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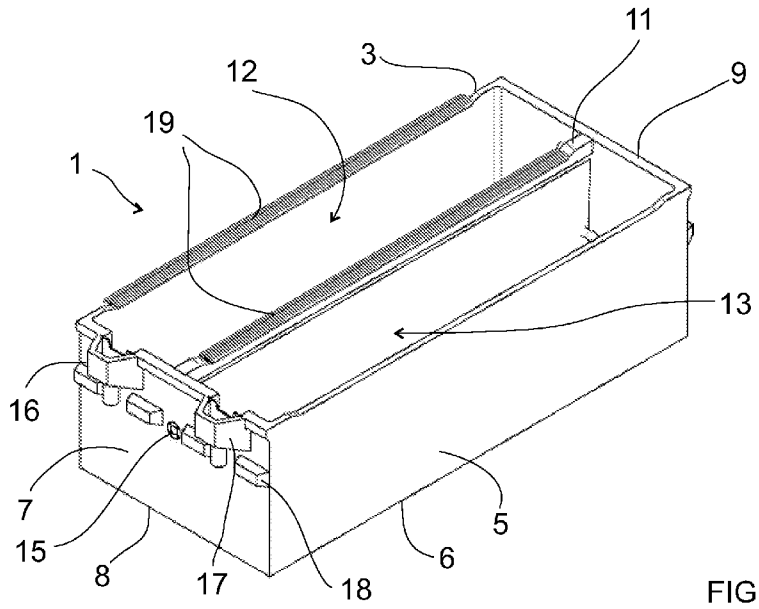

FIG 1

(57) Abstract: The invention relates to a method for manufacturing an electrolytic cell for a process for electrowinning or electrorefining of metals and to an electrolytic cell. The electrolytic cell comprises a container unit (1) having an inner space limited by a bottom (2), a first side wall (3), a second side wall (5), a first end wall (7), and a second end wall (9). The electrolytic cell comprises a support member (11) designed and dimensioned to extend between the first end wall (7) of the container unit (1) and the second end wall (9) of the container unit (1) to divide the inner space of the container unit (1) into a first part (12) for receiving a first row of anodes and cathodes (20) in alternating order and into a second part (13) for receiving a second row of anodes and cathodes in alternating order.

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METHOD FOR MANUFACTURING AN ELECTROLYTIC CELL FOR USE IN AN ELECTROLYSIS PROCESS AND ELECTROLYTIC CELL

Field of the invention

The invention relates to a method for manufacturing an electrolytic cell for corrosive electrolyte and for use in an electrolysis process such as for a process for electrowinning or electrorefining of metals as defined in the preamble of independent claim 1.

The invention also relates to an electrolytic cell for corrosive electrolyte and for use in an electrolysis process such as for a process for electrowinning or electrorefining of metals as defined in the preamble of independent claim 11.

Metal refers in this context for example but not limited to copper, nickel, zinc, lead, and silver.

By a container unit is in this context meant a container that is in the form of a separate unit having an inner space limited by a bottom, a first side wall extending from a first side edge of the bottom, a second side wall extending from a second side edge of the bottom, a first end wall extending from a first end edge of the bottom, and a second end wall extending from a second end edge of the bottom. A container unit of this type is for example presented in publication US 5,066,379.

Publication US 5,066,379 presents a container formed of polymer concrete in which minerals such as copper are purified in an electrolytic process. The container includes a bottom and end and side walls for containing a corrosive electrolyte, such as, a sulphuric or hydrochloric acid solution. An overflow box is integrally formed in a first formation extending vertically along one end wall of the cell and an overflow pipe is molded into the first formation and extends from the overflow box outwardly of the cell. A vertical covered inlet channel or cast-in pipe is provided at the opposite end of the container and extends from its upper to its lower end.

A problem with electrolytic cells is that they are expensive to manufacture and expensive to transport and install because of their large size.

Objective of the invention

The object of the invention is to provide an electrolytic cell that is economical to manufacture, transport and install.

Short description of the invention

The method of the invention is characterized by the definitions of independent claim 1.

Preferred embodiments of the method are defined in the dependent claims 2 to 10.

The method comprises a step for providing a container unit having an inner space limited by a bottom, a first side wall extending from a first side edge of the bottom, a second side wall extending from a second side edge of the bottom, a first end wall extending from a first end edge

of the bottom, and a second end wall extending from a second end edge of the bottom. The method comprises additionally a step for providing a support member designed and dimensioned to extend at least partly in the inner space of the container unit between the first end wall of the container unit and the second end wall of the container unit. The method comprises additionally a step for arranging the support member at least partly in the inner space of the container unit between the first end wall of the container unit and the second end wall of the container unit to divide the inner space of the container unit into a first part for a first row of anodes and cathodes in alternating order and into a second part for a second row of anodes and cathodes in alternating order.

The electrolytic cell of the invention is correspondingly characterized by the definitions of independent claim 11.

Preferred embodiments of the electrolytic cell are defined in the dependent claims 12 to 20.

The electrolytic cell comprises a container unit having an inner space limited by a bottom, a first side wall extending from a first side edge of the bottom, a second side wall extending from a second side edge of the bottom, a first end wall extending from a first end edge of the bottom, and a second end wall extending from a second end edge of the bottom. The electrolytic cell comprises a support member arranged at least partly in the inner space of the container unit between the first end wall of the container unit and the second end wall of the container unit to divide the inner space of the container unit into a first part for a first row of anodes and cathodes in alternating order and into a part for a second row of anodes and cathodes in alternating order.

The invention is based on providing a support member and dividing the inner space of the container unit into a first part for a first row of anodes and cathodes in alternating order and into a part for a second row of anodes and cathodes in alternating order. By doing so, the metal producing capacity is increased relative to the production, transport and installation costs of the electrolytic cell in comparison to an electrolytic cell according to the prior art. One reason for this is that if more anodes and cathodes producing capacity can fit into one container unit, the specific production cost of the container unit is reduced. In addition, the relative transportation and installation costs are lowered due to fewer transportation movements and fewer installation activities for the specified production capacity.

In a preferred embodiment the container unit has the following dimensions: The width of the container unit is between 2.5 and 2.6 m, the height of the container unit is between 1.7 and 1.8 m, and the length of the container unit is between 5.6 and 6.0 m. Such dimensions allow two container units to be packed in one 40 foot high cube shipping container so that the container units each lie on one of their side walls inside the shipping container and this lowers the transportation cost.

List of figures

In the following the invention will described in more detail by referring to the figures, of which

Figure 1 shows an electrolytic cell according to a first embodiment,

Figure 2 shows the electrolytic cell shown in figure 1 as seen from above,

Figure 3 shows the electrolytic cell shown in figure 1 as seen from one end,

Figure 4 shows the electrolytic cell shown in figure 1 as seen from the other end,

Figure 5 shows the electrolytic cell shown in figure 1 as cut along line B – B in figure 2,

Figure 6 shows the electrolytic cell shown in figure 1 as cut along line A – A in figure 5,

Figure 7 shows an electrolytic cell according to a second embodiment,

Figure 8 shows the electrolytic cell shown in figure 7 as seen from above,

Figure 9 shows the electrolytic cell shown in figure 7 as seen from one end,

Figure 10 shows the electrolytic cell shown in figure 7 as seen from the other end,

Figure 11 shows the electrolytic cell shown in figure 7 as cut along line B – B in figure 8,

Figure 12 shows the electrolytic cell shown in figure 7 as cut along line A – A in figure 11,

Figure 13 shows an electrolytic cell according to a third embodiment,

Figure 14 shows the electrolytic cell shown in figure 13 as seen from above,

Figure 15 shows the electrolytic cell shown in figure 13 as seen from one end,

Figure 16 shows the electrolytic cell shown in figure 13 as seen from the other end,

Figure 17 shows the electrolytic cell shown in figure 13 as cut along line B – B in figure 14,

Figure 18 shows the electrolytic cell shown in figure 13 as cut along line A – A in figure 17, and

Figure 19 shows an electrolytic cell according to the second embodiment shown in figures 7 to 12 where in the first part is arranged a first row of anodes and cathodes in alternating order.

Detailed description of the invention

The invention relates to a method for manufacturing an electrolytic cell for corrosive electrolyte and for use in an electrolysis process such as for a process for electrowinning or electrorefining of metals and to an electrolytic cell for corrosive electrolyte and for use in an electrolysis process such as for a process for electrowinning or electrorefining of metals.

First the method and some preferred embodiments and variants thereof will be described in greater detail.

The method comprises a first providing step for providing a container unit 1 having an inner space (not marked with a reference numeral) limited by a bottom 2, a first side wall 3

extending from a first side edge 4 of the bottom 2, a second side wall 5 extending from a second side edge 6 of the bottom 2, a first end wall 7 extending from a first end edge 8 of the bottom 2, and a second end wall 9 extending from a second end edge 10 of the bottom 2.

The method comprises additionally a second providing step for providing a support member 11 designed and dimensioned to extend at least partly inside the inner space of the container unit 1 between the first end wall 7 of the container unit 1 and the second end wall 9 of the container unit 1.

The method comprises additionally an arranging step for arranging the support member 11 at least partly inside the inner space of the container unit 1 between the first end wall 7 of the container unit 1 and the second end wall 9 of the container unit 1 to divide the inner space of the container unit 1 into a first part 12 for a first row of anodes and cathodes 20 in alternating order and into a second part 13 for a second row of anodes and cathodes (not shown in the figures) in alternating order.

The method may additionally comprise a third providing step for providing an additional support member (not shown in the figures) designed and dimensioned to extend at least partly inside the inner space of the container unit 1 between the first end wall 7 of the container unit 1 and the second end wall 9 of the container unit 1 and an additional arranging step for arranging such additional support member at least partly inside the inner space of the container unit 1 between the first end wall 7 of the container unit 1 and the second end wall 9 of the container unit 1 to divide the inner space of the container unit 1 in addition to a first part 12 and in addition to a second part 13 additionally into a third part(not shown in the figures) for a third row of anodes and cathodes (not shown in the figures) in alternating order.

Figures 1 to 6 show an electrolytic cell manufactured according to a first embodiment of the method.

In this first embodiment of the method a support member 11 in the form of a prefabricated partition member designed and dimensioned to extend in the inner space of the container unit 1 between the first end wall 7 and the second end wall 9 of the container unit 1 and the bottom 2 of the container unit 1 is provided in the second providing step.

In this first embodiment of the method the arranging step comprises arranging said prefabricated partition member in the inner space of the container unit 1, and attaching the prefabricated partition member to the end walls of the container unit 1 and to the bottom 2 of the container unit 1 to divide the inner space of the container unit 1 into a first part 12 and into a second part 13 such that the first part 12 forms a first sub-inner space for a first row of anodes and cathodes 20 in alternating order, and such that the second part 13 forms a second sub-inner space that is separated from the first sub-inner space and that is for a second row of anodes and cathodes in alternating order.

In this first embodiment of the electrolytic cell the first sub-inner space can be separated by the prefabricated partition member from the second sub-inner space so that electrolyte is

prevented from flowing between the first sub-inner space and the second sub-inner space.

Figures 7 to 12 show an electrolytic cell manufactured according to a second embodiment of the method.

In this second embodiment of the method the second providing step comprises providing a support member 11 in the form of a prefabricated partition member designed and dimensioned to extend in the inner space of the container unit 1 between the first end wall 7 and the second end wall 9 of the container unit 1 and the bottom 2 of the container unit 1 and having at least one opening 14 allowing electrolyte to freely mix between the first sub-inner space and the second sub-inner space.

In this second embodiment of the method the arranging step comprises arranging said prefabricated partition member in the inner space of the container unit 1, and attaching the prefabricated partition member to the end walls of the container unit 1 and to the bottom 2 of the container unit 1 to divide the inner space of the container unit 1 into a first part 12 and into a second part 13 such that the first part 12 forms a first sub-inner space for a first row of anodes and cathodes 20 in alternating order, and such that the second part 13 forms a second sub-inner space that is separated from the first sub-inner space and that is for a second row of anodes and cathodes in alternating order.

Said at least one opening 14 can be formed in the edge of the prefabricated partition member, as is the case in the embodiment shown in figures 7 to 12. Alternatively said at least one opening 14 can be surrounded by material of the prefabricated partition member.

Figures 13 to 18 show an electrolytic cell manufactured according to a third embodiment of the method.

In this third embodiment of the method the second providing step comprises providing a support member 11 in the form of a prefabricated beam designed and dimensioned to extend in the inner space of the container unit 1 between the first end wall 7 and the second end wall 9 of the container unit 1 and allowing electrolyte to freely mix between the first part 12 and the second part 13.

In this third embodiment of the method the arranging step comprises arranging said prefabricated beam in the inner space of the container unit 1, and attaching the prefabricated beam to the first end wall 7 and to the second end wall 9 of the container unit 1 to divide the inner space of the container unit 1 into a first part 12 for a first row of anodes and cathodes 20 in alternating order and into a second part 13 for a second row of anodes and cathodes in alternating order.

The first part 12 for a first row of anodes and cathodes 20 in alternating order and the second part 13 for a second row of anodes and cathodes in alternating order formed in the method have preferably, but not necessarily, the same dimensions and form.

The method comprises preferably, but not necessarily, arranging the support member 11 in the arranging step so that the first row of anodes and cathodes 20 to be arranged in alternating

order in the first part 12 and second row of anodes and cathodes to be arranged in alternating order in the second part 13 will be parallel as is the case in the embodiments shown in the figures.

The method comprises preferably, but not necessarily, arranging the support member 11 in the arranging step so that the support member 11 and the first side wall 3 of the container unit 1 will form a first supporting arrangement (not marked with a reference numeral) in the first part 12 for indirect or direct support of the hanger bars or similar of the anodes and cathodes to be arranged in alternating order in the first part 12, and so that the support member 11 and the second side wall 5 of the container unit 1 will form a second supporting arrangement (not marked with a reference numeral) in the second part 13 for indirect or direct support of the hanger bars or similar of the anodes and cathodes to be arranged in alternating order in the second part 13.

In an embodiment of the method, the first providing step comprises providing a container unit 1 made of polymer concrete, concrete lined with glass fibre or entirely from glass fibre or polymeric material.

In an embodiment of the method, the second providing step comprises providing a prefabricated partition member made of polymer concrete, concrete lined with glass fibre or entirely from glass fibre or polymeric material.

The method comprises preferably, but not necessarily, providing in the first providing step a container unit 1 made of polymer concrete, concrete lined with glass fibre or entirely from glass fibre or polymeric material, and providing in the second providing step a prefabricated partition member made of polymer concrete, concrete lined with glass fibre or entirely from glass fibre or polymeric material.

The method comprises preferably, but not necessarily, providing in the first providing step a container unit 1 having the following dimensions:

- The width of the container unit 1 being between 2 and 3m, preferably between 2.5 and 2.6 m
- The height of the container unit 1 being between 1 and 2 m, preferably between 1.7 and 1.8 m
- The length of the container unit 1 being between 4 and 12 m, preferably between 5.6 and 6.0 m

In a preferred embodiment of the method the first providing step includes providing two container units 1 having the following dimensions:

- The width of each of said two container units 1 being between 2.5 and 2.6 m
- The height of each of said two container units 1 being between 1.7 and 1.8 m
- The length of each of said two container units 1 being between 5.6 and 6.0 m

This preferred embodiment of the method includes a packing step for packing said two container units 1 in one 40 foot shipping container, preferably in a 40 foot high cube shipping

container so that said two container units 1 each lie on one of their side walls (3 or 5 inside the shipping container.

The method comprises preferably, but not necessarily, providing the electrolytic cell with a common inlet 15 for feeding electrolyte to both the first part 12 and the second part 13.

The method comprises preferably, but not necessarily, providing in the first providing step a container unit 1 comprising a first overflow bowl 16 for the first part 12 and a second overflow bowl 17 for the second part 13.

The first providing step comprises preferably, but not necessarily, providing a container unit 1 provided with supports 18 for walking bridges (not shown in the figures) to be placed between the electrolytic cells in the tankhouse where the electrolytic cell are used.

The method can comprise a step for providing at least one of the support member 11, the first side wall 3 and the second side wall 5 with a busbar arrangement 19 for supplying electrical energy to the anodes and cathodes.

Next the electrolytic cell and some preferred embodiments and variants thereof will be described in greater detail.

The electrolytic cell comprises a container unit 1 having an inner space limited by a bottom 2, a first side wall 3 extending from a first side edge 4 of the bottom 2, a second side wall 5 extending from a second side edge 6 of the bottom 2, a first end wall 7 extending from a first end edge 8 of the bottom 2, and a second end wall 9 extending from a second end edge 10 of the bottom 2.

The electrolytic cell comprises a support member 11 arranged at least partly in the inner space of the container unit 1 between the first end wall 7 of the container unit 1 and the second end wall 9 of the container unit 1 to divide the inner space of the container unit 1 into a first part 12 for a first row of anodes and cathodes 20 in alternating order and into a second part 13 for a second row of anodes and cathodes (not shown in the figures) in alternating order.

The support member 11 can be in the form of a prefabricated support member 11 that is arranged at least partly in the inner space of the container unit 1 between the first end wall 7 and the second end wall 9 of the container unit 1.

The electrolytic cell may additionally comprise an additional support member (not shown in the figures) designed and dimensioned to extend at least partly inside the inner space of the container unit 1 between the first end wall 7 of the container unit 1 and the second end wall 9 of the container unit 1 and such additional support member may be arranged at least partly inside the inner space of the container unit 1 between the first end wall 7 of the container unit 1 and the second end wall 9 of the container unit 1 to divide the inner space of the container unit 1 in addition to a first part 12 and in addition to a second part 13 additionally into a third part (not shown in the figures) for a third row of anodes and cathodes (not shown in the figures) in alternating order.

Figures 1 to 6 show an electrolytic cell according to a first embodiment.

In this first embodiment of the electrolytic cell the support member 11 is in the form of a prefabricated partition member designed and dimensioned to extend in the inner space of the container unit 1 between the first end wall 7 of the container unit 1 and the second end wall 9 of the container unit 1 and the bottom 2 of the container unit 1.

Said prefabricated partition member is in this first embodiment of the electrolytic cell arranged in the inner space of the container unit 1 and is attached to the first end wall 7 of the container unit 1 and to the second end wall 9 of the container unit 1 and to the bottom 2 of the container unit 1 to divide the inner space of the container unit 1 into a first part 12 in the form of a first sub-inner space for a first row of anodes and cathodes 20 in alternating order and into a second part 13 in the form of a second sub-inner space for a second row of anodes and cathodes in alternating order.

In this first embodiment of the electrolytic cell the first sub-inner space can be separated by the prefabricated partition member from the second sub-inner space so that electrolyte is prevented from flowing between the first sub-inner space and the second sub-inner space.

Figures 7 to 12 show an electrolytic cell according to a second embodiment.

In this second embodiment of the electrolytic cell the support member 11 is in the form of a prefabricated partition member designed and dimensioned to extend in the inner space of the container unit 1 between the first end wall 7 and the second end wall 9 of the container unit 1 and the bottom 2 of the container unit 1.

In this second embodiment of the electrolytic cell the prefabricated partition member has at least one opening 14 allowing electrolyte to freely mix between the first sub-inner space and the second sub-inner space.

Said prefabricated partition member is in this second embodiment arranged in the inner space of the container unit 1 and is attached to the first end wall 7 of the container unit 1 and to the second end wall 9 of the container unit 1 and to the bottom 2 of the container unit 1 to divide the inner space of the container unit 1 into a first part 12 in the form of a first sub-inner space for a first row of anodes and cathodes 20 in alternating order and into a second part 13 in the form of a second sub-inner space for a second row of anodes and cathodes in alternating order.

Figures 13 to 18 show an electrolytic cell according to a third embodiment.

In this third embodiment of the electrolytic cell the support member 11 is in the form of a prefabricated beam member designed and dimensioned to extend in the inner space of the container unit 1 between the first end wall 7 and the second end wall 9 of the container unit 1. Said prefabricated beam member is arranged in the inner space of the container unit 1 and is attached to the end walls of the container unit 1 to divide the inner space of the container unit 1 into a first part 12 for a first row of anodes and cathodes 20 in alternating order and into a second part 13 for a second row of anodes and cathodes in alternating order.

In the electrolytic cell, the support member 11 is preferably, but not necessarily, arranged so that the first row of anodes and cathodes 20 to be arranged in alternating order in the first part

12 and second row of anodes and cathodes to be arranged in alternating order in the second part 13 will be parallel.

In the electrolytic cell, the support member 11 is preferably, but not necessarily, arranged so that the support member 11 and the first side wall 3 of the container unit 1 forms a first supporting arrangement in the first part 12 for indirect or direct support of the hanger bars or similar of the anodes and cathodes in the first row of anodes and cathodes 20 to be arranged in alternating order in the first part 12, and so that the support member 11 and the second side wall 5 of the container unit 1 forms a second supporting arrangement in the second part 13 for indirect or direct support of the hanger bars or similar of the anodes and cathodes in the second row of anodes and cathodes to be arranged in alternating order in the second part 13.

The container unit 1 is preferably, but not necessarily, made of polymer concrete, concrete lined with glass fibre or entirely from glass fibre or polymeric material.

The support member 11 is preferably, but not necessarily, made of polymer concrete, concrete lined with glass fibre or entirely from glass fibre or polymeric material.

The container unit 1 is preferably, but not necessarily, made of polymer concrete, concrete lined with glass fibre or entirely from glass fibre or polymeric material, and the support member 11 being made of polymer concrete, concrete lined with glass fibre or entirely from glass fibre or polymeric material.

The container unit 1 has preferably, but not necessarily, the following dimensions:

- The width of the container unit 1 being between 2 and 3m, preferably between 2.5 and 2.6 m
- The height of the container unit 1 being between 1 and 2 m, preferably between 1.7 and 1.8 m
- The length of the container unit 1 being between 4 and 12 m, preferably 5.6 and 6.0 m

The electrolytic cell has preferably, but not necessarily, a common inlet 15 for feeding electrolyte to both the first part 12 and the second part 13.

The container unit 1 comprises preferably, but not necessarily, a first overflow bowl 16 for the first part 12 and a second overflow bowl 17 for the second part 13.

The container unit 1 comprises preferably, but not necessarily, supports 18 for walking bridges (not shown in the figures) to be placed between the electrolytic cells in the tankhouse where the electrolytic cell are used.

At least one of the support member 11, the first side wall 3 and the second side wall 5 may be provided with a busbar arrangement 19 for supplying electrical energy to the anodes and cathodes.

It is apparent to a person skilled in the art that as technology advances, the basic idea of the invention can be implemented in various ways. The invention and its embodiments are therefore not restricted to the above examples, but they may vary within the scope of the claims.

Claims

1. A method for manufacturing an electrolytic cell for corrosive electrolyte and for use in an electrolysis process such as for a process for electrowinning or electrorefining of metals, wherein the method comprise

a first providing step for providing a container unit (1) having an inner space limited by a bottom (2), a first side wall (3) extending from a first side edge (4) of the bottom (2), a second side wall (5) extending from a second side edge (6) of the bottom (2), a first end wall (7) extending from a first end edge (8) of the bottom (2), and a second end wall (9) extending from a second end edge (10) of the bottom (2),

characterized

by a second providing step for providing a support member (11) designed and dimensioned to extend at least partly inside the inner space of the container unit (1) between the first end wall (7) of the container unit (1) and the second end wall (9) of the container unit (1), and

by an arranging step for arranging the support member (11) at least partly in the inner space of the container unit (1) between the first end wall (7) of the container unit (1) and the second end wall (9) of the container unit (1) to divide the inner space of the container unit (1) into a first part (12) for receiving a first row of anodes and cathodes (20) in alternating order and into a second part (13) for receiving a second row of anodes and cathodes in alternating order.

2. The method according to claim 1, **characterized**

by providing in the second providing step a support member (11) in the form of a prefabricated partition member designed and dimensioned to extend at least partly in the inner space of the container unit (1) between the first end wall (7) of the container unit (1) and the second end wall (9) of the container unit (1) and the bottom (2) of the container unit (1), and

by the arranging step comprises attaching the prefabricated partition member to the first end wall (7) of the container unit (1) and to the second end wall (9) of the container unit (1) and to the bottom (2) of the container unit (1) to divide the inner space of the container unit (1) into a first part (12) in the form a first sub-inner space for receiving a first row of anodes and cathodes (20) in alternating order and into a second part (13) in the form of a second sub-inner space for receiving a second row of anodes and cathodes in alternating order.

3. The method according to claim 2, **characterized** by arranging the prefabricated partition member in the arranging step so that at least one opening (14) allowing electrolyte to freely mix between the first sub-inner space and the second sub-inner space is formed.

4. The method according to claim 2, **characterized** by arranging the prefabricated partition member in the arranging step so that electrolyte is prevented from mixing between the first sub-

inner space and the second sub-inner space.

5. The method according to any of the claims 1 to 4, **characterized** by arranging the support member (11) in the arranging step so that a first row of anodes and cathodes (20) to be arranged in alternating order in the first part (12) and a second row of anodes and cathodes to be arranged in alternating order in the second part (13) will be parallel.

6. The method according to any of the claims 1 to 5, **characterized** by arranging the support member (11) in the arranging step so that the support member (11) and the first side wall (3) of the container unit (1) will form a first supporting arrangement in the first part (12) for indirect or direct support of the hanger bars or similar of the anodes and cathodes in the first row of anodes and cathodes (20) to be arranged in alternating order in the first part (12), and so that the support member (11) and the second side wall (5) of the container unit (1) will form a second supporting arrangement in the second part (13) for indirect or direct support of the hanger bars or similar of the anodes and cathodes in the second row of anodes and cathodes to be arranged in alternating order in the second part (13).

7. The method according to any of the claims 1 to 6, **characterized**

by providing in the first providing step a container unit (1) made of polymer concrete, concrete lined with glass fibre or entirely from glass fibre or polymeric material, and

by providing in the second providing step a prefabricated partition member made of polymer concrete, concrete lined with glass fibre or entirely from glass fibre or polymeric material.

8. The method according to any of the claims 1 to 7, **characterized** by providing in the first providing step a container unit (1) having the following dimensions:

- The width of the container unit (1) being between 2 and 3m, preferably between 2.5 and 2.6 m
- The height of the container unit (1) being between 1 and 2 m, preferably between 1.7 and 1.8 m
- The length of the container unit (1) being between 4 and 12 m, preferably between 5.6 and 6.0 m.

9. The method according to any of the claims 1 to 7, **characterized**

by providing in the first providing step two container units (1) having the following dimensions:

- The width of each of said two container units (1) being between 2.5 and 2.6 m
- The height of each of said two container units (1) being between 1.7 and 1.8 m
- The length of each of said two container units (1) being between 5.6 and 6.0 m

and by a packing step for packing said two container units (1) in one 40 foot shipping container, preferably in a 40 foot high cube shipping container so that the container units (1) each lie on one of their side walls (3 or 5) inside the shipping container.

10. The method according to any of the claims 1 to 9, **characterized** by providing a common inlet (15) for feeding electrolyte to both the first part (12) and the second part (13).

11. The method according to any of the claims 1 to 10, **characterized** by providing in the providing step a container unit (1) comprising a first overflow bowl (16) for the first part (12) and a second overflow bowl (17) for the second part (13).

12. An electrolytic cell for corrosive electrolyte and for use in an electrolysis process such as for a process for electrowinning or electrorefining of metals, wherein the electrolytic cell comprises

a container unit (1) having an inner space limited by a bottom (2), a first side wall (3) extending from a first side edge (4) of the bottom (2), a second side wall (5) extending from a second side edge (6) of the bottom (2), a first end wall (7) extending from a first end edge (8) of the bottom (2), and a second end wall (9) extending from a second end edge (10) of the bottom (2),

characterized

by a support member (11) designed and dimensioned to extend between the first end wall (7) of the container unit (1) and the second end wall (9) of the container unit (1), and

by the support member (11) being arranged at least partly in the inner space of the container unit (1) between the first end wall (7) of the container unit (1) and the second end wall (9) of the container unit (1) to divide the inner space of the container unit (1) into a first part (12) for receiving a first row of anodes and cathodes (20) in alternating order and into a second part (13) for receiving a second row of anodes and cathodes in alternating order.

13. The electrolytic cell according to claim 12, **characterized**

by the support member (11) being in the form of a prefabricated partition member designed and dimensioned to extend at least partly in the inner space of the container unit (1) between the first end wall (7) of the container unit (1) and the second end wall (9) of the container unit (1) and the bottom (2) of the container unit (1), and

by the prefabricated partition member being attached to the first end wall (7) of the container unit (1) and to the second end wall (9) of the container unit (1) and to the bottom (2) of the container unit (1) to divide the inner space of the container unit (1) into a first part (12) in the form a first sub-inner space for receiving a first row of anodes and cathodes (20) in alternating order and into a second part (13) in the form of a second sub-inner space for receiving a second

row of anodes and cathodes in alternating order.

14. The electrolytic cell according to claim 13, **characterized** by the prefabricated partition member being attached so that at least one opening (14) allowing electrolyte to freely mix between the first sub-inner space and the second sub-inner space is formed.

15. The electrolytic cell according to claim 13, **characterized** by arranging the prefabricated partition member being attached so that electrolyte is prevented from mixing between the first sub-inner space and the second sub-inner space.

16. The electrolytic cell according to any of the claims 12 to 15, **characterized** by the support member (11) being arranged so that a first row of anodes and cathodes (20) to be arranged in alternating order in the first part (12) and a second row of anodes and cathodes to be arranged in alternating order in the second part (13) will be parallel.

17. The electrolytic cell according to any of the claims 12 to 16, **characterized** by the support member (11) being arranged so that the support member (11) and the first side wall (3) of the container unit (1) forms a first supporting arrangement in the first part (12) for indirect or direct support of the hanger bars or similar of the anodes and cathodes in the first row of anodes and cathodes (20) to be arranged in alternating order in the first part (12), and so that the support member (11) and the second side wall (5) of the container unit (1) forms a second supporting arrangement in the second part (13) for indirect or direct support of the hanger bars or similar of the anodes and cathodes in the second row of anodes and cathodes to be arranged in alternating order in the second part (13).

18. The electrolytic cell according to any of the claims 12 to 17, **characterized**

by the container unit (1) being made of polymer concrete, concrete lined with glass fibre or entirely from glass fibre or polymeric material, and

by the support member (11) being made of polymer concrete, concrete lined with glass fibre or entirely from glass fibre or polymeric material.

19. The electrolytic cell according to any of the claims 12 to 18, **characterized** by the container unit (1) having the following dimensions:

- The width of the container unit (1) being between 2 and 3m, preferably between 2.5 and 2.6 m
- The height of the container unit (1) being between 1 and 2 m, preferably between 1.7 and 1.8 m
- The length of the container unit (1) being between 4 and 12 m, preferably 5.6 and

6.0 m.

20. The electrolytic cell according to any of the claims 12 to 19, **characterized** by a common inlet (15) for feeding electrolyte to both the first part (12) and the second part (13).

5

21. The electrolytic cell according to any of the claims 12 to 20, **characterized** by the container (1) comprising a first overflow bowl for the first part (12) and a second overflow bowl for the se unit cond part (13).

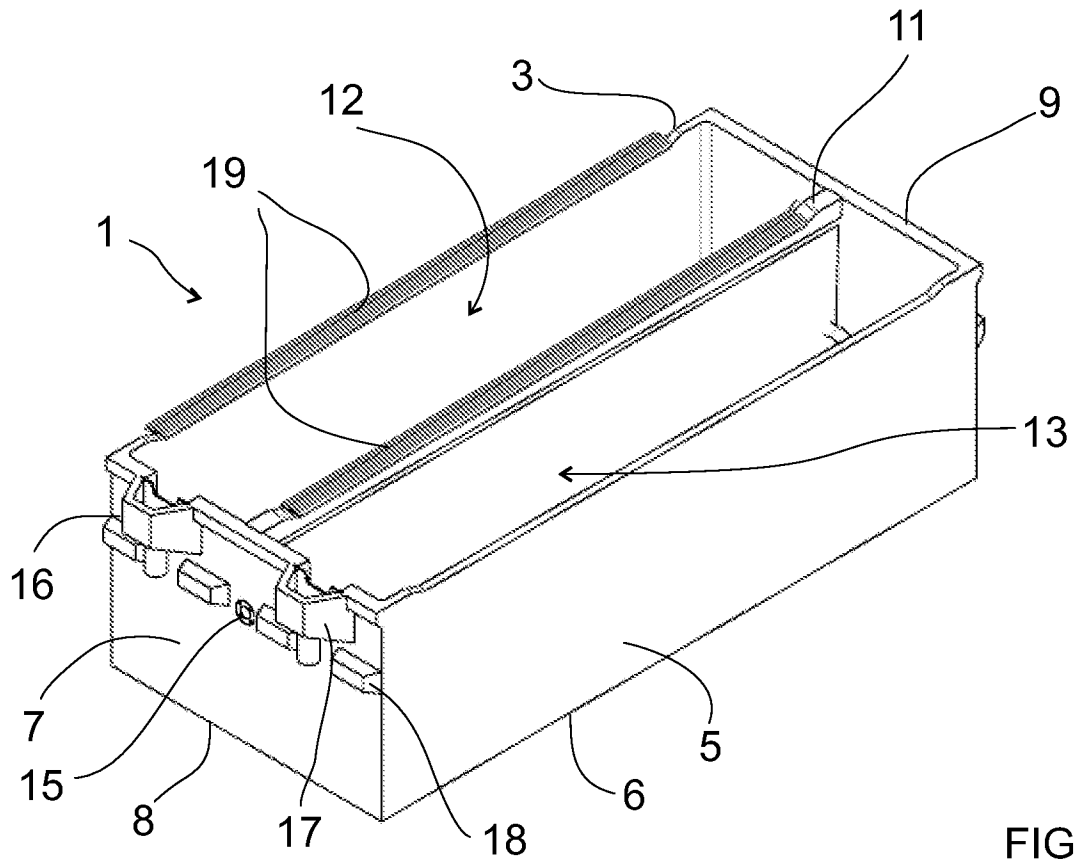

FIG 1

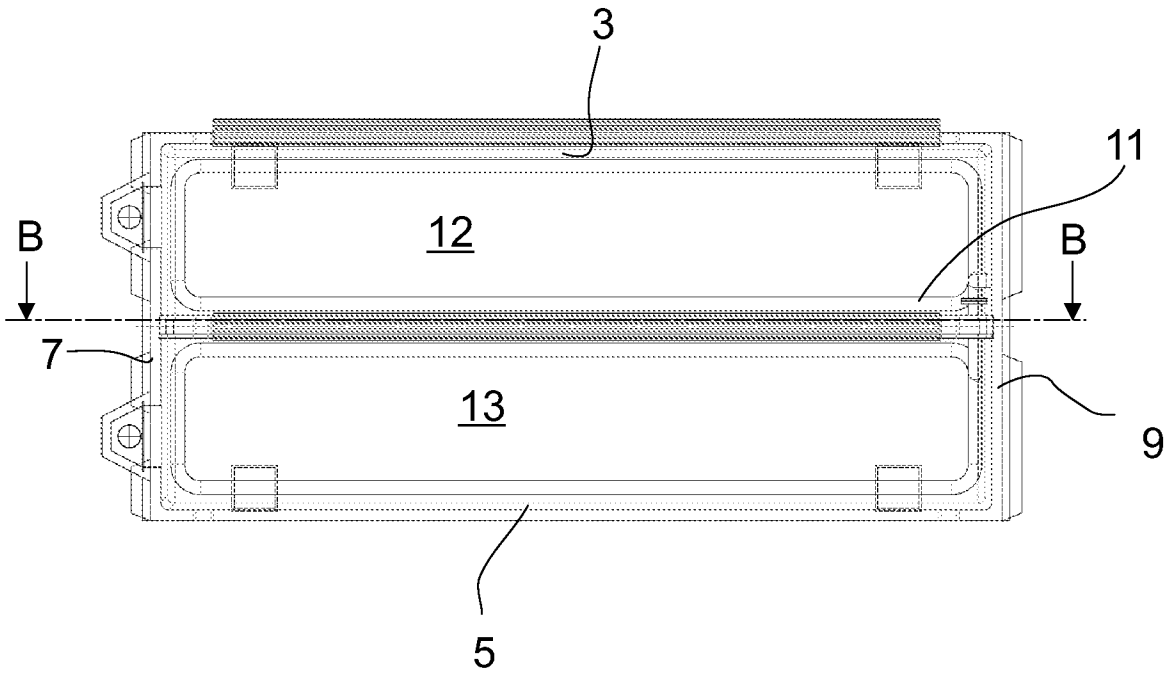

FIG 2

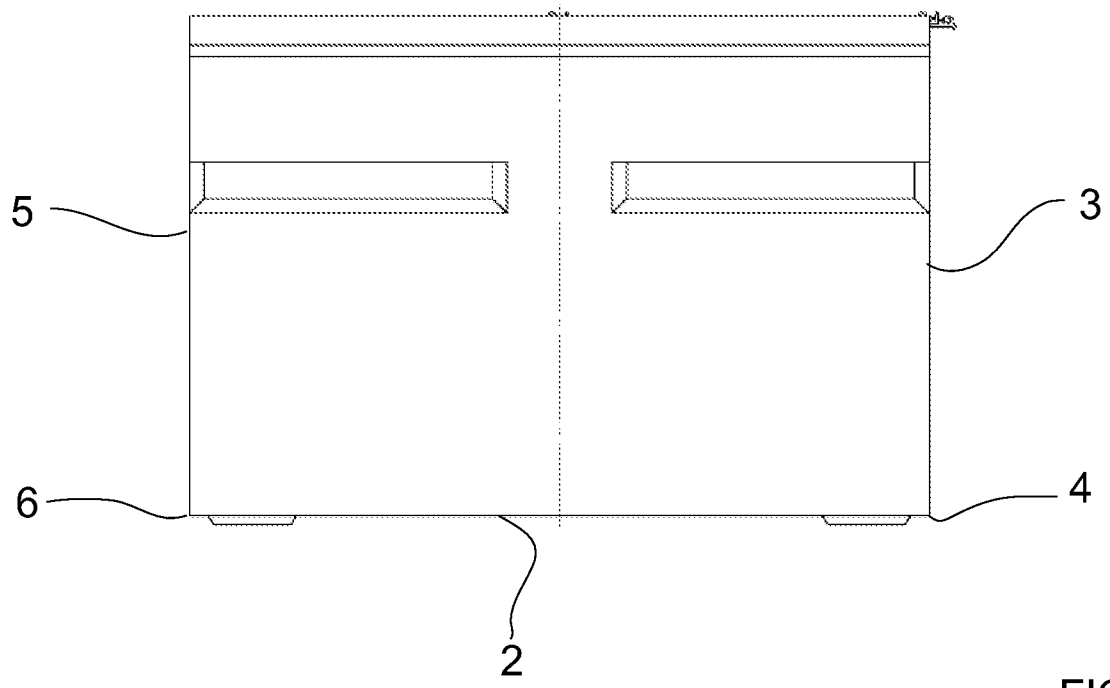

FIG 3

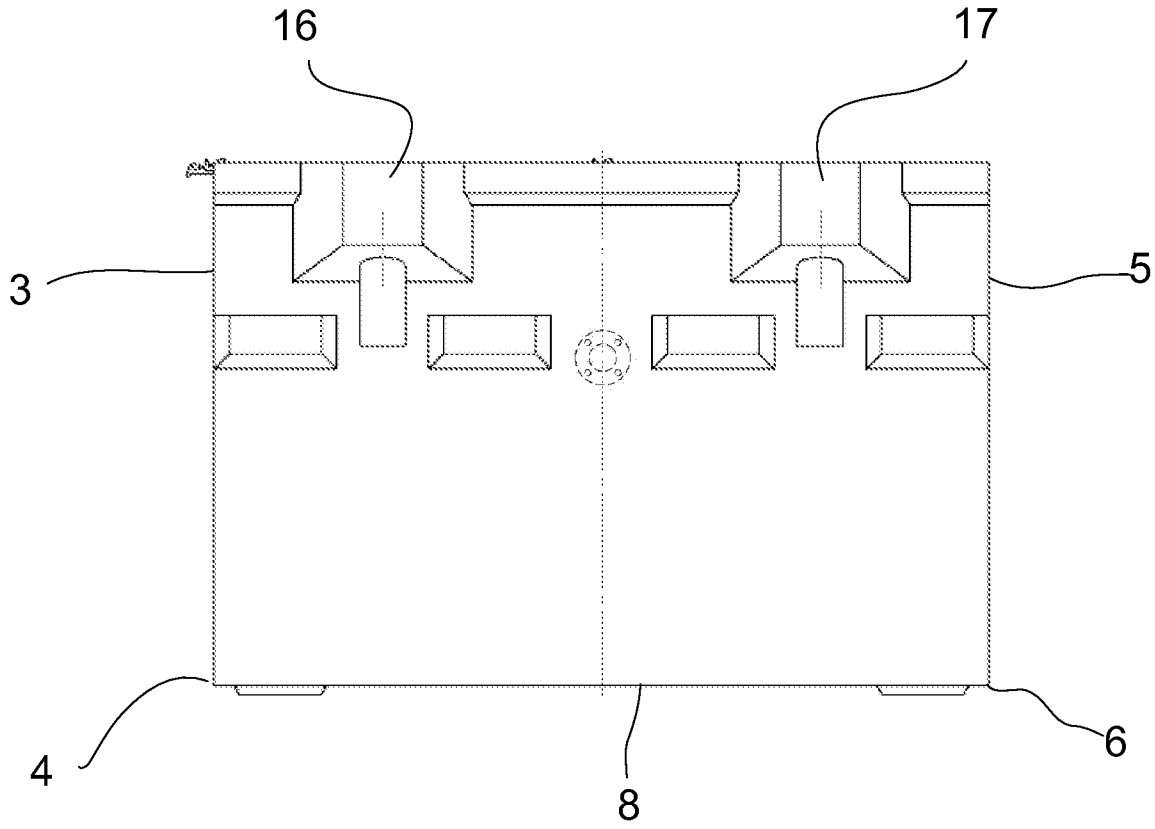

FIG 4

(FIG 2 B-B:)

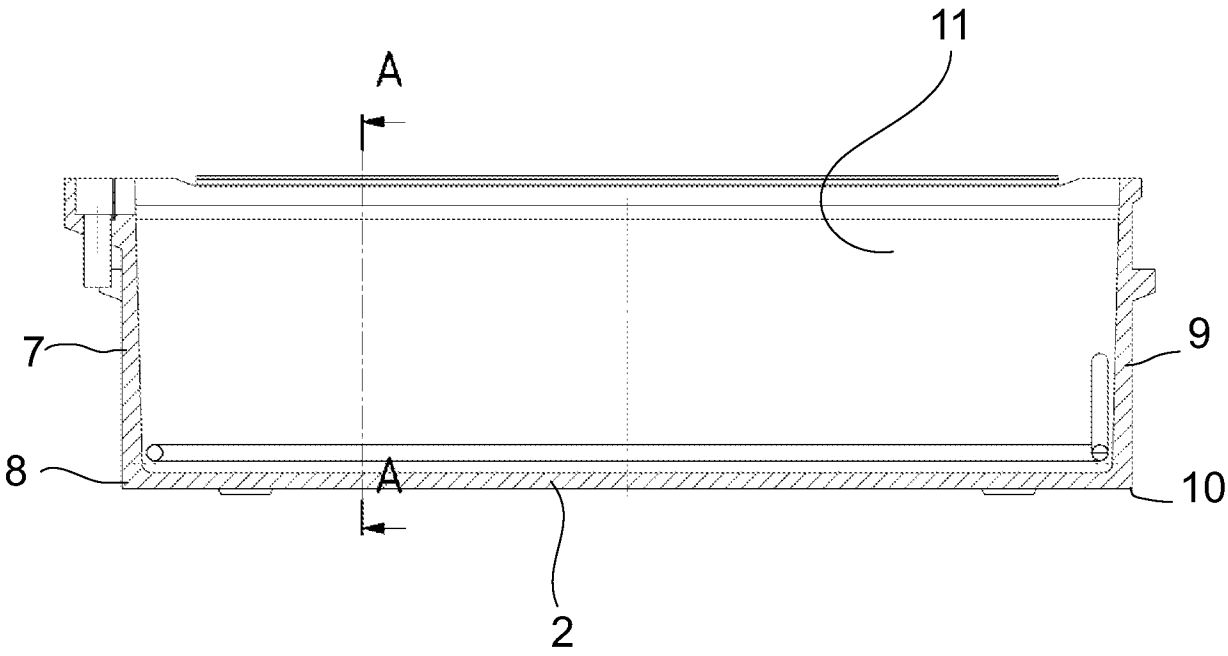

FIG 5

(FIG 5 A-A:)

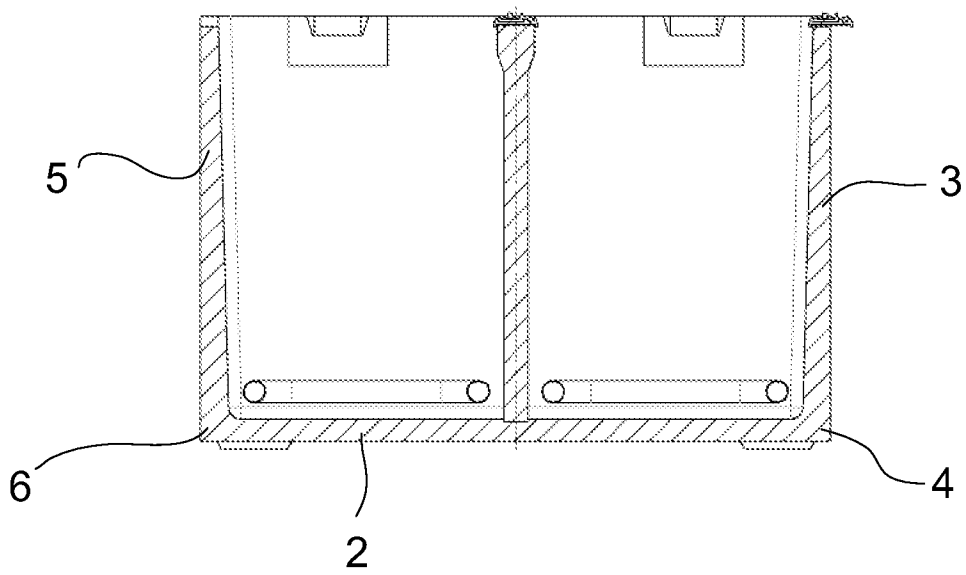

FIG 6

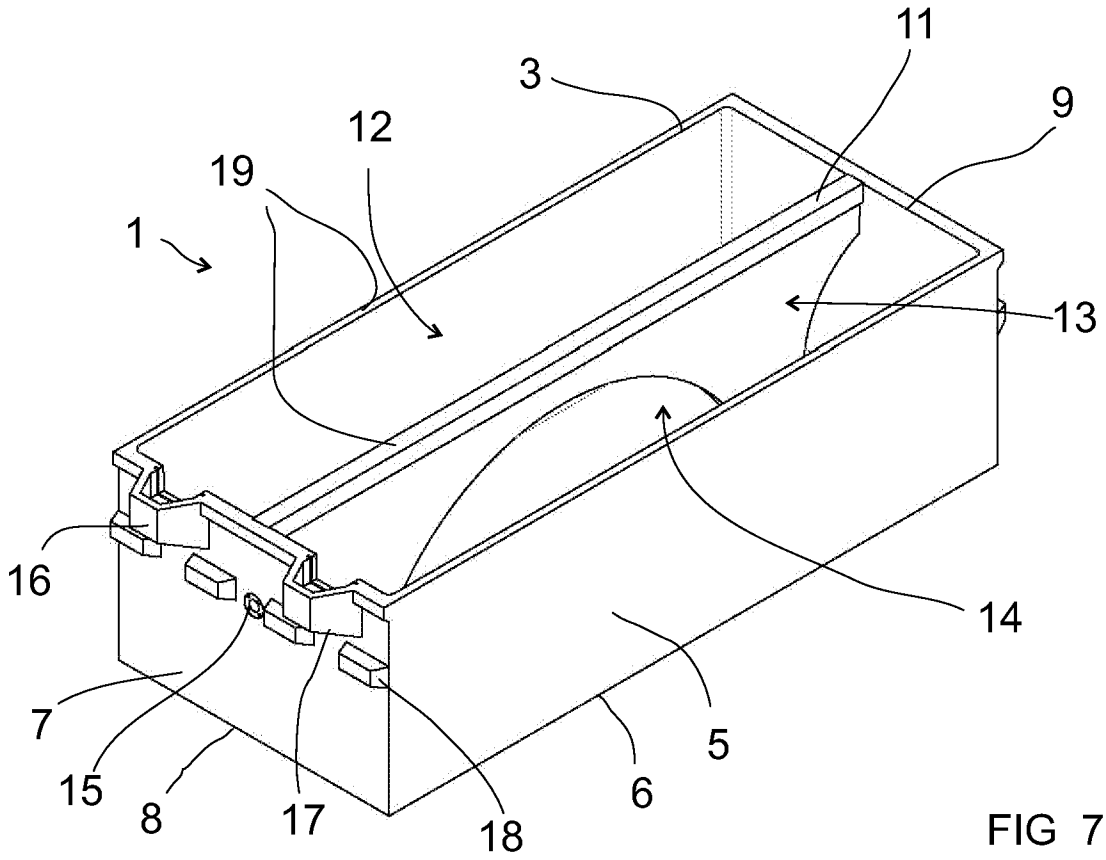

FIG 7

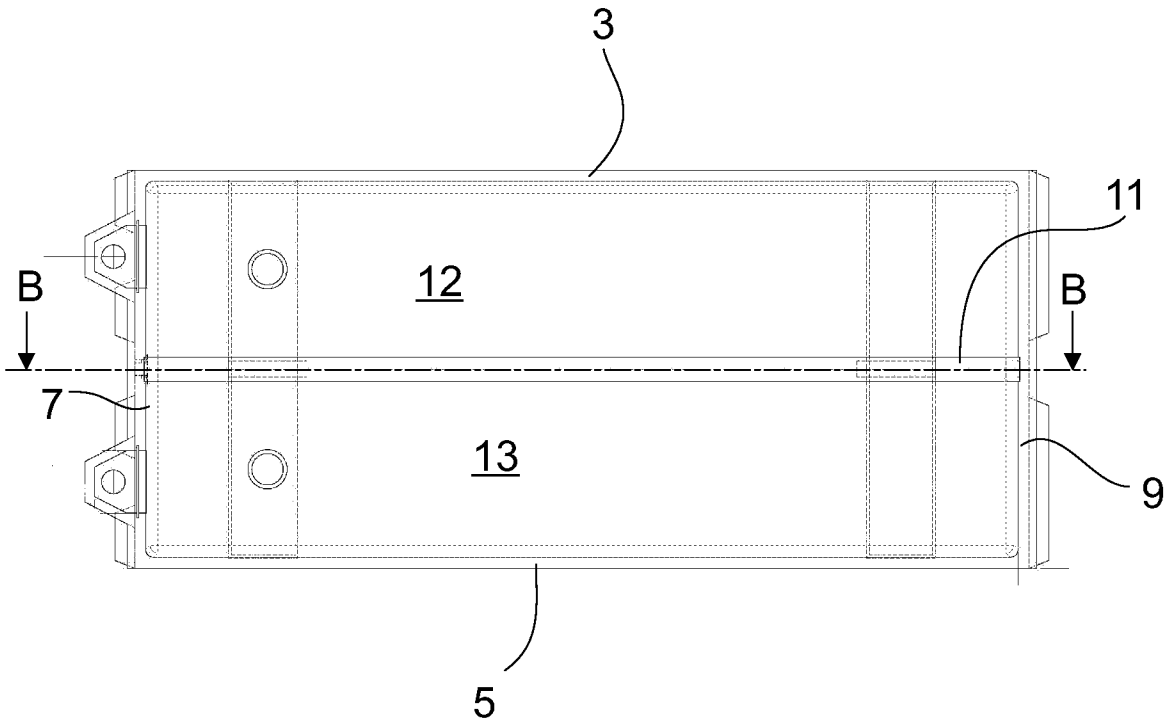

FIG 8

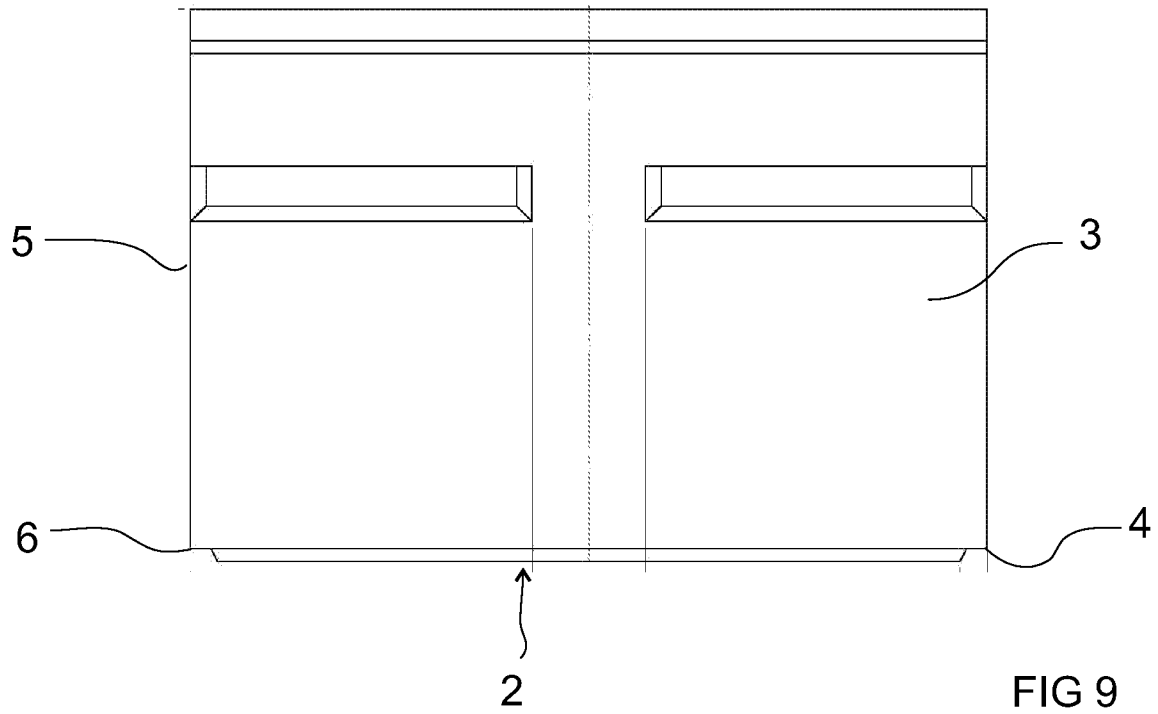

FIG 9

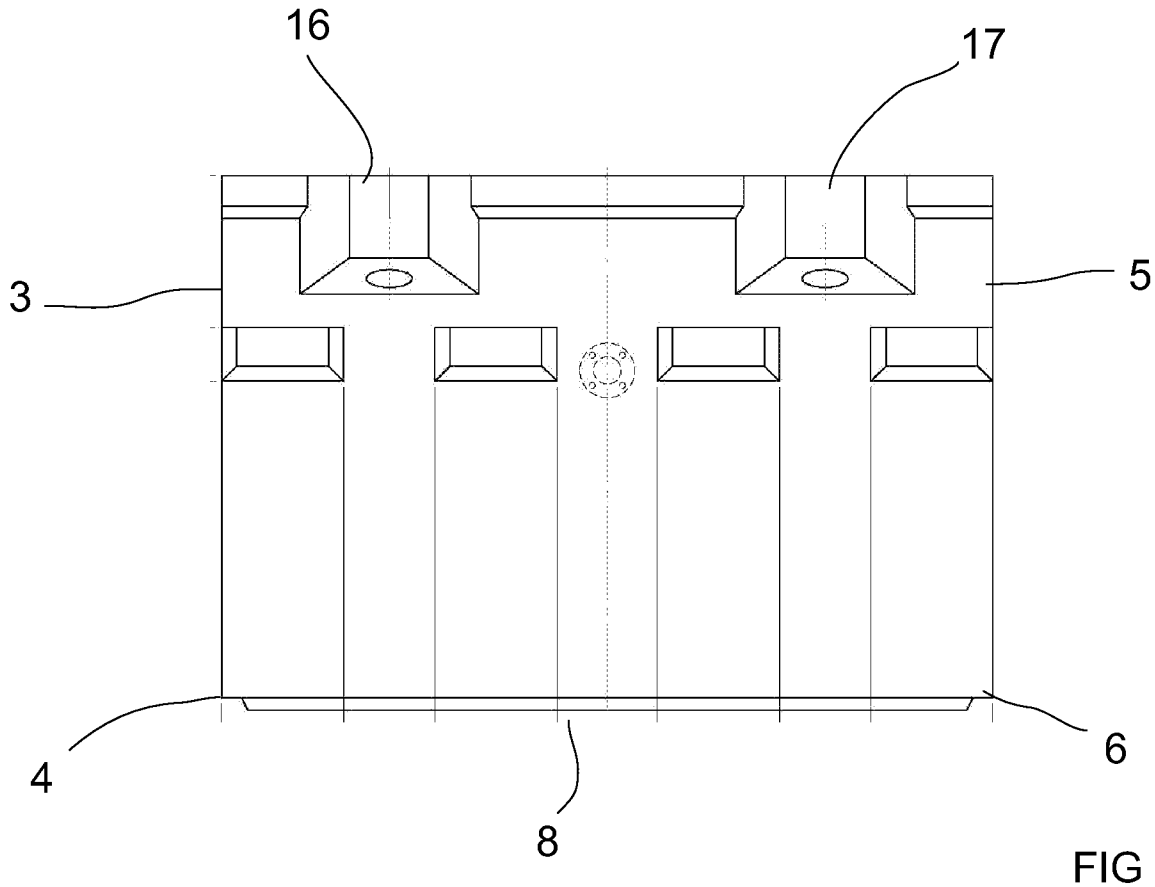

FIG 10

(FIG 8 B-B:)

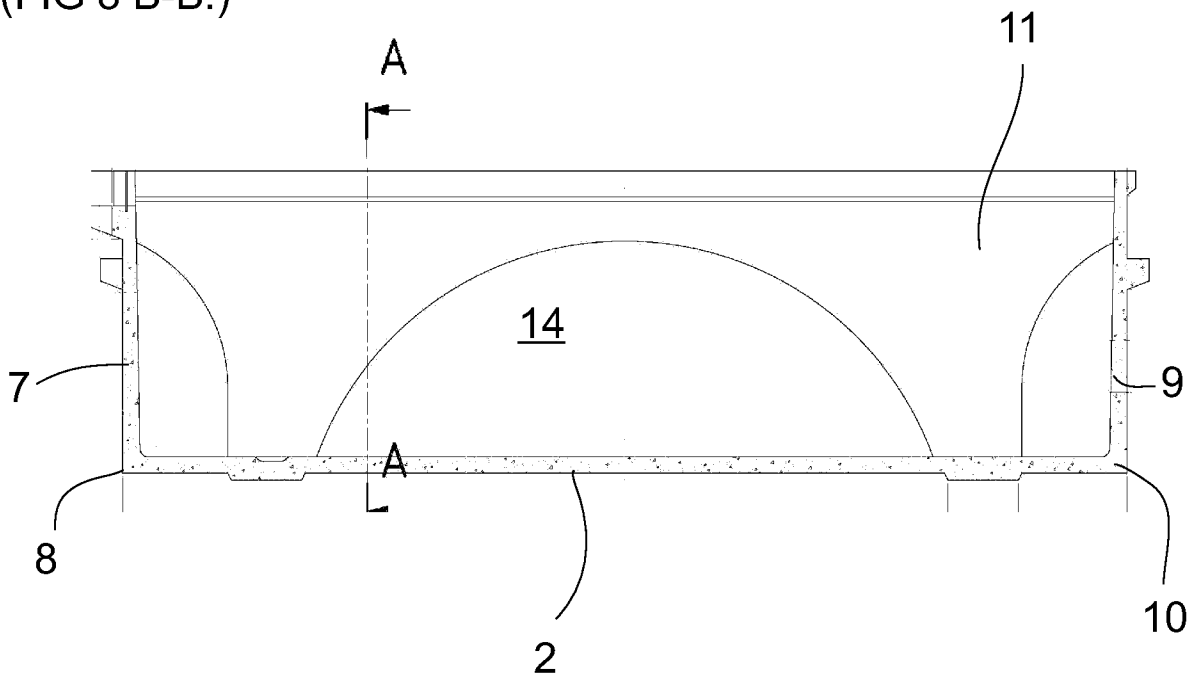

FIG 11

(FIG 11 A-A:)

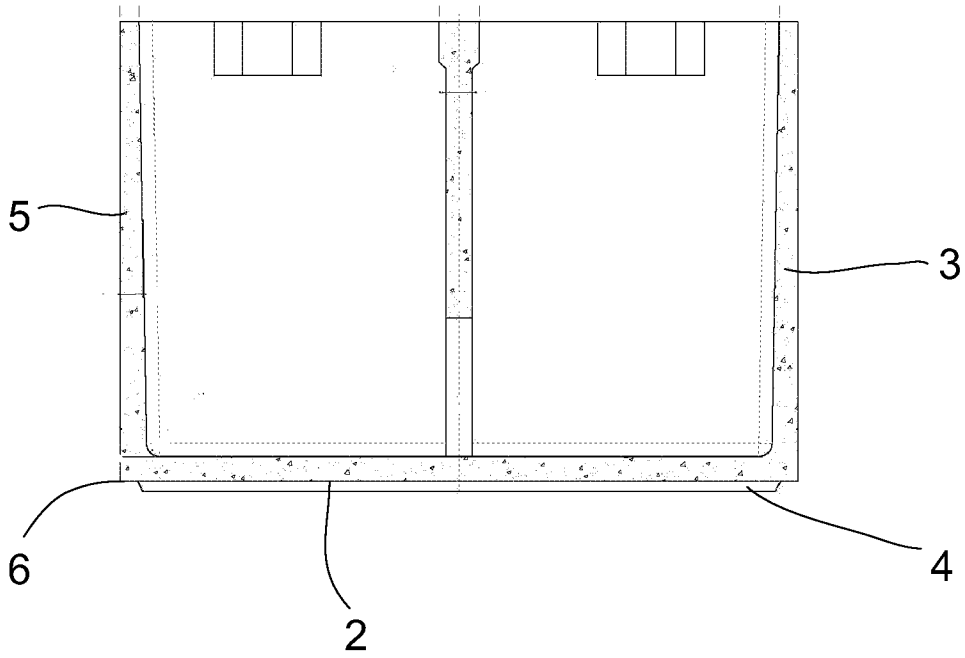

FIG 12

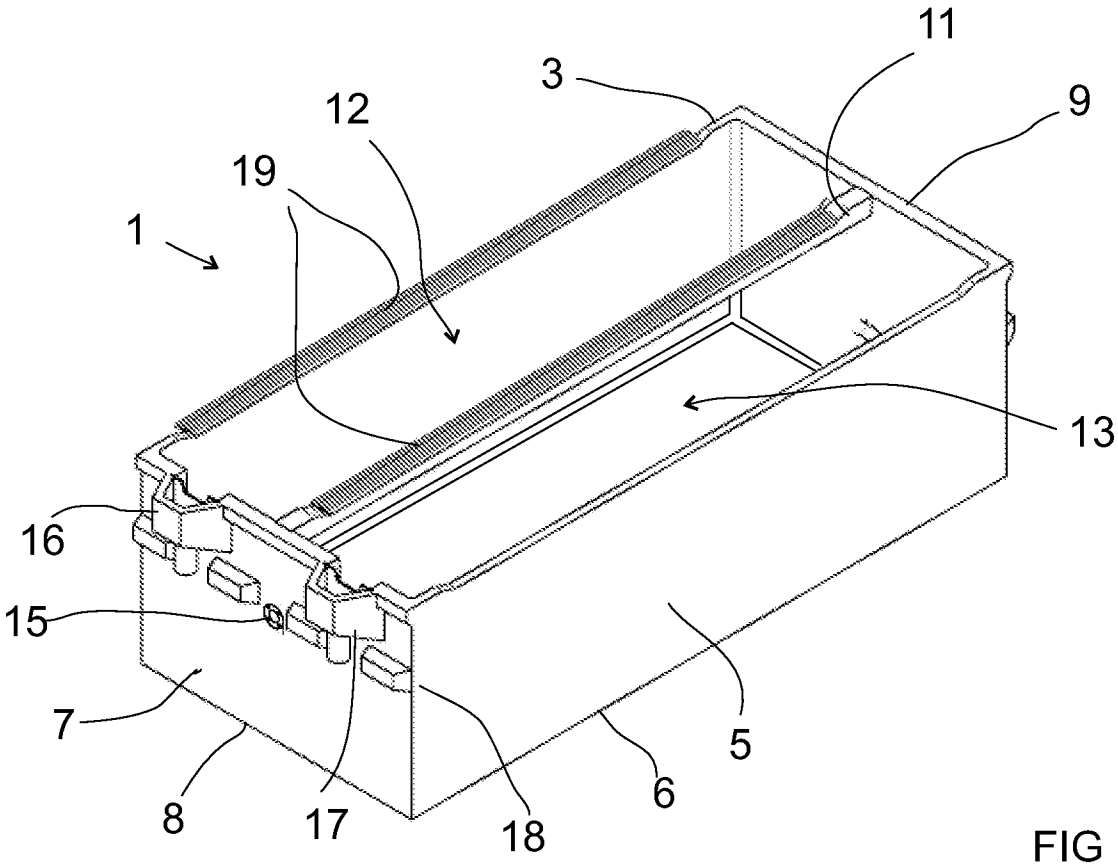

FIG 13

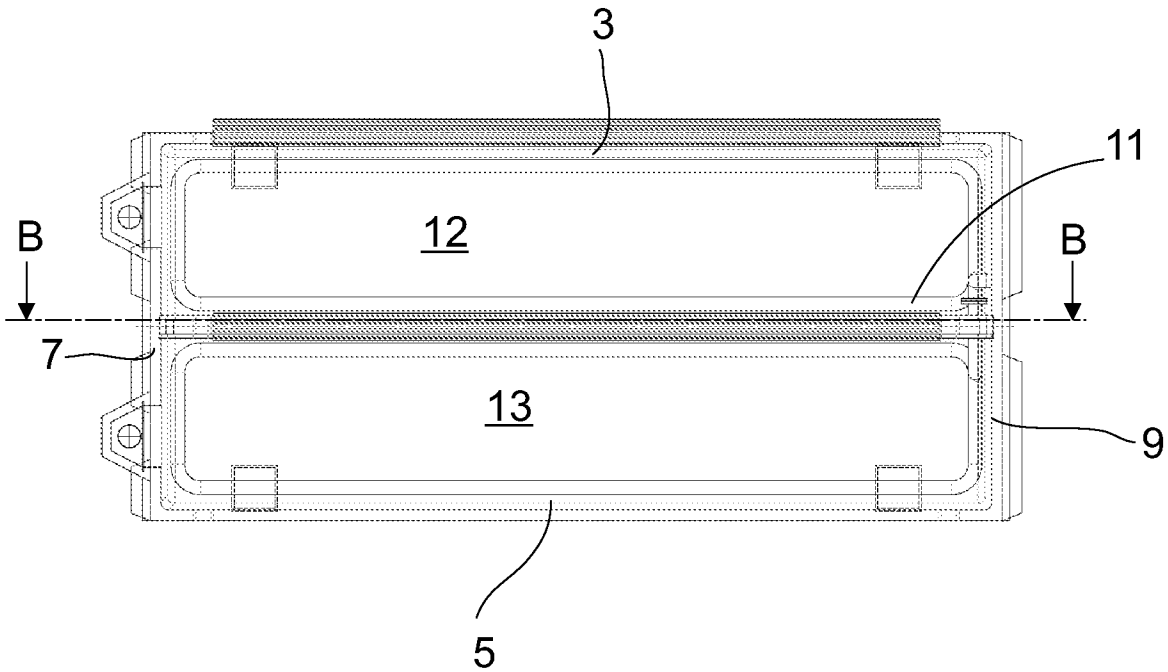

FIG 14

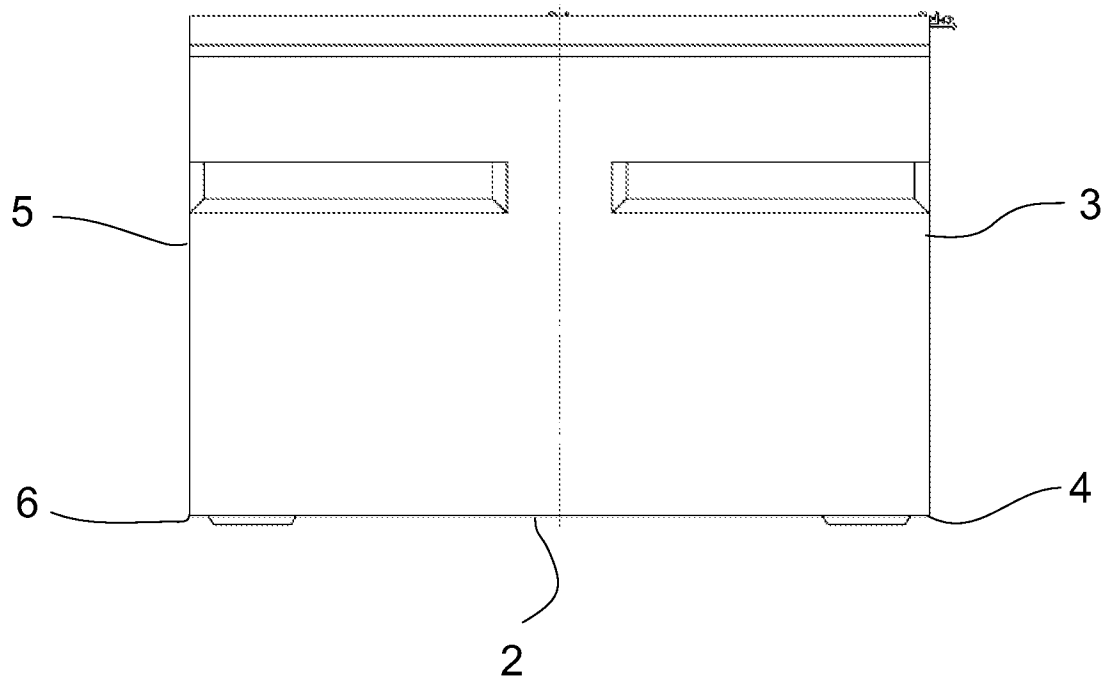

FIG 15

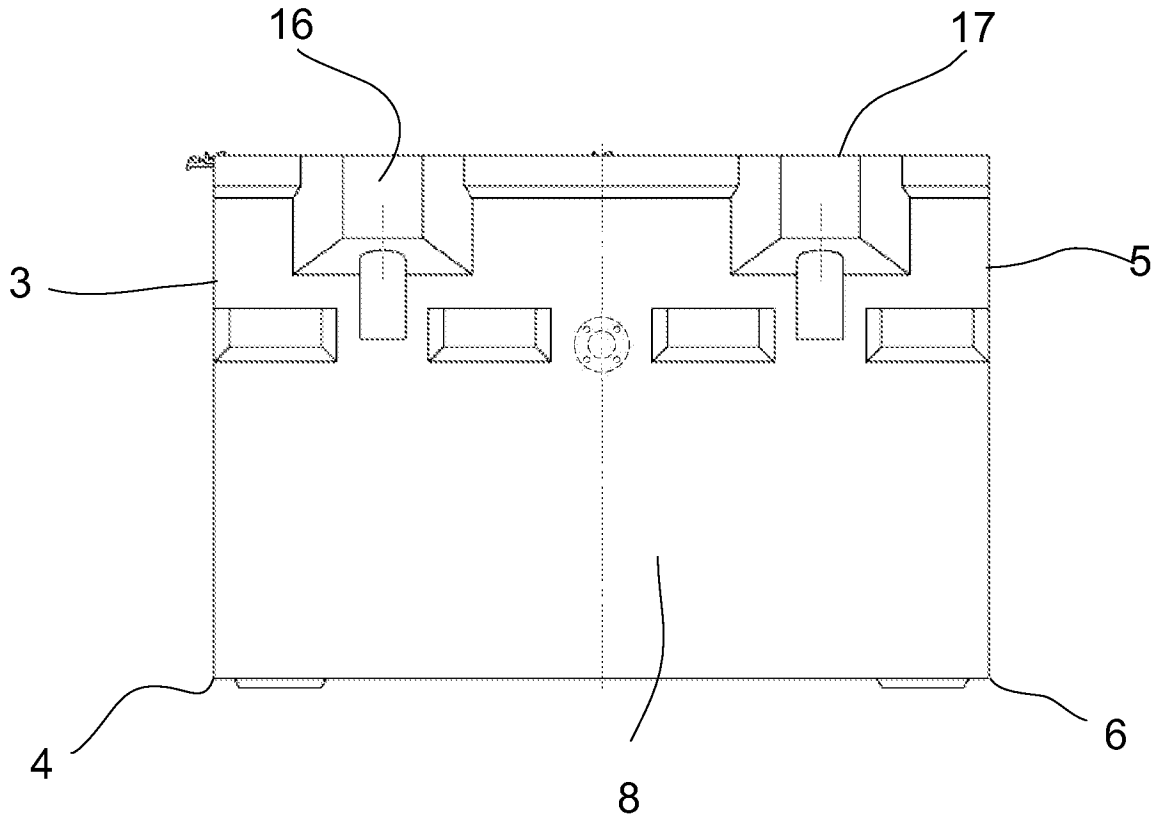

FIG 16

(FIG 14 B-B:)

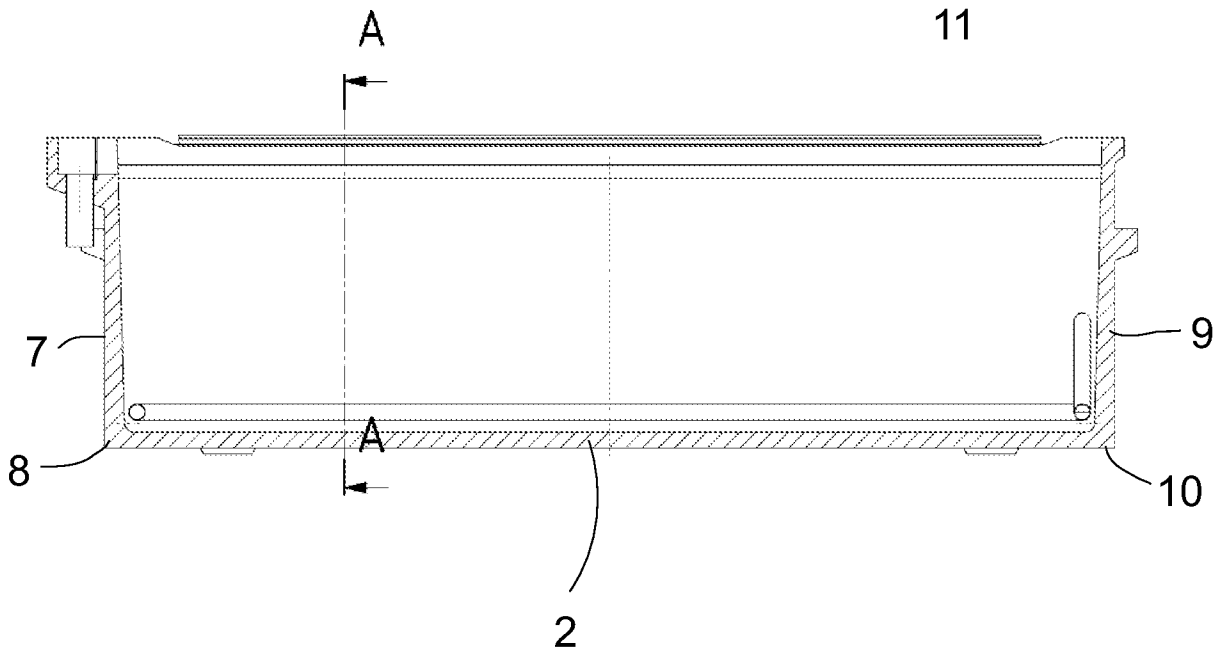

FIG 17

(FIG 17 A-A:)

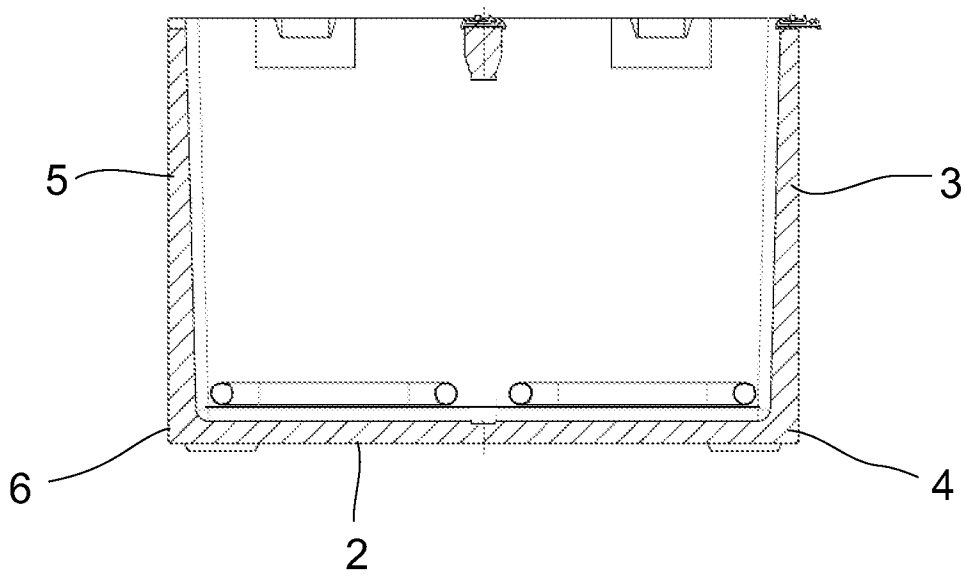

FIG 18

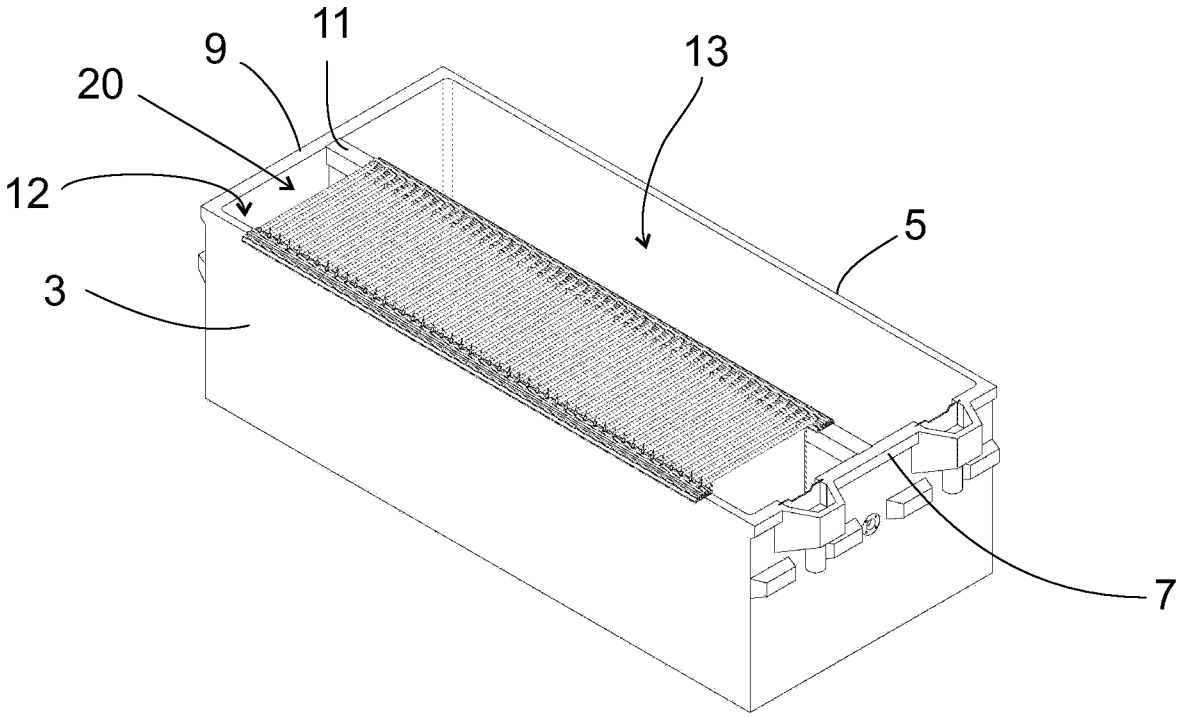

FIG 19

INTERNATIONAL SEARCH REPORT

International application No.
PCT/FI2013/051155

A. CLASSIFICATION OF SUBJECT MATTER

See extra sheet

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC: C25C, C25B, C25D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

FI, SE, NO, DK

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, WPI, XPTK, COMPDX, INSPEC, PUBCOMP, PUBSUBS

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 2351874 A2 (NOVEL COMPOSITES TECHNOLOGIES S A [CL]) 03 August 2011 (03.08.2011) page 2, paragraphs [0002], [0005]; page 3, paragraphs [0011]-[0013]; page 4, paragraphs [0029], [0032]; page 5, claim 1; page 7, claim 28; figures 1, 2, 3, 5	1, 2, 4-13, 15-21
Y		3, 14
Y	US 3682809 A (MARQUARDSON KENT F et al.) 08 August 1972 (08.08.1972) column 2, lines 40-48 and 57-59; figure 1	3, 14
A	US 4134806 A (DE NORA ORONZIO et al.) 16 January 1979 (16.01.1979) whole document	1-21

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:
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"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
21 February 2014 (21.02.2014)	06 March 2014 (06.03.2014)

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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/FI2013/051155

Patent document cited in search report	Publication date	Patent family members(s)	Publication date
EP 2351874 A2	03/08/2011	AU 2009310606 A1	06/05/2010
		CA 2742174 A1	06/05/2010
		CN 102257183 A	23/11/2011
		CN 102257183 B	25/12/2013
		EA 201100704 A1	30/04/2012
		EA 018370 B1	30/07/2013
		EP 2351874 B1	27/02/2013
		ES 2416208 T3	30/07/2013
		JP 2012506949 A	22/03/2012
		KR 20110098718 A	01/09/2011
		MX 2011004568 A	16/12/2011
		US 2011203919 A1	25/08/2011
		US 8454809 B2	04/06/2013
		WO 2010048739 A2	06/05/2010
US 3682809 A	08/08/1972	GB 1294783 A	01/11/1972
		SE 363124 B	07/01/1974
		SE 363124 C	18/09/1975
US 4134806 A	16/01/1979	AU 6491274 A	31/07/1975
		BE 810315 A1	16/05/1974
		CA 1063061 A1	25/09/1979
		DE 2404167 A1	01/08/1974
		DE 2404167 C2	14/08/1985
		FR 2215483 A1	23/08/1974
		FR 2215483 B1	09/06/1978
		GB 1434334 A	05/05/1976
		GB 1434335 A	05/05/1976
		IT 978581 B	20/09/1974
		JP S49105701 A	07/10/1974
		JP S5720393 B2	28/04/1982
		NO 141373 B	19/11/1979
		NO 141373 C	27/02/1980
		SE 405988 B	15/01/1979
		SE 405988 C	26/04/1979
		ZA 7400135 A	27/08/1975

INTERNATIONAL SEARCH REPORT

International application No.
PCT/FI2013/051155

CLASSIFICATION OF SUBJECT MATTER

Int.Cl.
C25C 7/00 (2006.01)