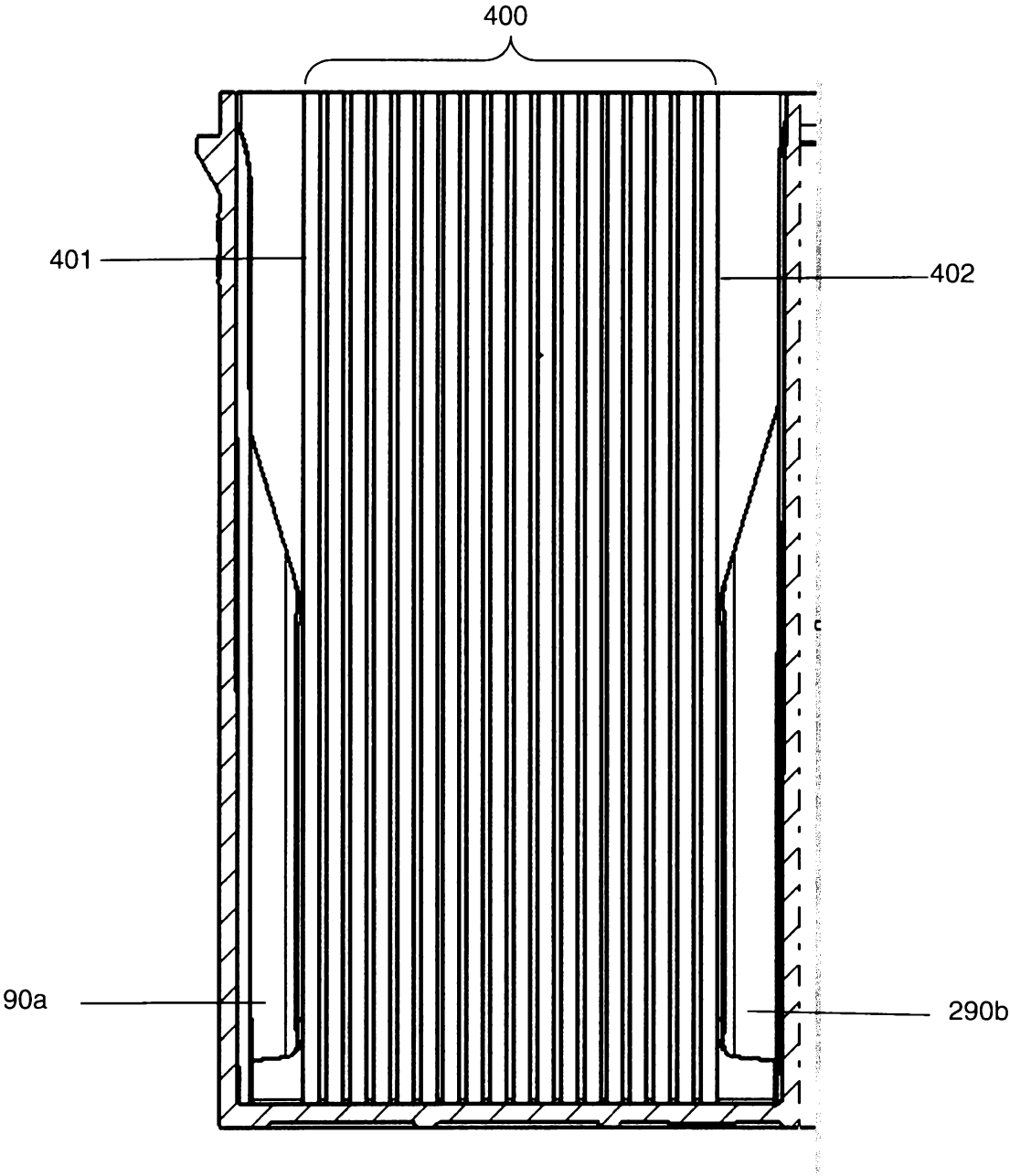


Figure 9

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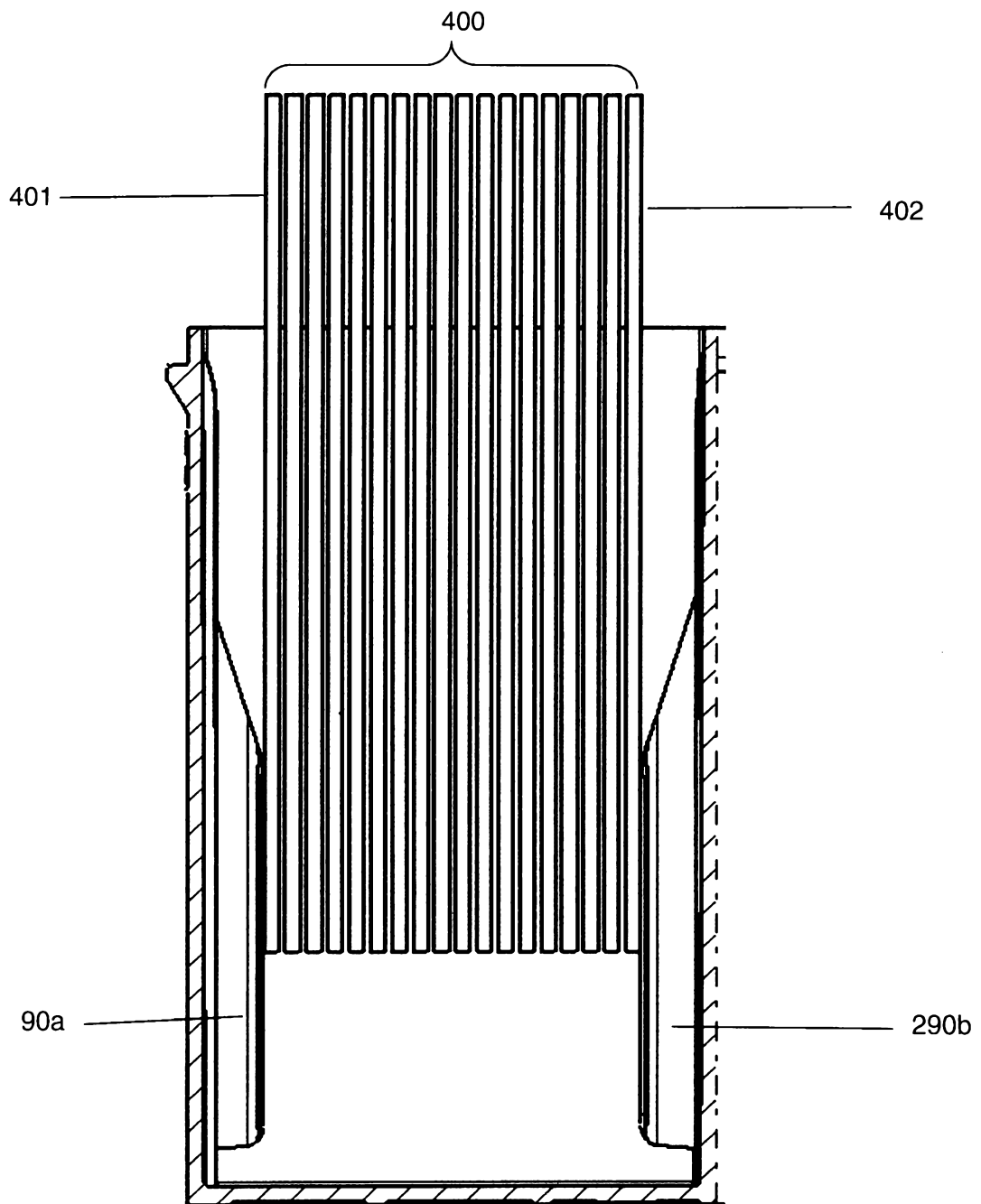


Figure 10

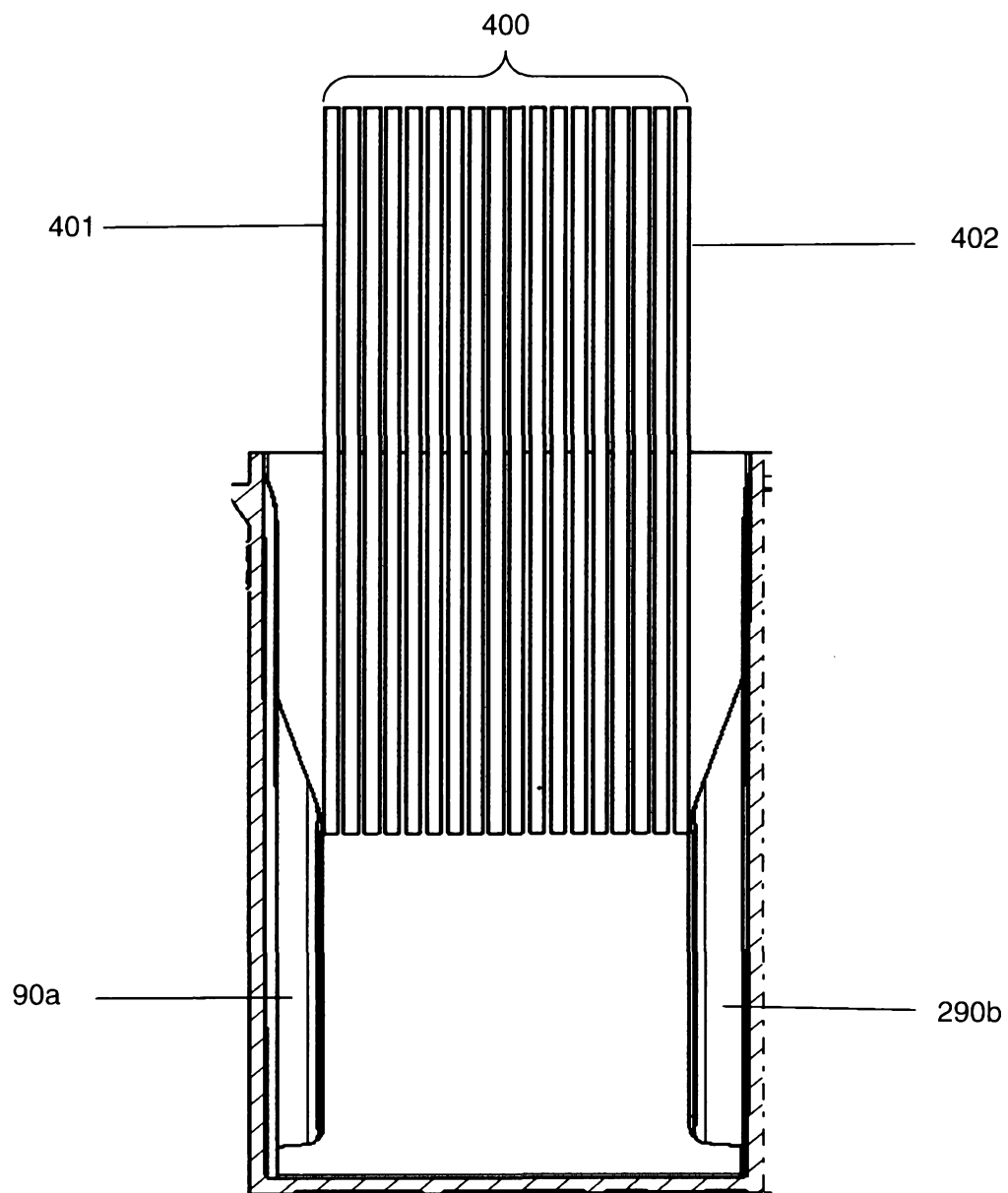


Figure 11

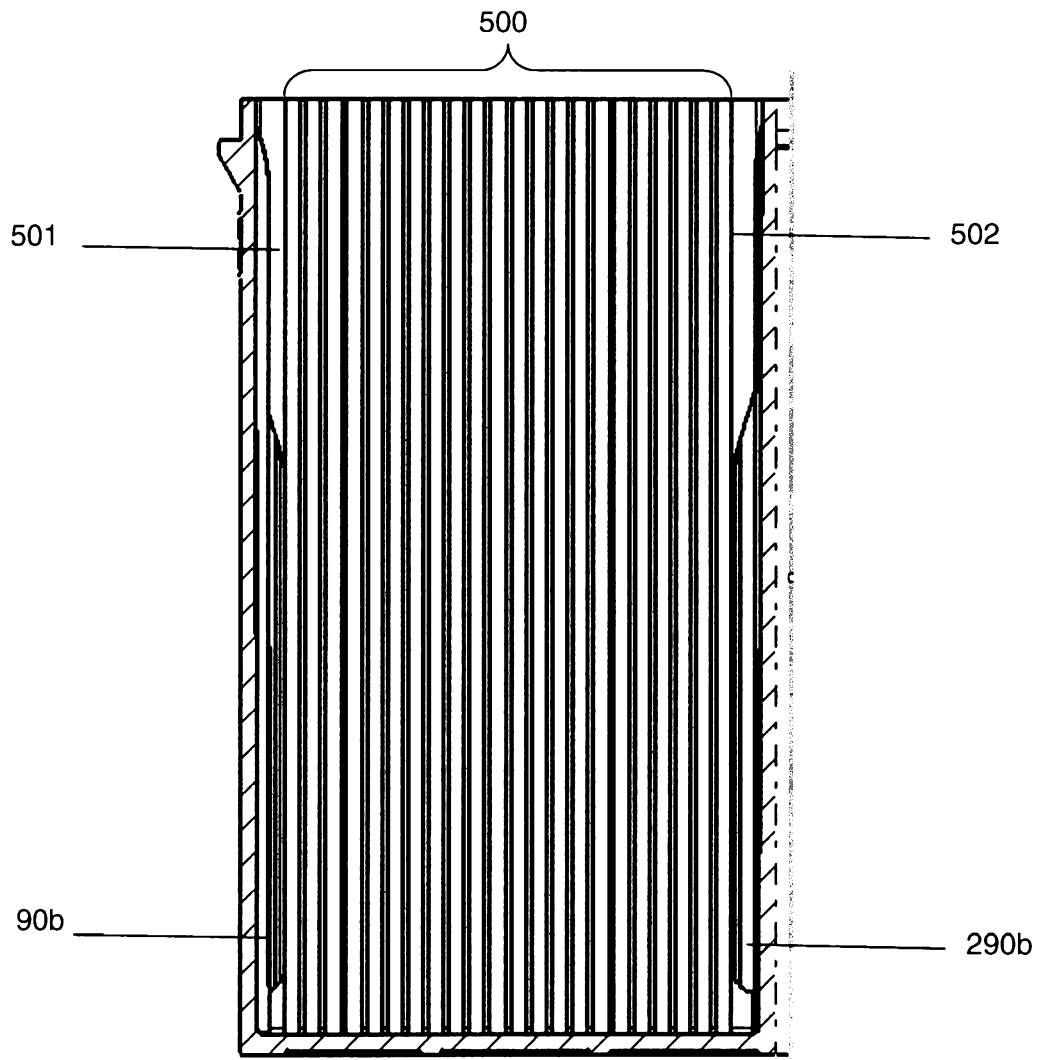


Figure 12

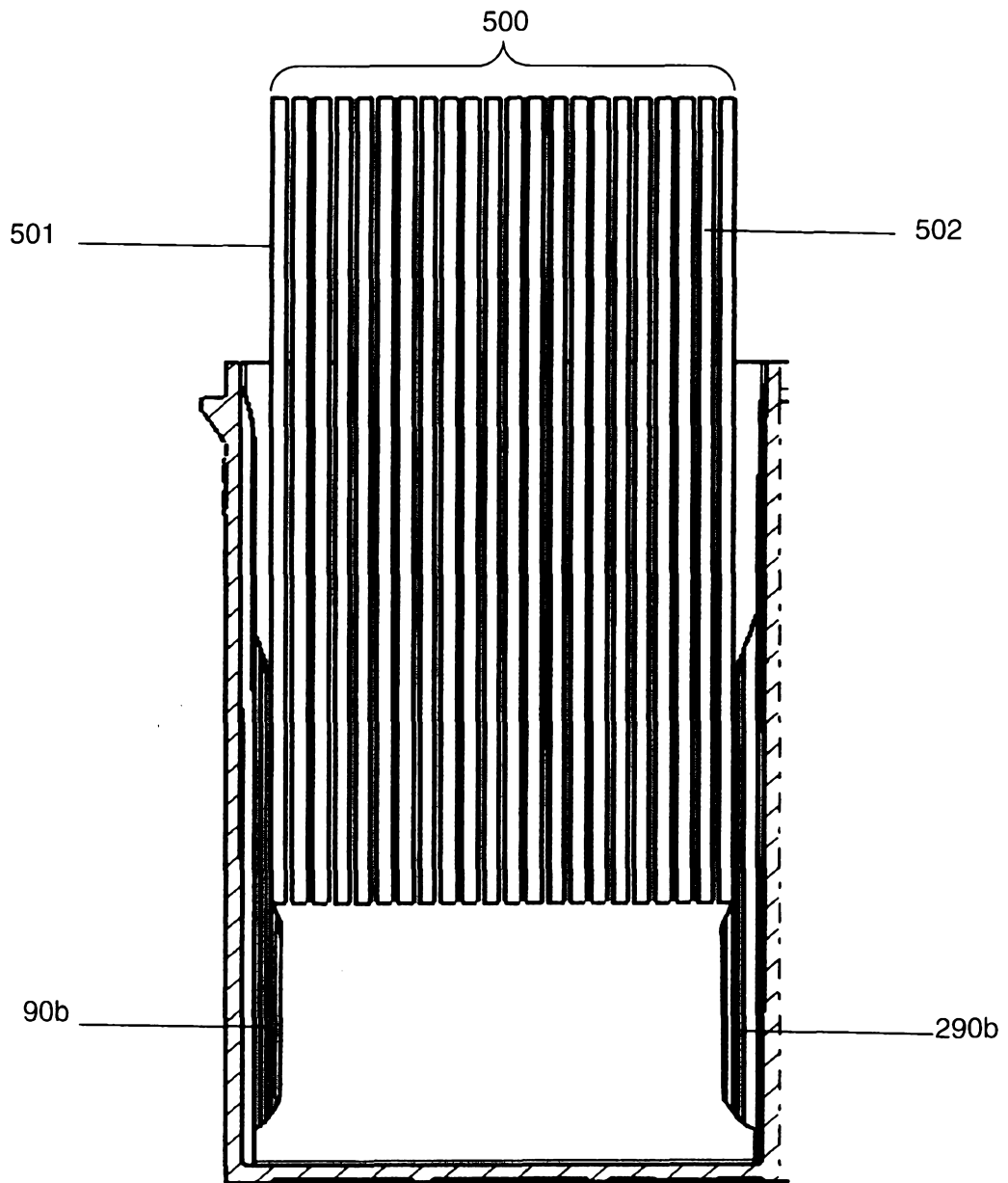


Figure 13

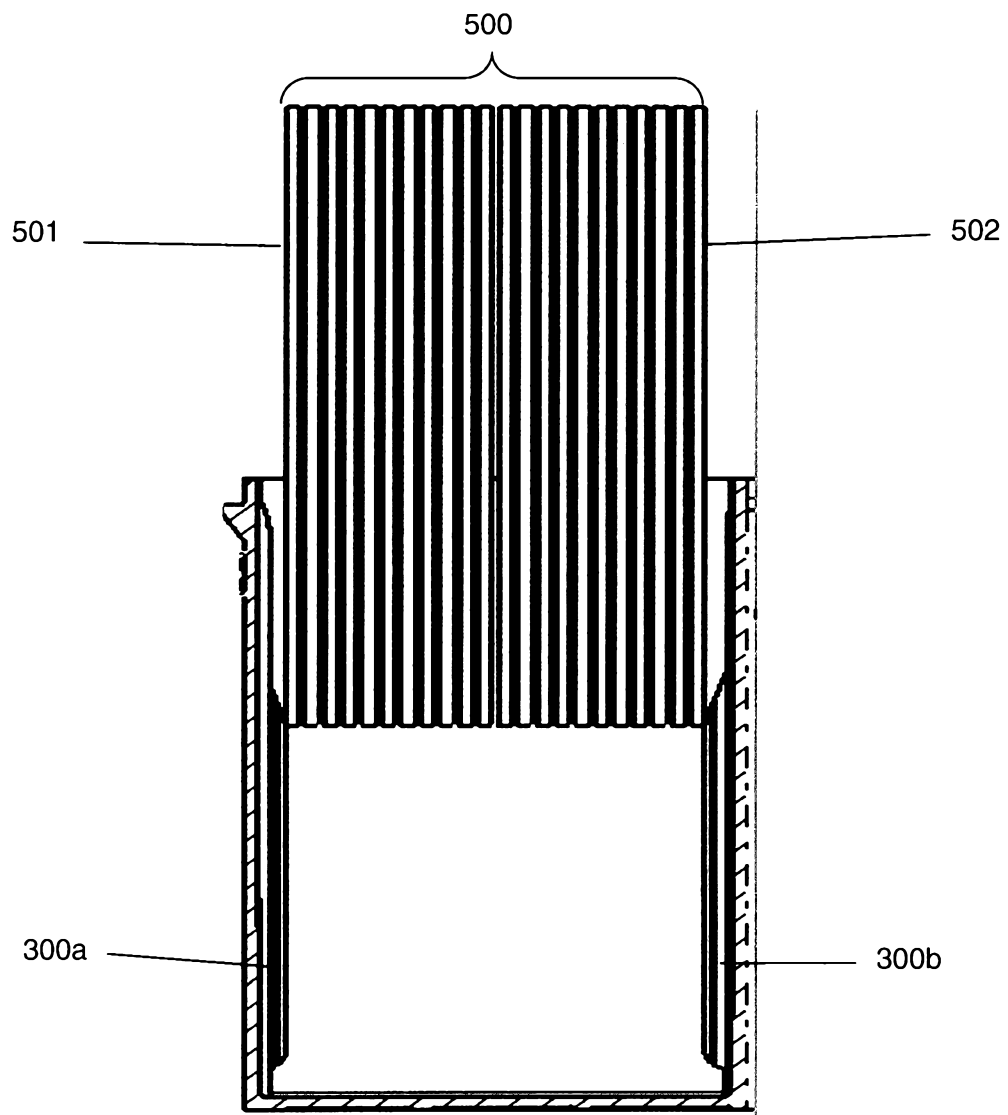
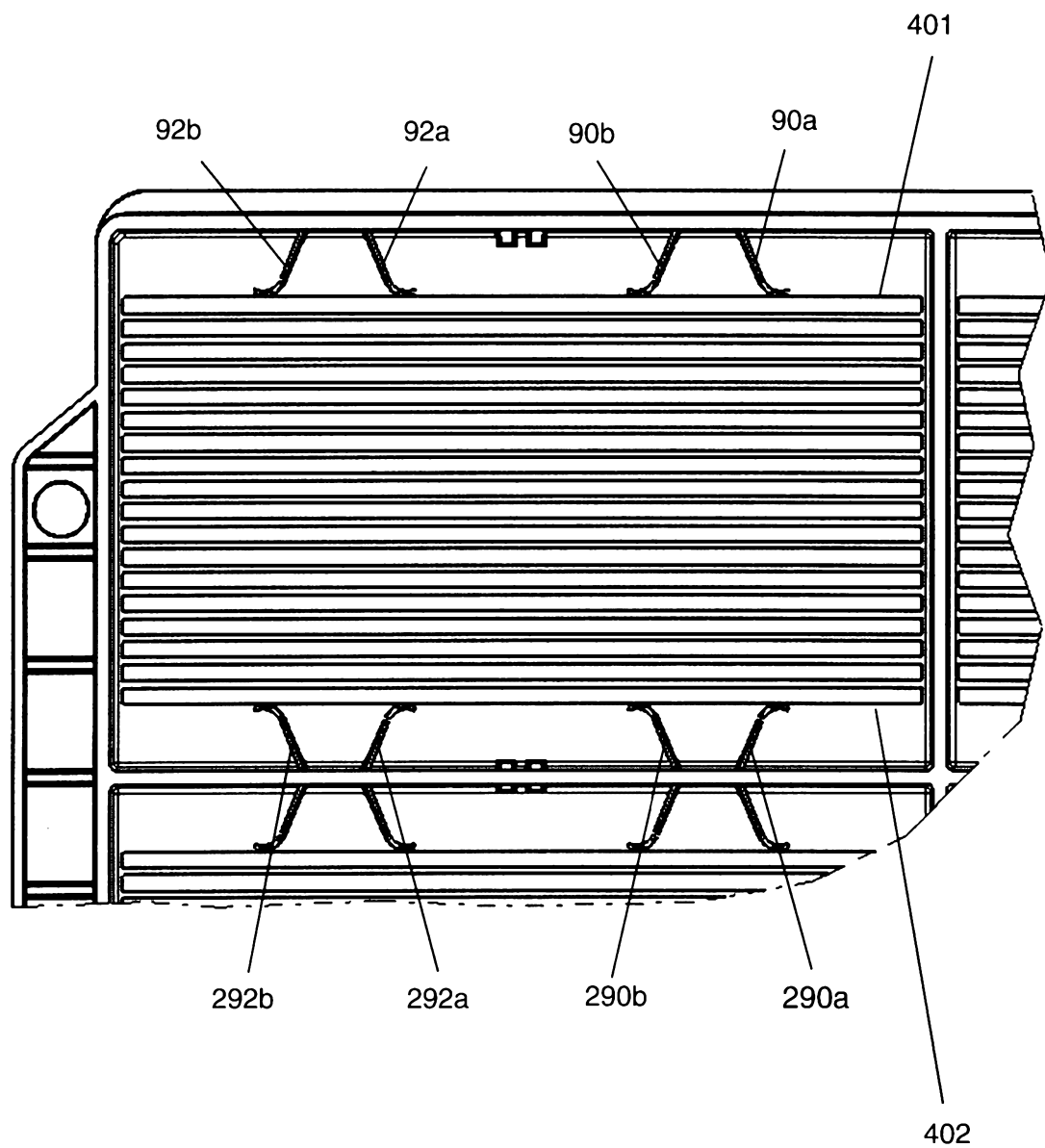


Figure 14

**Figure 15**

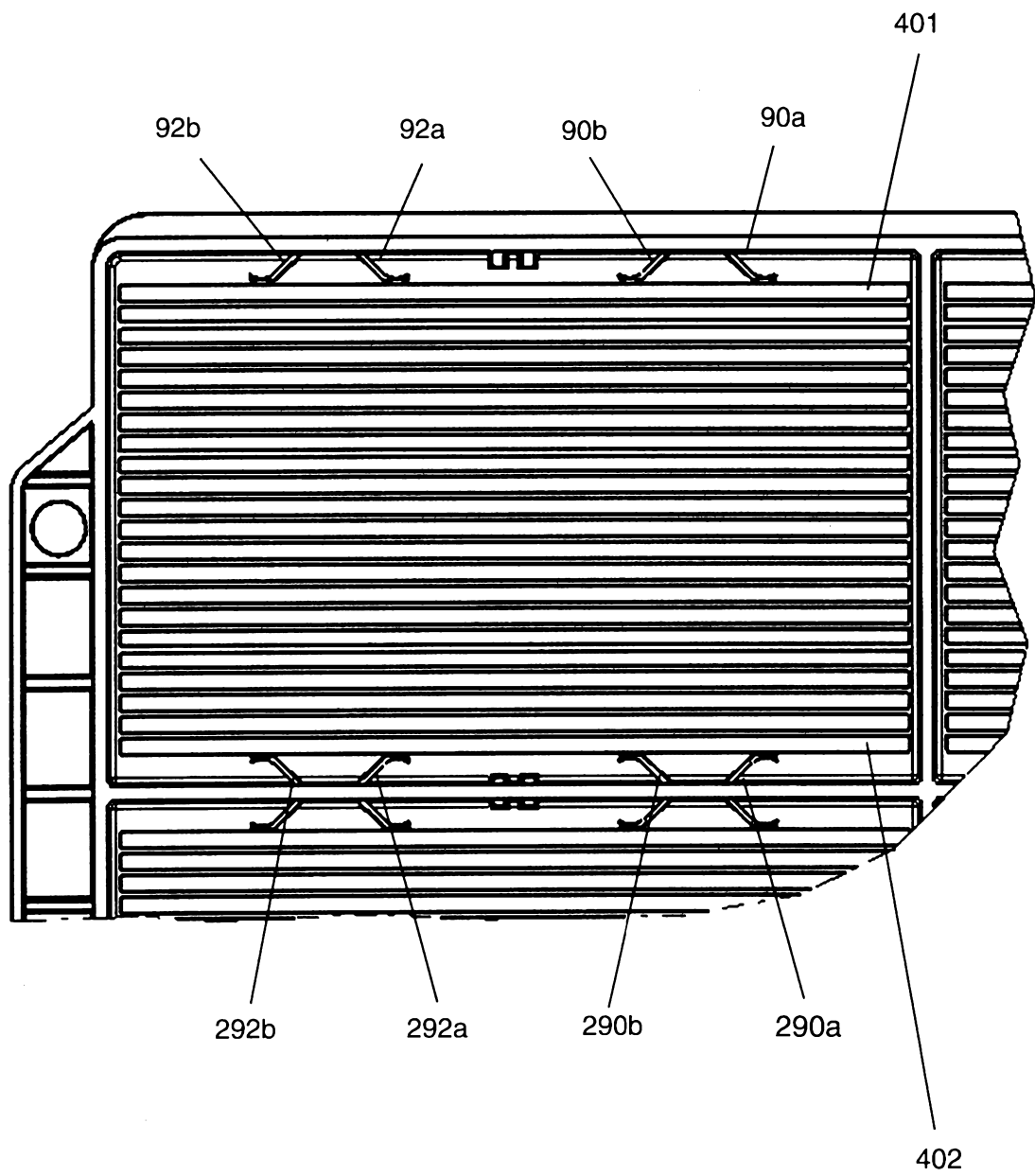


Figure 16

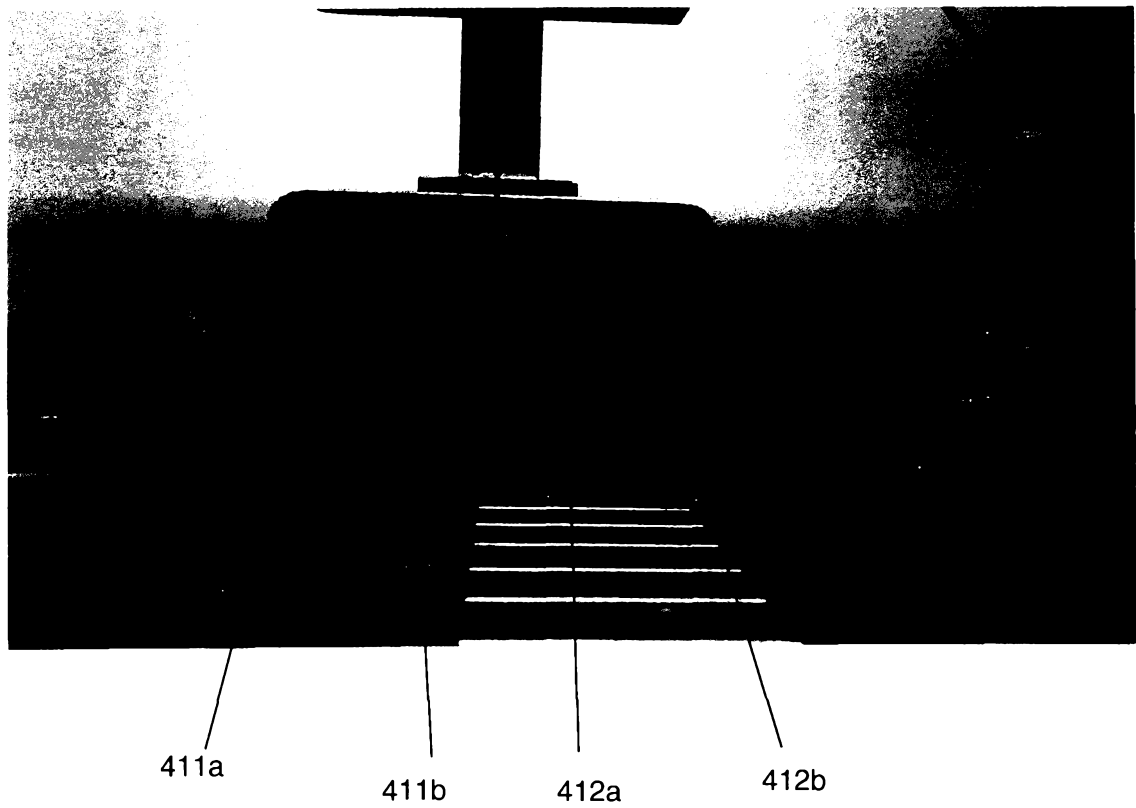


Figure 17

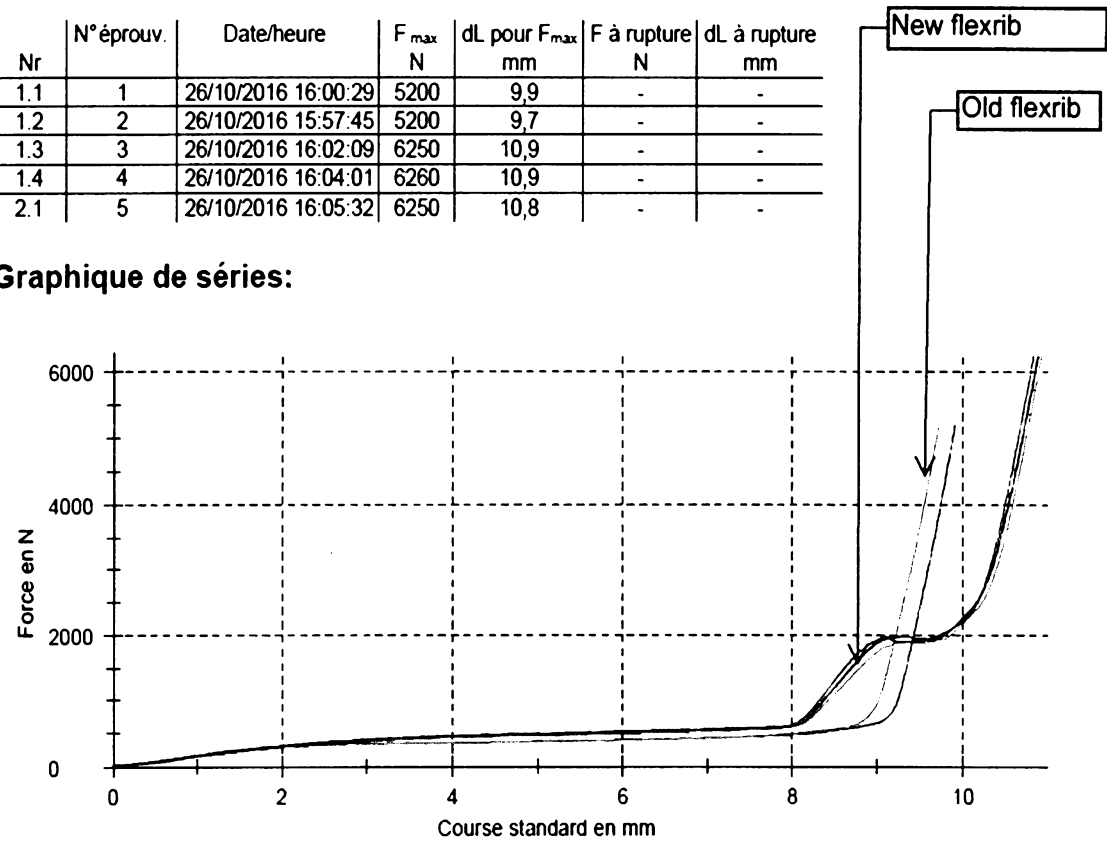
PV de l'essai

Titre : PV de l'essai
Précharge : 10 N
Vitesse d'essai : 50 mm/min

Résultats d'essai:

Nr	N°éprov.	Date/heure	F _{max} N	dL pour F _{max} mm	F à rupture N	dL à rupture mm
1.1	1	26/10/2016 16:00:29	5200	9,9	-	-
1.2	2	26/10/2016 15:57:45	5200	9,7	-	-
1.3	3	26/10/2016 16:02:09	6250	10,9	-	-
1.4	4	26/10/2016 16:04:01	6260	10,9	-	-
2.1	5	26/10/2016 16:05:32	6250	10,8	-	-

Graphique de séries:



Statistiques:

Série n = 5	N°éprov.	F _{max} N	dL pour F _{max} mm	F à rupture N	dL à rupture mm
$\bar{x}$	3	5830	10,4	-	-
s	2	577	0,6	-	-
v	52,70	9,89	5,52	-	-

Figure 18

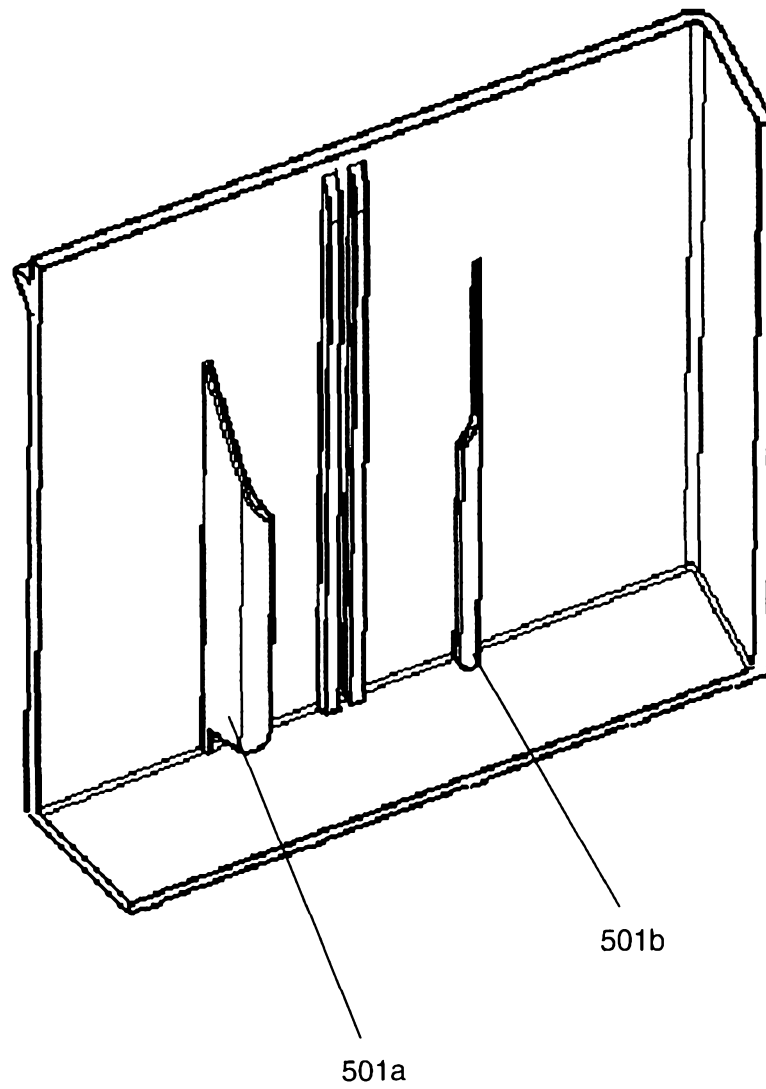


Figure 19

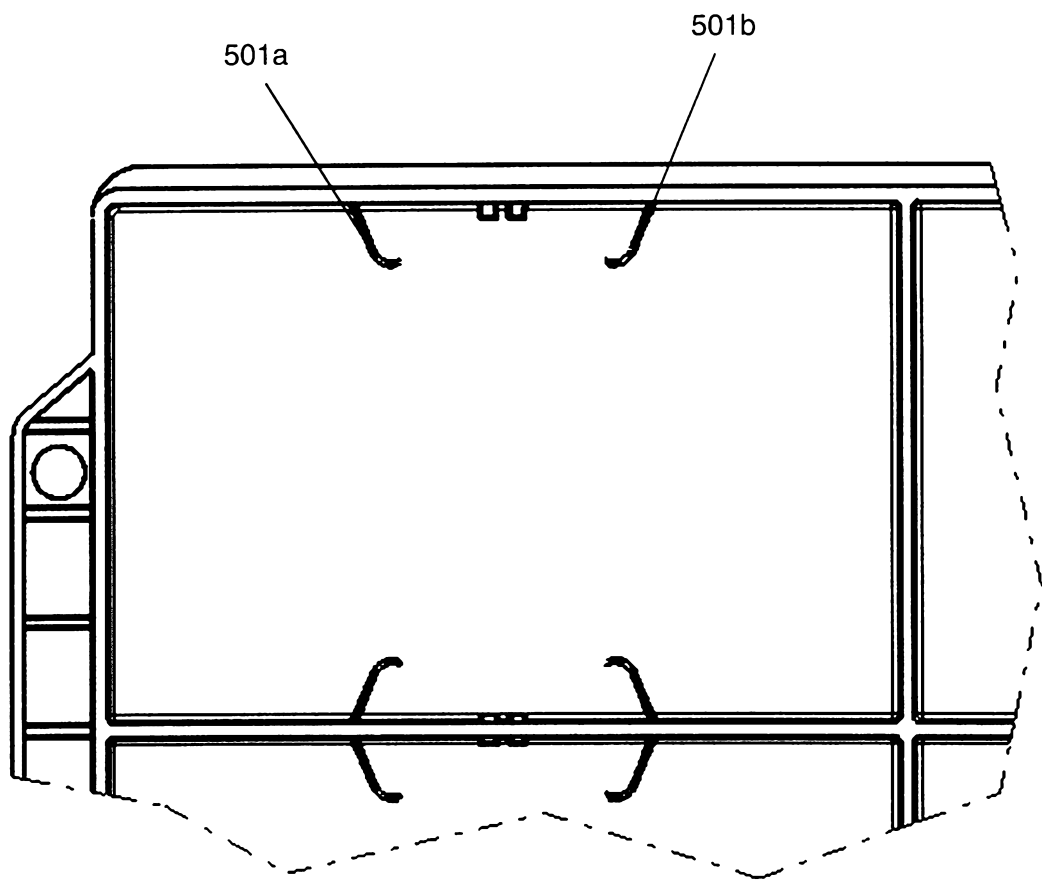


Figure 20

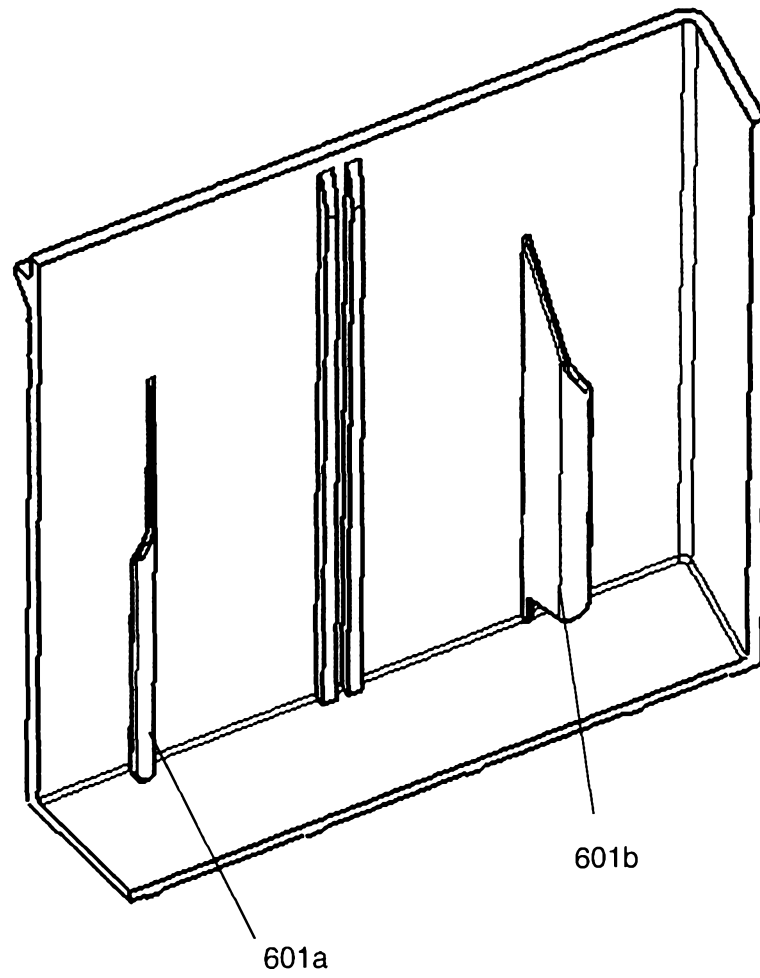


Figure 21

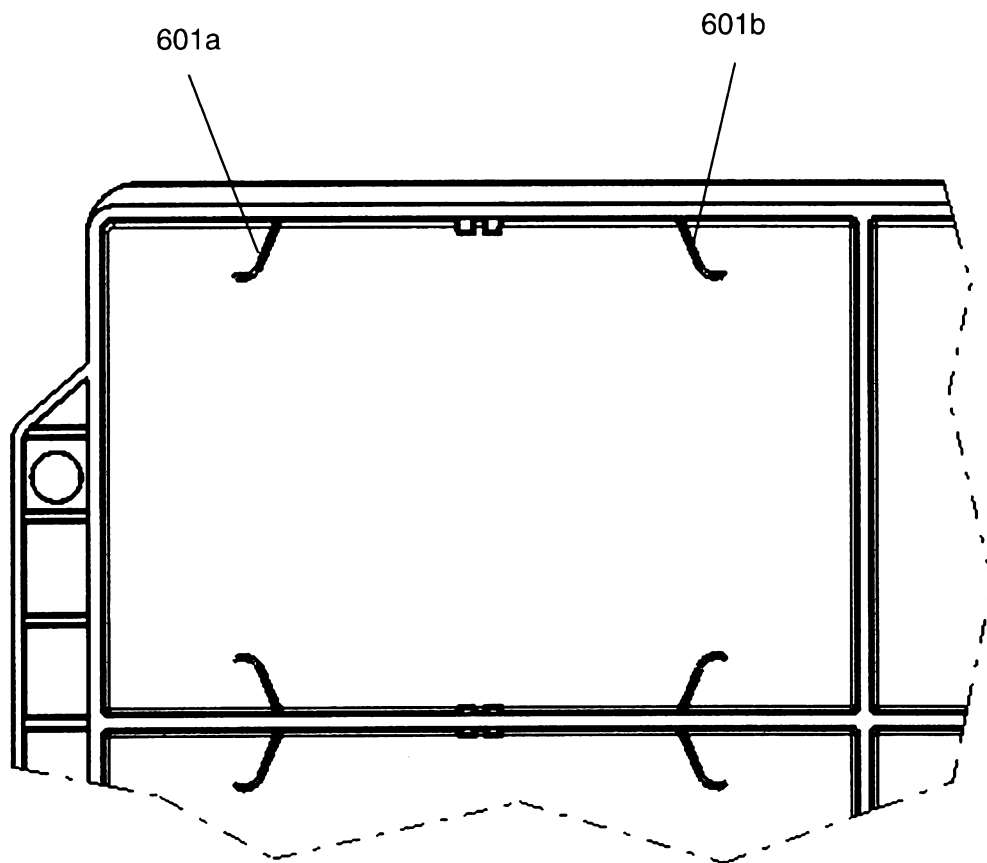


Figure 22

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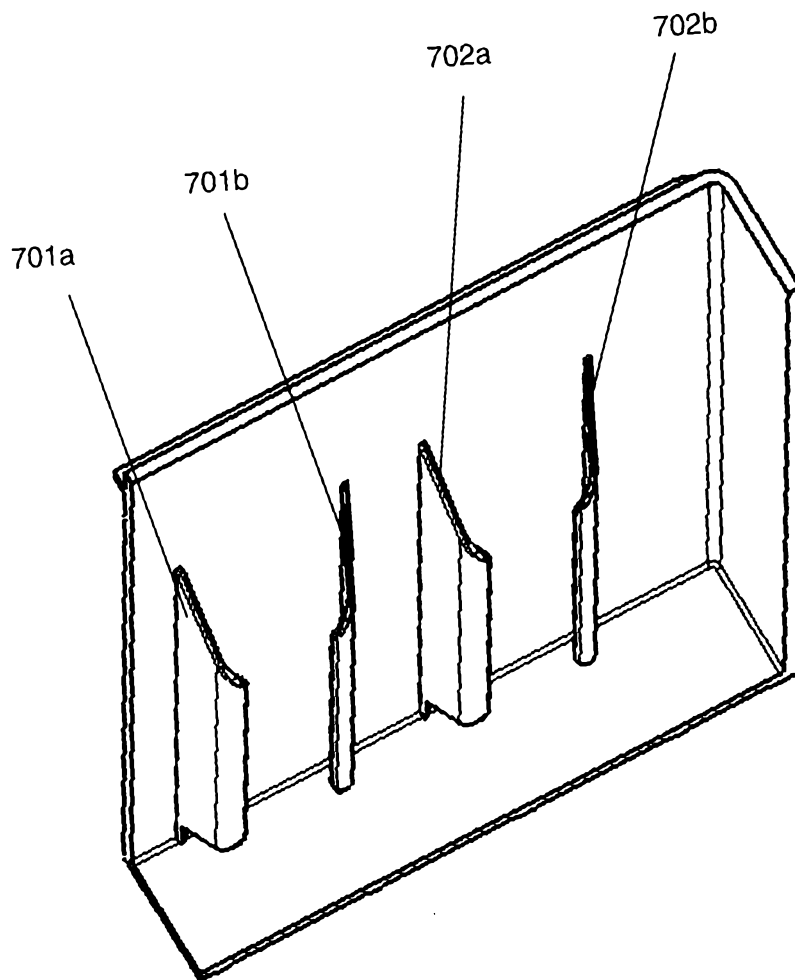


Figure 23

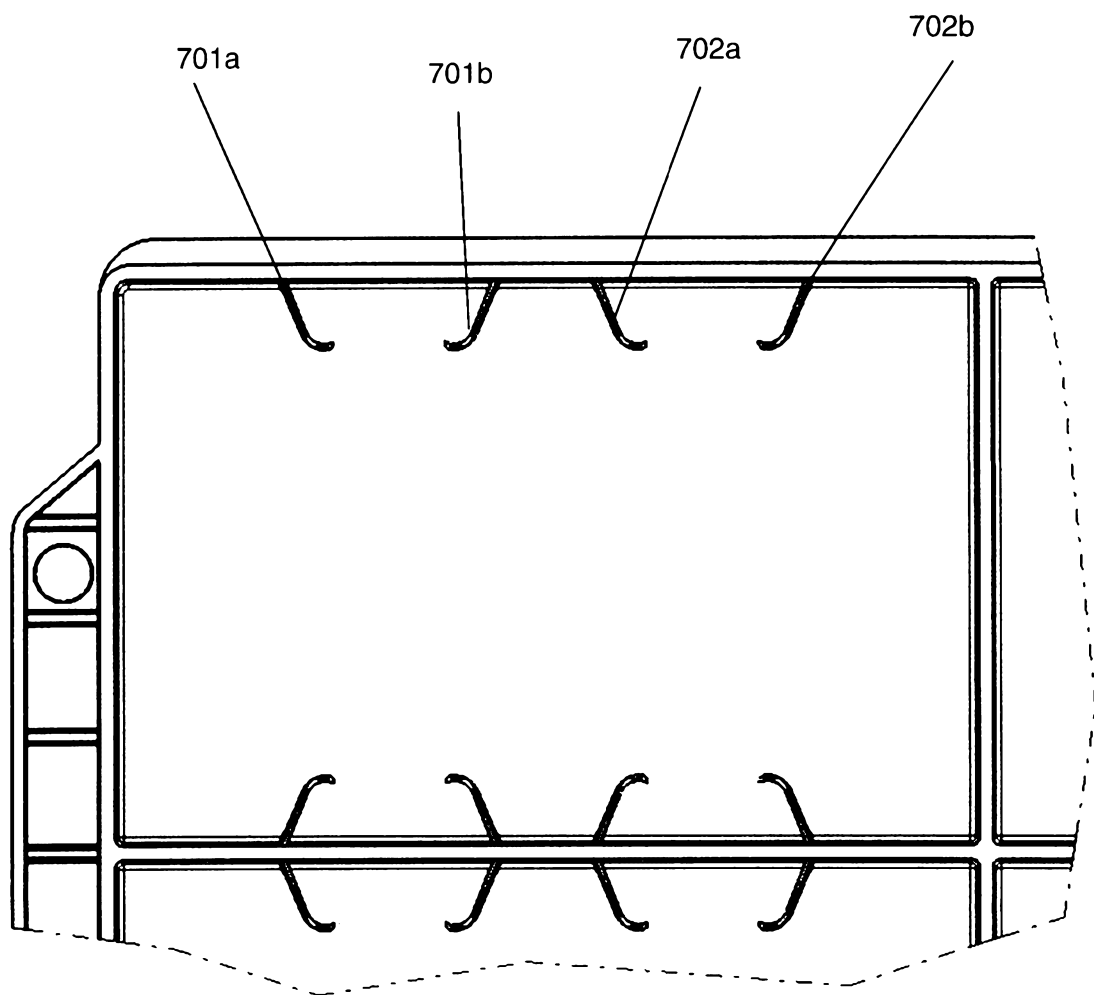


Figure 24

ABSTRACT

5 A battery container having at least one compartment suitable for receiving one or more cell elements or plate packs. The at least one compartment has a pair of opposing sidewalls and at least one guide or rib arranged on a surface of at least one of the sidewalls. Each guide or rib extends from a respective sidewall and defines at least one curved portion. A floor extends between a lower end of the sidewalls. At least a portion of a lower end or edge of each guide or rib does not extend the planar floor.

10 [Figure 1]



SEARCH REPORT
in accordance with Article 35.1 a)
of the Luxembourg law on patents
dated 20 July 1992

LO 1644
LU 100178

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 A	WO 01/28008 A1 (JOHNSON CONTROLS TECH CO [US]) 19 April 2001 (2001-04-19) * page 6, line 26 - page 7, line 21 * * figures 1,2,3,4,9,11 * -----	1-6, 10-15 7-9	
X A	EP 1 515 379 A2 (ACCUMA SPA [IT]) 16 March 2005 (2005-03-16) * claims 1-23 * * paragraph [0002] * * paragraph [0025] * * paragraph [0027] * * paragraph [0028] * -----	1-6,10, 13-15 7-9,11, 12	
A	DE 10 2007 030652 B3 (VARTA AUTOMOTIVE SYSTEMS GMBH [DE]) 13 November 2008 (2008-11-13) * figures 1a, 1b * * claims 1-12 * -----	1-15	
			TECHNICAL FIELDS SEARCHED (IPC)
The present search report has been drawn up for all claims			
		Date of completion of the search 20 July 2017	Examiner Kuhn, Tanja
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			

2
ISO-FC2284:1993 03 02 (P) (C) 501

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

LO 1644
LU 100178

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.

20-07-2017

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 1394875 A1	03-03-2004	CN 1484331 A	24-03-2004
		EP 1394875 A1	03-03-2004
		IT V120020185 A1	12-11-2002
		US 2004053127 A1	18-03-2004
EP 2693513 A1	05-02-2014	NONE	
WO 0128008 A1	19-04-2001	AU 7752700 A	23-04-2001
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		WO 0128008 A1	19-04-2001
EP 1515379 A2	16-03-2005	EP 1515379 A2	16-03-2005
		US 2005058899 A1	17-03-2005
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		DE 102007030652 B3	13-11-2008
		EP 2174365 A1	14-04-2010
		US 2010151315 A1	17-06-2010
		WO 2009003440 A1	08-01-2009



WRITTEN OPINION

File No. LO1644	Filing date (day/month/year) 28.04.2017	Priority date (day/month/year)	Application No. LU100178
International Patent Classification (IPC) INV. H01M2/02 H01M2/10 H01M10/04 H01M10/06 H01M10/16 ADD. B29C45/26			
Applicant Accumalux S.A.			

This report contains indications relating to the following items:

- ☒ Box No. I Basis of the opinion
- ☐ Box No. II Priority
- ☐ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- ☐ Box No. IV Lack of unity of invention
- ☒ Box No. V Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- ☐ Box No. VI Certain documents cited
- ☒ Box No. VII Certain defects in the application
- ☒ Box No. VIII Certain observations on the application

Form LU237A (Cover Sheet) (January 2007)	Examiner Kuhn, Tanja
--	-------------------------

WRITTEN OPINION

Application No.

LU100178

Box No. I Basis of the opinion

1. This opinion has been established on the basis of the latest set of claims filed before the start of the search.
2. With regard to any **nucleotide and/or amino acid sequence** disclosed in the application and necessary to the claimed invention, this opinion has been established on the basis of:
 - a. type of material:
 - ☐ a sequence listing
 - ☐ table(s) related to the sequence listing
 - b. format of material:
 - ☐ on paper
 - ☐ in electronic form
 - c. time of filing/furnishing:
 - ☐ contained in the application as filed.
 - ☐ filed together with the application in electronic form.
 - ☐ furnished subsequently.
3. ☐ In addition, in the case that more than one version or copy of a sequence listing and/or table relating thereto has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that in the application as filed or does not go beyond the application as filed, as appropriate, were furnished.
4. Additional comments:

Box No. V Reasoned statement with regard to novelty, inventive step and industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty	Yes: Claims	8, 12
	No: Claims	1-7, 9-11, 13-15
Inventive step	Yes: Claims	8
	No: Claims	1-7, 9-15
Industrial applicability	Yes: Claims	1-15
	No: Claims	

2. Citations and explanations

see separate sheet

WRITTEN OPINION

Application No.
LU100178

Box No. VII Certain defects in the application

The following defects in the form or contents of the application have been noted:

see separate sheet

Box No. VIII Certain observations on the application

see separate sheet

Re Item V

Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1 Reference is made to the following documents:

D1 EP 1 394 875 A1 (STOCCHIERO FRANCO [IT]) 3 March 2004 (2004-03-03)

D2 EP 2 693 513 A1 (BIASIN SRL [IT]) 5 February 2014 (2014-02-05)

D3 WO 01/28008 A1 (JOHNSON CONTROLS TECH CO [US]) 19 April 2001 (2001-04-19)

D4 EP 1 515 379 A2 (ACCUMA SPA [IT]) 16 March 2005 (2005-03-16)

D5 DE 10 2007 030652 B3 (VARTA AUTOMOTIVE SYSTEMS GMBH [DE]) 13 November 2008 (2008-11-13)

2 The present application does not meet the criteria of patentability, because the subject-matter of **independent claims 1, 14 and 15** is not new.

1.1 Document D1 discloses:

A battery container (1, 100) with at least one compartment (see Figure 1 and claim 1), suitable for receiving one or more cell elements (E) or plate packs, where in the at least one compartment has a pair of opposing side walls (2), and at least one guide or rib (support tabs 4) extends from a respective side wall and defines at least one curved portion (here with in the twist of the support tabs (4) and as can be seen in Figure 5, a curved portion is present and in contact with the supported cell elements. D1 further discloses that at least a portion of a lower end or edge of the at least one guide or rib does not extend the planar floor (see Fig. 3, the upper part of the twisted portion (7)), that each guide or rib extends from a respective sidewall and defines at least one curved portion.

Document D1 also discloses the construction of such a battery container comprising the step of forming the battery container by moulding with a mould (see claims 12 and 13 paragraph 4).

Independent claims 1, 14 and 15 are therefore not novel over D1.

1.2 Also D2 discloses:

A vehicle battery with at least one compartment (see paragraph 1 and Figure 1 and claim 1), suitable for receiving one or more cell elements or plate (P) packs, where in the at least one compartment has a pair of opposing side walls, and at least one guide or rib (within the laminar element 4) extends from a respective side wall and defines at least one curved portion (see Fig. 4a, 5 and 8).

D2 further discloses that at least a portion of a lower end or edge of the at least one guide or rib does not extend the planar floor (namely the hollow portion within the ribs of the laminar element).

Document D2 also discloses the construction of such a battery container comprising the step of forming the battery container by moulding with a mould (paragraph 66).

Independent claims 1, 14 and 15 are therefore not novel over D2.

1.3 D3 discloses:

A battery container (10, Fig. 1, 5 and 11) with at least one compartment, suitable for receiving one or more cell elements (30) or plate packs (page 6, line 25 to page 7, line 28), where in the at least one compartment (28) has a pair of opposing side walls (20, 26), and at least one guide or rib (flexible spacer ribs 14) extends from a respective side wall and defines at least one curved portion (here as seen in Figure 11). D1 further discloses that at least a portion of a lower end or edge of the at least one guide or rib does not extend the planar floor (see Fig. 11), that each guide or rib extends from a respective sidewall and defines at least one curved portion.

Document D1 also discloses the construction of such a battery container comprising the step of forming the battery container by moulding with a mould (see page 7, lines 8 to 12).

Independent claims 1, 14 and 15 are therefore not novel over D1.

1.4 D4, cited by the applicant, also discloses the subject matter of claim 1 (Fig. 4, 5D and 6 and see the respective passages cited in the search report), 14 (the guide is hollow, so at *a portion of a lower end* of the guide (2,7) does not extend the planar floor) and 15 (D4 claim 13).

- 3 **Dependent claims** 2-7, 9-13 do not contain any features which, in combination with the features of any claim to which they refer, meet the requirements of novelty and/or inventive step:

D1 also discloses the subject matter of dependent claims 2 (see Figure 5), 3 (planar floor (12, 13), see Figures 1, 3 and 6), 4 (the at least one compartment has a plurality of guides or ribs, wherein at least one guide or rib is located on a respective sidewall and the other one on an opposing sidewall), 5 (see Fig. 1), 6 (see Fig 5 and paragraphs 13, 28, 29), 7 (Fig. 5 and Fig. 1: both alternatives), 9 (by the twisting the support tabs), 10 (all alternatives achieved by twisting and bending the support tabs (4)), 11 (the curved portion is between 30 to 120 degrees) and 12 (ribs are arranged opposite to each other on the inner container surface).

D2 also discloses the subject matter of claims 2 (convex portions 8, 8a - 8d of laminar element 4), 3 (Fig. 4a), 4 (plurality of guides ribs), 5 (Fig. 4a), 6 (elastic deformation, see paragraph 35) and 13 (Fig 4a).

D3 also discloses the subject matter of claim 2 (Fig. 11 and respective passages in the description of D3), 3 (planar floor (24) Fig. 11), 4, 5, 6, 10, 11 (first alternative) and 13 (see Fig. 11 and the already cited passages of D3),

Dependent claims 2 to 7 and 9 to 12 are therefore not novel.

D4 also discloses the subject matter of claims 2, (Fig. 6), 3 (Fig. 4), 4 and 5 (Fig 3), 6 (D4, claim 15), 10, 13 (see the respective cited passage in the search report).

The subject matter of claim 12 appears to be not inventive over the disclosure of D1 or D3 as a person skilled in the art would adapt the compression flexibility of the support tabs (4) known from D1 to an extend that gives enough support to the battery elements of the lead acid battery. Therefore claim 12 is not inventive over D1 or D3.

- 4 The combination of the features of dependent claim 8 is not known from, nor rendered obvious by, the available prior art. None of the prior art documents discloses the subject matter of claim and this is also no general knowledge in the art of battery containers. Claim 8 differs from the prior art in that each guide or rib is substantially thicker at the base than at a distalmost edge, thus the application proposes an efficient *alternative structure* of guides or ribs, which is for the person skilled in battery containers not obvious from the prior art documents.

Re Item VII

Certain defects in the application

The features of claims 1 to 15 are not provided with reference signs placed in parentheses.

Re Item VIII

Certain observations on the application

Claim 12 does not meet the requirement of clarity because the matter for which protection is sought is not clearly defined. The claim attempts to define the subject-matter in terms of the result to be achieved (when subjected to forces...two pairs of guides or ribs.. deform by...8 mm"), which merely amounts to a statement of the underlying problem, without providing the technical (materials/ rib/guide size definitions) necessary for achieving this result.

Lack of Conciseness

Although claims 1 and 14 have been drafted as separate independent claims, they appear to relate effectively to the same subject-matter and to differ from each other only with regard to the definition of the subject-matter for which protection is sought and/or in respect of the terminology used for the features of that subject-matter. The aforementioned claims therefore lack conciseness.