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(54) Titre : BATTERIE CONSTITUEE D'UNE PLURALITE DE CELLULES POSITIONNEES ET RELIEES ENTRE ELLES,
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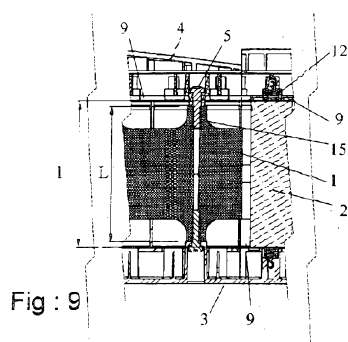


Fig : 9

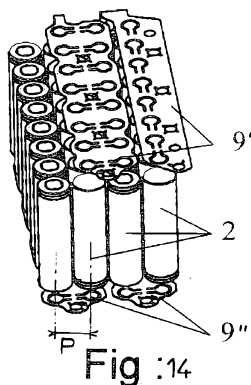


Fig :14

(57) Abstract: The invention relates to a battery including a plurality of juxtaposed cylindrical or prismatic cells (2) located in the through holes (6) of a separating and positioning crate (1), characterised in that the separating and positioning crate (1) is provided between two contact and holding plates (3, 4) having inner surfaces provided with one or more contact strips (9) attached without welding against said faces and ensuring the electric interconnection between a plurality of cells (9), wherein said contact strip (9) or each of said contact strips (9) is made of a flexible conducting material having a plurality of flexible contact tabs (10) cut in said contact strip(s) (9) and maintained against the terminals of the cells (2) by individual elastic pressure means (3, 4) secured by screwing onto the separating and positioning crate (1) so that said contact tabs (10) are individually pressed against one of the terminals or poles of said cells.

(57) Abrégé : Batterie constituée d'une pluralité de cellules cylindriques ou prismatiques juxtaposées (2) logées dans les alvéoles traversants (6) d'un casier séparateur et positionneur (1), caractérisée en ce que ce casier séparateur et positionneur (1) est disposé entre deux panneaux de contact et de maintien (3, 4) dont les faces internes sont munies d'une ou plusieurs bande(s) de contact (9) fixée(s), sans soudure, contre lesdites faces et assurant l'interconnexion électrique d'une pluralité de cellules, cette bande de contact (9) ou chacune des bandes de contact (9) étant réalisées dans un matériau conducteur flexible et comportant une pluralité de languettes de contact flexibles (10) découpées dans ladite ou dans lesdites bande(s) de contact (9) et maintenues plaquées contre les bornes des cellules (2), par des moyens élastiques de pression individuels (12) répartis sur la face interne des panneaux de contact et de maintien (3, 4) qui sont fixés par vissage sur le casier séparateur et positionneur (1), de sorte que lesdites languettes de contact (10) se trouvent pressées individuellement contre l'une des bornes ou pôles desdites cellules.

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BATTERY CONSISTING OF A PLURALITY OF CELLS POSITIONED AND CONNECTED TOGETHER WITHOUT WELDING

The present invention concerns a battery consisting of a plurality of cylindrical or prismatic cells positioned and connected together, without welding.

5 Current batteries, in particular those intended for storing the electric energy needed for driving motorized tools, consist of a large number of elements (sometimes in the hundreds) electrically connected together by contacts formed by conducting lamellae welded to the terminals of said elements which are separated by non-conductors and assembled in the form of packs by an adhesive tape. The manufacture of such batteries
10 requires an assembly which is tedious, time-consuming and costly. Furthermore, they do not allow the replacement of one or several elements which might turn out to be defective, by customer-service or maintenance personnel.

In an application of manufacturing batteries consisting of a small number of elements and intended for supplying the electric energy required for operating small portable
15 equipment such as movie cameras, cameras, compact disc players, a battery without welding has been proposed (US-5 096 788) which includes:

- a housing with a cover;
- a plurality of cells positioned in a pair of upper and lower alignment plates and seated in said housing, each cell having a positive and a negative terminal;
- 20 - a flex strip consisting of a single conducting sheet providing the interconnection between the plurality of cells;
- a first pressure element positioned between the interior surface of the bottom of the housing and a portion of said conducting flex strip; - and a second pressure element placed between the cover and another portion of the conducting flex strip, each of
25 said first and second pressure elements being equipped with elastic fingers, said elastic fingers being tilted toward the positive and negative terminals, so as to flatten said opposite portions of the conducting sheet against said terminals and to establish the interconnection of said plurality of cells.

The application of such a device to batteries consisting of a large number of cells does
30 not appear to be feasible. As a matter of fact, in such an application a device of this kind would present at least the following radical drawbacks:

- the batteries consisting of a large number of cells (for example in the order of a hundred cells) assembled in a parallel connection, generate very strong electrical currents to be flowing through the interconnecting circuits (up to 100 Amperes)
35 which cannot be done with flexstrips;
- the material used to produce the flexstrips (polyamide or polyester film) is very fragile and can be destroyed by the friction of the contact springs in case of slight movements, which would result in a loss of electrical contact;
- the springs as described summarily in document US-5 096 788 (springs supposedly cut-outs from sheet metal) do not have sufficient travel and contact force to ensure an
40 efficacious contact of the flex strip on the cell terminals; as a matter of fact, the manufacturing tolerances require a travel of 2 mm and the contact force must be in

- the order of 2 kg for the contact to be reliable, which cannot be obtained with the device described in the aforementioned document;
- the cost of the flex strip is directly dependent on the surface of the latter; one can imagine that it would be very high, if the technology proposed in this document were applied to the manufacture of batteries consisting of a large number of cells to be connected (very large surface to be covered);
- according to this document, the battery can no longer be disassembled once the cover has been closed by a sealing process.

In an application for the manufacture of batteries consisting of a reduced number of cells, it has been proposed (DE-515 051) to house these cells in a casing closed by a lid. According to this document, a plurality of small flexible tabs is fastened on the underside of the lid, so as to connect each cell with an adjacent cell once said lid is closed. Such a construction implies a very precise and lengthy assembly of the contact tabs which means it can hardly be considered for the manufacture of batteries featuring a large number of cells. Furthermore, the tabs are placed against the cell terminals only under the effect of their own elasticity, yet such pressure is insufficient to guarantee a perennially good contact which may contribute to a reduction in the life of batteries being used in an active manner for professional purposes.

Finally, an application for the manufacture of batteries consisting of a large number of cells, it has been known (EP-1.450.422) to house these cells in a casing that is open on its two sides and to connect them, two by two, by way of small connecting plates that are welded on the opposite ends of said cells.

This connection method has the drawback of requiring elements or cells suitable for welding as well as specialized, costly tooling that is cumbersome and tricky to manipulate in order to execute multiple weldments. Another major drawback of this connection method is that it makes it impossible to disassemble the battery, for example in order to replace one or several defective elements.

Furthermore, the small connecting plates used in the device described by document EP-1 450 422 are not pushed against the poles of the battery elements by individual pressure-providing means but by a collective pressure device consisting of plates of an elastic material such as rubber plates interposed between the terminals of the connected cells and the upper and lower cover plates. Such elastic plates are unable to guarantee continuity of the electrical contact between the small connecting plates and the elements or cells, particularly in case of broken welds.

The invention provides a battery formed by a plurality of juxtaposed, cylindrical or prismatic cells connected together without welding and housed in through-holes of a separating and positioning casing, wherein the separating and positioning casing is disposed between two contact and holding panels comprising a framework and the internal faces of which are provided with one or more contact strips fixed without welding against said faces and each ensuring electrical interconnection of a plurality of cells, that is to say a number of cells greater than two, said contact strip or each of the

contact strips being made of a flexible conducting material and comprising a plurality of flexible contact tongue portions which are cut out in said or in each of said contact strips and attached to the same, said contact tongue portions being held pressed against the terminals of the cells by individual elastic pressure means distributed over the internal

5 face of the contact and holding panels, said panels being fixed by screwing to large opposite faces of the separating and positioning casing in such a way that said contact tongue portions equipping the internal face of said panels are pressed individually against a positive or negative pole or terminal constituting the opposite ends of said cells.

Some embodiments of the present invention may enable the manufacture of batteries consisting of a plurality of elements or cells that are juxtaposed and connected together, without welding or glue, in a simple manner that is faster, more economical, allows

10 disassembly and is highly reliable.

In some embodiments of the present invention the cells are individually seated in through-holes of a separating and positioning case, such a battery being particularly

15 notable in that these through-holes are of a length that is preferably less than that of the cells, so that the positive and negative terminals of said cells emerge from the open ends of the through-holes, this separating and positioning being placed between two contact and holding panels the interior faces of which being equipped with one or several fixed contact strips, without welding, against said faces and providing the electrical

20 interconnection of a plurality of cells, this contact strip or each of the contract strips being made of a flexible conducting material and featuring a plurality of flexible contact tabs cut out in said contact strip(s) and held pressed against the cell terminals, by individual elastic pressure devices spread over the interior face of the contact and holding panels which are screwed into the separating and positioning case, so that said contact tabs are

25 pressed individually against one of the terminals or poles of said cells.

It is clear that the mechanical assembly of the three structural elements of the battery by screws means a simplification of the assembly of the latter, a significant gain of time in the assembly which favorably affects its cost. Furthermore, this assembly is very sturdy, thus providing enhanced reliability of the battery over time, relative to assemblies

30 requiring welding or the use of glue, insulators or adhesive tapes.

This method of assembly also allows for easy replacement of one or several elements or cells which might be defective, by customer-service or maintenance personnel.

On the other hand, one obtains a very reliable contact, especially for strong currents, between the flex strip or each of the flexstrips and the terminals or poles of the elements

35 or cells of the battery. The fact that each flex strip is firmly pressed against one of the terminals or poles of the cells or elements is of particular interest for strong currents in that it prevents electric losses and consequently heating at the contacts.

According to an advantageous method of execution, the flexible contact tabs continue to be pressed individually against the terminals of the cells by springs that are oriented in

the direction of said terminals and anchored in the framework element of the contact and holding panels.

- 5 According to another characteristic arrangement, the contact surfaces of the contact strips with the terminals or positive and negative poles of the elements or cells are coated with conductive contact grease, known as such, the presence of this grease enhancing conduction and preventing corrosion at the contact points over a long period of use.

According to another characteristic arrangement, the interior face of each contact and holding panel is equipped with several flexstrips that are separated from each other and positioned in parallel.

- 10 The fact of using a number of flexstrips provides a solution, according to the present invention, that is significantly more reliable and economical, relative to the utilization of a single flexible connection circuit as proposed by the document US- 5 096 788.

Advantageously, each flex strip features two or more than two parallel alignments of flexible tabs.

- 15 According to a manufacturing method that is applicable to batteries featuring a plurality of alignments or lines of cells or elements separated by a gap or spacing, the flexstrips of one of the contact and holding panels are set off by a step relative to the flexstrips of the other contact and holding panel.

- 20 It may also be possible to orient the positive and negative poles of the cells or elements seated in the through-holes of the separator-positioner casing and to position the flexstrips so as to permit an interconnection of said elements or cells:

- in a connection in parallel; or
- in a connection in series; or
- in a connection in parallel and in series at the same time.

- 25 In the case of batteries consisting of lithium ion elements assembled in series/parallel requiring a voltage control and equalizing, the voltage can be measured and equalized per line of elements in parallel. In this case, the control and equalizing can be performed by means of an electronic board positioned inside the battery housing and connected to said flexstrips.

- 30 According to another characteristic arrangement, the flex strip or each flex strip is attached on the interior face of the framework element of the contact and holding panels by hooking it over pins provided on said face.

- 35 This arrangement allows precise, simple, and quick positioning of the flexstrips on the contact and holding panels. On the other hand, it ensures that the flexstrips are held in place when a contact and holding panel is removed, for instance, when customer-service of maintenance personnel needs to replace one or several defective elements.

According to another characteristic arrangement, one or several passages is or are made between the lateral surface of the elements and the interior surface of the through-holes in which said elements are seated, so as to provide circulation of cooling air along the latter.

5 According to a preferred method of execution, the holes or boxes in the separating and positioning case in which the cylindrical elements or cells of the battery are seated, without any notable play, present a polygonal section, preferably square in the aggregate.

10 By this arrangement, one obtains a circulation of cooling air along and around the cylindrical or prismatic elements or cells of the battery, while keeping the latter positioned without any significant play. This result is important, on account of the fact that during the charge or discharge of the elements or cells of the battery, particularly when the latter is composed of lithium-based (lithium ion or other) accumulators, an increase in temperature is produced in said accumulators, a temperature which it is highly desirable to equalize between the elements or cells, inside the battery, and to reduce.

15 To this same end, the structural element of at least one of the contact and holding panels fastened on each of the large faces of the separating and holding case is open-worked, preferably over its entire surface or extent. Advantageously, this applies to the upper panel or cover of the battery pack.

20 According to another characteristic arrangement, a portion of the screws of the screw works system providing the fastening of the contact and holding panels on the separating and holding case go through the spaces made between the flexstrips.

Due to this arrangement, the contact and holding panels are solidly fastened on the large faces of the separating and positioning case.

25 According to another characteristic arrangement, the screws going through the spaces made between the flexstrips are spread out so that their screwed axis finds itself in the center of the axes of a group of four elements or cells of the battery whereby it is possible to compress the springs and to ensure constant, firm and stable pressure of the four contact tabs surrounding the terminals of said four elements or cells oriented opposite said tabs.

30 Embodiments of the present invention may be advantageously usable in all applications needing a high voltage power supply requiring the grouping of numerous base cells, such as, for example, electric vehicles, new-generation portable power tools, etc...

The above characteristics, and advantages, and yet others will become clearer from the following description and the attached drawings in which:

35 Figure 1 is an exploded view in perspective of the three constitutive parts of a battery pack according to the invention. Figure 2 is a plan view of the separating/holding case in the through-holes or cut-outs of which are seated the elements or cells of the battery

where certain ones have been removed to facilitate description and understanding of the invention.

5 Figure 3 is a plan view of the interior face of the upper panel or lid of the battery pack, one of the contact strips having been removed likewise to facilitate understanding of the description of the invention.

Figure 4 is a plan view of the interior face of the lower panel or bottom of the battery pack, one of the contact strips having been unhooked to facilitate understanding of the description which follows.

Figure 5 is a top view, with partial break-away, of the battery pack.

10 Figure 6 is a longitudinal section view along the line 6-6 of figure 5.

Figure 7 is a cross section along the line 7-7 of figure 5. Figure 8 is a detail plan view, and at a larger scale, showing the air circulation passages along the cells of the battery.

Figure 9 is a section view along line 9-9 of figure 8.

15 Figure 10 is a partial view of the interior face of the contact and holding panel, with break-away, showing the fastening by hooking flexstrips on said interior face.

Figure 11 is a section view along line 11-11 of figure 10.

Figure 12 is a detailed section view, and at a larger scale, showing a method of anchoring the springs so as to press the contact tabs against the positive or negative poles of the cells.

20 Figure 13 is a detailed front view, and at a larger scale, showing the distribution of the pressure springs inside the space defined by the perimeter of the battery pack.

Figure 14 is an exploded view in perspective illustrating an example of positioning of the interconnecting strips relative to the opposing poles of an assembly of cells.

25 Figure 15 is a view in perspective, with partial break-away, illustrating a battery according to the invention, provided with its protective housing or cover.

Figure 16 is a view in perspective, with partial break-away, showing a portable battery according to the invention, located in a sack of the backpack kind.

30 Figure 17 is a view analog to figure 16, illustrating a method of production of the portable battery, according to which one the exterior parts of the housing containing the battery pack, is an integral part of the carrying device.

Reference is made to said drawings to describe an advantageous, although by no means limiting, example of manufacture, of the battery without welding, according to the invention.

In the following description and in the claims:

- 5 - The term "cell" designates a rechargeable base accumulator, preferably of a cylindrical shape, which is most often called an "element" in technical French.
- The word "plurality" designates a number higher than two and, in the context of the present invention, it must be understood as the equivalent of the term "numerous" or of the expression "large number".
- 10 - The words "bottom" and "lid" are purely conventional and their meaning is simply to distinguish the contact and holding panels when this is necessary.
- The expression battery pack designates the assembly constituted by the three main parts of the battery.
-
- 15 The battery, according to the invention, in its function of storing electrical energy, is essentially constituted by three parts, namely:
 - a separator-positioner 1 in which are housed individually the electrical energy storage cells 2;
 - two contact and holding panels 3 and 4 fastened by means of screws 5 on the large
- 20 faces opposite of said separator-positioner 1.

The separator-positioner 1 is primarily constituted by a casing, for instance in a general rectangular shape; this casing featuring a plurality of openings or through-holes 6 of an advantageously polygonal, preferably in the aggregate square section. These openings 6 are so dimensioned as to enclose the preferably cylindrical cells 2, seated without any

25 notable play in said openings. Because of this fitting, passages 7 are created along the cells 2 positioned in the casing 1, so as to allow for the circulation of cooling air along and around said cells (figures 8 and 9).

The openings 6 are located on several parallel lines or alignments. Their number may vary depending on the intended use of the batteries. For example, the casing 1 may be

30 provided with 96 holes 6 more or less, distributed in twelve alignments of eight holes each.

The openings 6 present, preferably and advantageously, a length L inferior to the length l of the cells 2, so that when the latter are positioned in the casing 1, their opposing ends constituted by their positive and negative terminals emerge from the open ends of said

35 openings (figure 9).

The contact and holding panels 3 and 4 feature a framework 8 on the interior face of which is positioned and fastened at least on contact strip 9 and, preferably, several contact bands 9 (figures 3 and 4) ensuring the electrical interconnection of the elements 2 of the battery, when said panels 3 and 4 are assembled to the central separator-positioner

40 1. The contact strips 9 are preferably made of a flexible material, and may be constituted

by thin blades of any electricity-conducting and non-oxidizing metal, for example thin strips of nickel-plated copper.

5 In the case of lithium ion cells being used, one of the ends of the contact strips 9 is equipped with a clip 9a for connecting to the voltage measuring system of the battery and to the equalizing system of the cells during the charge.

The two contact strips 9 placed at the ends of the row of flexstrips are also equipped with a second clip 9b that is connected to the + and - terminals, respectively, of the battery, these clips being meant to be connected to a powered device or machine, and/or a battery charger.

10 The framework element 8 of at least one of the contact and holding panels 3, 4 is perforated, preferably over its entire surface or extent, to allow cooling air to circulate through said panel(s).

The casing 1 and the framework element 8 of panels 3 and 4 may be made of any appropriate rigid plastic material, for example polyamide 6.

15 According to another interesting characteristic of the invention, the contact strip 9, or each contact strip 9, features a plurality of flexible tabs 10 which are, preferably, cutouts in said flex strip(s). These flexible tabs 10 are kept pressed, individually, against the + or - terminals or poles of the cells 2, by distinct means of pressure, with which is equipped, for example, the interior surface of the framework element of the panels and of which an
20 interesting method of execution is described below. The contact tabs 10 could also be made of a plastic material, so as to constitute by themselves the pressure device or spring holding them pressed against the poles of the cells 2.

25 Preferably, the interior face of each contact and holding panel 3 and 4 is equipped with several flexstrips 9, separated from each other and positioned in parallel. Each contact strip 9 features at least two parallel alignments of flexible tabs 10.

Advantageously, the flex strip or each flex strip 9 is fastened against the interior face of the framework element 8 of the contact and holding panels 3 and 4, by hooking them over the pins 11 said face is equipped with (figures 10-12).

30 According to another advantageous arrangement of the invention, the + and - poles of the cells 2 positioned in the casing 1 and the contact strips 9 are organized so as to achieve:

- either the mounting in parallel of said cells;
- or their mounting in series;
- or their mounting in series and in parallel.

35 The cells 2 positioned in the casing 1 form several alignments or lines of parallel elements the axes of which are separated by a distance of step p and according to a characteristic arrangement of the invention, the flexstrips 9' of one of the contact and

holding panels are offset by a step p, relative to the contact strips 9" of the other contact panel (figure 14).

According to a very efficacious method of execution, the interior face of the framework element 8 of the panels 3 and 4 is equipped with a plurality of springs oriented towards the + or - terminals of the cells 2 and pushing against the flexible tabs 10 of the contact strips 9 thereby enabling said flexible tabs 10 to be pushed individually against said terminals.

These springs are, preferably, constituted by helical springs 12 anchored permanently, through the intermediary of one of their ends, in the framework element 8 of the panels 3 and 4 (figure 12).

As previously indicated, the contact and holding panels 3 and 4 are assembled, by means of screws 5, to the central separator-positioner 1. A portion of the screws of the screw works ensuring this assembly goes through the spaces 13 created between the contact strips 9. The screws 5 are screwed into distance sleeves 15 which the casing 1 has on its periphery and inside the space delimited by the latter. The distance sleeves 15 are of slightly greater height than the casing, so that they protrude on each face of the casing 1.

Advantageously, the screws 5 going through the spaces 13 created between the contact strips 9 are distributed so that their screwing axis finds itself situated in the center of axes of a group of four springs 12a, 12b, 12c, 12d, and of four cells 2a, 2b, 2c, 2d or 2a¹, 2b¹, 2c¹, 2d¹ positioned in the casing 1 (figure 13). This multiplicity of assembly points and their well thought-out distribution serve to provide a sturdy assembly of the three parts of the battery pack, as well as constant and stable pressure of all the flexible contact tabs 10 on the + and - poles or terminals of the cells 2.

This direct and stable contact of the tabs 10 of the interconnecting strips 9 and the + and - poles of the cells 2 allows for very precise measuring of the voltage of said cells, because of the fact that with this contact there is very low resistance which does not falsify the measurements which are necessary, especially in the case of lithium-ion batteries.

Advantageously, the contact surfaces of the flexible tabs 10 of the interconnecting strips 9 with the + and - poles of the cells 2 are coated with conductive contact grease known as such.

The contact and holding panels 3 and 4 may be essentially identical and may constitute, with the separator-positioner 1 and the cells 2, a battery pack which can be seated in a housing or shell 14. Alternately, the contact and holding panels 3 and 4 may be fitted so as to constitute directly the housing of the battery, the panel 3 constituting, for example, the bottom of this housing the lid of which is, in this case, formed by the panel 4. According to another method of execution, the lower panel constitutes the bottom of a housing the remaining part of which is formed by a hood attached, in a removable manner, to said bottom.

Neither the means for linking the contact strips to the connection terminals which make it possible to connect the battery to power tools or to chargers nor the electronic circuit ensuring proper functioning and safety of the battery are described here, as the expert is well familiar with these means and circuits.

Another characteristic of the battery 16 produced in the manner described above is that it is portable.

5 It may be placed in a backpack of the rucksack type 17 (figure 15), or one of the exterior parts of the housing 14 of the battery 16 or of the battery pack may be provided with straps or suspenders 18, so they can be carried piggy-back (figure 16).

10 In the claims which follow and in the preceding description of the invention, except where the context requires otherwise due to express language or necessary implication, the word "comprise" or variations such as "comprises" or "comprising" is used in an inclusive sense, i.e. to specify the presence of the stated features but not to preclude the presence or addition of further features in various embodiments of the invention.

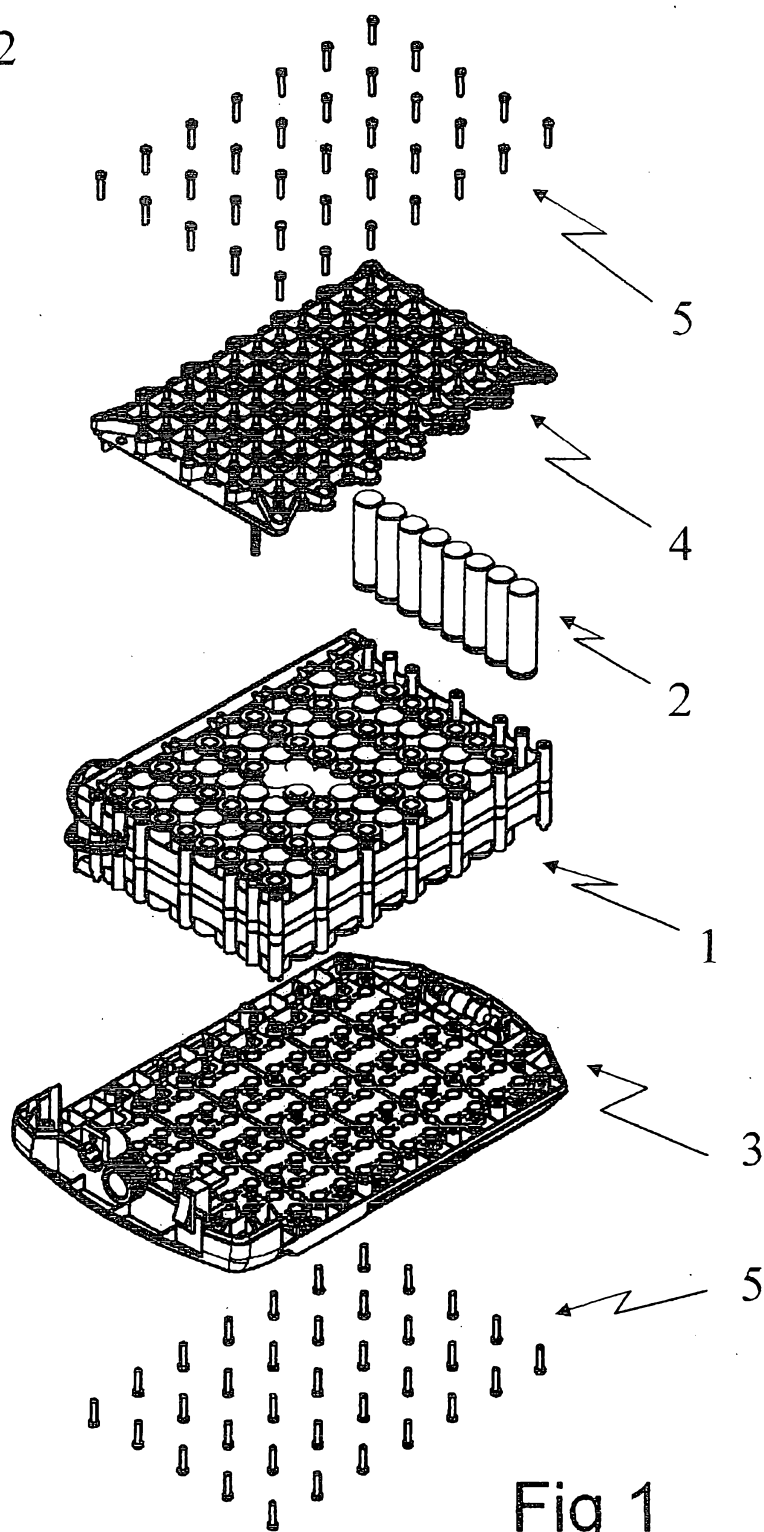
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CLAIMS

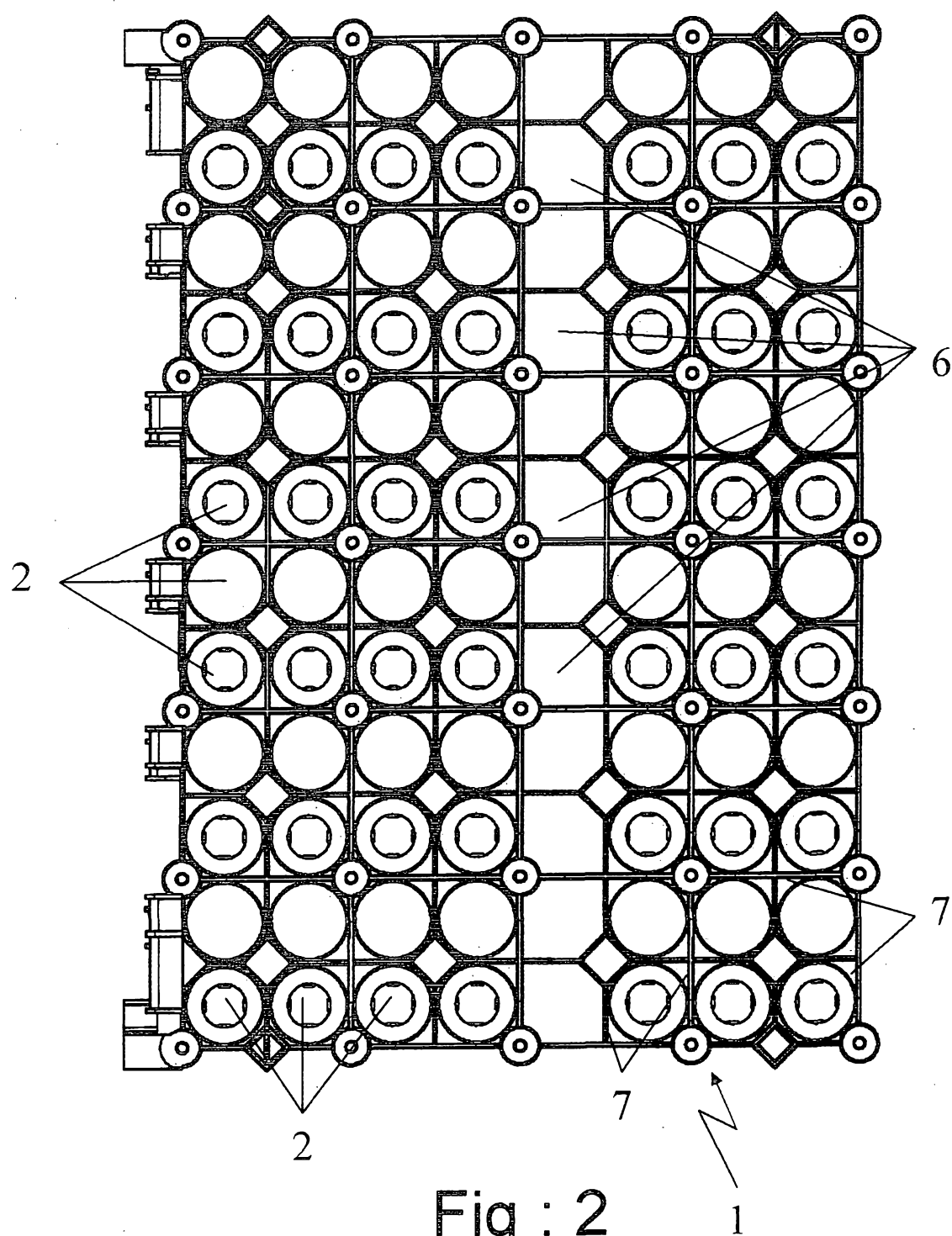
1. A battery formed by a plurality of juxtaposed, cylindrical or prismatic cells connected together without welding and housed in through-holes of a separating and positioning casing, wherein the separating and positioning casing is disposed between two contact and holding panels comprising a framework and the internal faces of which are provided with one or more contact strips fixed without welding against said faces and each ensuring electrical interconnection of a plurality of cells, that is to say a number of cells greater than two, said contact strip or each of the contact strips being made of a flexible conducting material and comprising a plurality of flexible contact tongue portions which are cut out in said or in each of said contact strips and attached to the same, said contact tongue portions being held pressed against the terminals of the cells by individual elastic pressure means distributed over the internal face of the contact and holding panels, said panels being fixed by screwing to large opposite faces of the separating and positioning casing in such a way that said contact tongue portions equipping the internal face of said panels are pressed individually against a positive or negative pole or terminal constituting the opposite ends of said cells.
2. A battery according to claim 1, wherein the flexible contact tongue portions are held pressed individually against the terminals of the cells by means of springs oriented in the direction of said terminals and anchored in the framework element of the contact and holding panels.
3. A battery according to claim 1 or 2, wherein the internal face of each contact and holding panel is provided with a plurality of contact strips separated from each other and disposed in parallel relationship.
4. A battery according to claim 3, wherein each contact strip comprises parallel alignments of flexible contact tongue portions.
5. A battery according to claim 3 or 4, wherein its cells are positioned and the contact strips are organized in order to provide for parallel mounting of said cells.
6. A battery according to claim 3 or 4, wherein its cells are positioned and the contact strips are organized in order to provide for series mounting of said cells.
7. A battery according to claim 3 or 4, wherein its cells are positioned and the contact strips are organized in order to provide for parallel and series mounting of said cells.
8. A battery according to claim 4, comprising a plurality of alignments or lines of cells separated by a distance or pitch, wherein the contact strips of one of the contact and holding panels are displaced by said pitch with respect to the contact strips of the other contact and holding panel.
9. A battery according to any one of claims 1 to 8, wherein the contact strip or each contact strip is fastened on the internal face of the framework element of the contact and holding panels by plugging engagement on lugs with which said face is equipped.

10. A battery according to any one of claims 1 to 9, wherein one or more passages is or are provided between the lateral surface of the cells and the internal surface of the through-holes in which said cells are accommodated, in such a way as to permit a flow of cooling air along the latter.
- 5 11. A battery according to claim 10, comprising one of the cylindrical cells (2), wherein the holes or cavities of the separating and positioning casing in which said cells are accommodated are of a polygonal section so as to permit a flow of cooling air along and around said cells while keeping the latter positioned without significant play.
- 10 12. A battery according to any one of claims 1 to 11, wherein the framework element of at least one of the contact and holding panels is apertured to permit a flow of cooling air through said panel or panels.
- 15 13. A battery according to any one of claims 3 to 12, wherein a portion of a plurality of screws of a screwing system providing for fixing of the contact and holding panels on the separating and positioning casing passes through spaces between the contact strips.
- 20 14. A battery according to claim 13, wherein the screws passing through the spaces between the contact strips are so distributed so that a screwing axis of each respective screw is at a center of axes of a group of four cells so as to ensure a constant, firm and stable support for the four surrounding contact tongue portions on the poles of said four cells.
- 25 15. A battery according to claim 13 or 14, wherein the screws are screwed into protruding column portions on the separating and positioning casing on each of its faces at its periphery and in the internal space delimited by the periphery.
- 30 16. A battery according to any one of claims 1 to 9, wherein the contact tongue portions of the contact strips with the positive and negative poles of the cells are coated with a per se known conductive contact grease.
17. A battery according to any one of claims 1 to 16, wherein the through-holes of the separating and positioning casing are of a length that is less than the length of the cells so that the positive and negative terminals of said cells protrude from the open ends of the through-holes in the casing.
18. A battery according to any one of claims 1 to 17, said battery being portable and placed in a bag of the rucksack type or provided with straps or bands attached an external part of the housing or to one of the holding panels of the battery.
19. A battery substantially as herein described with reference to the accompanying drawings.

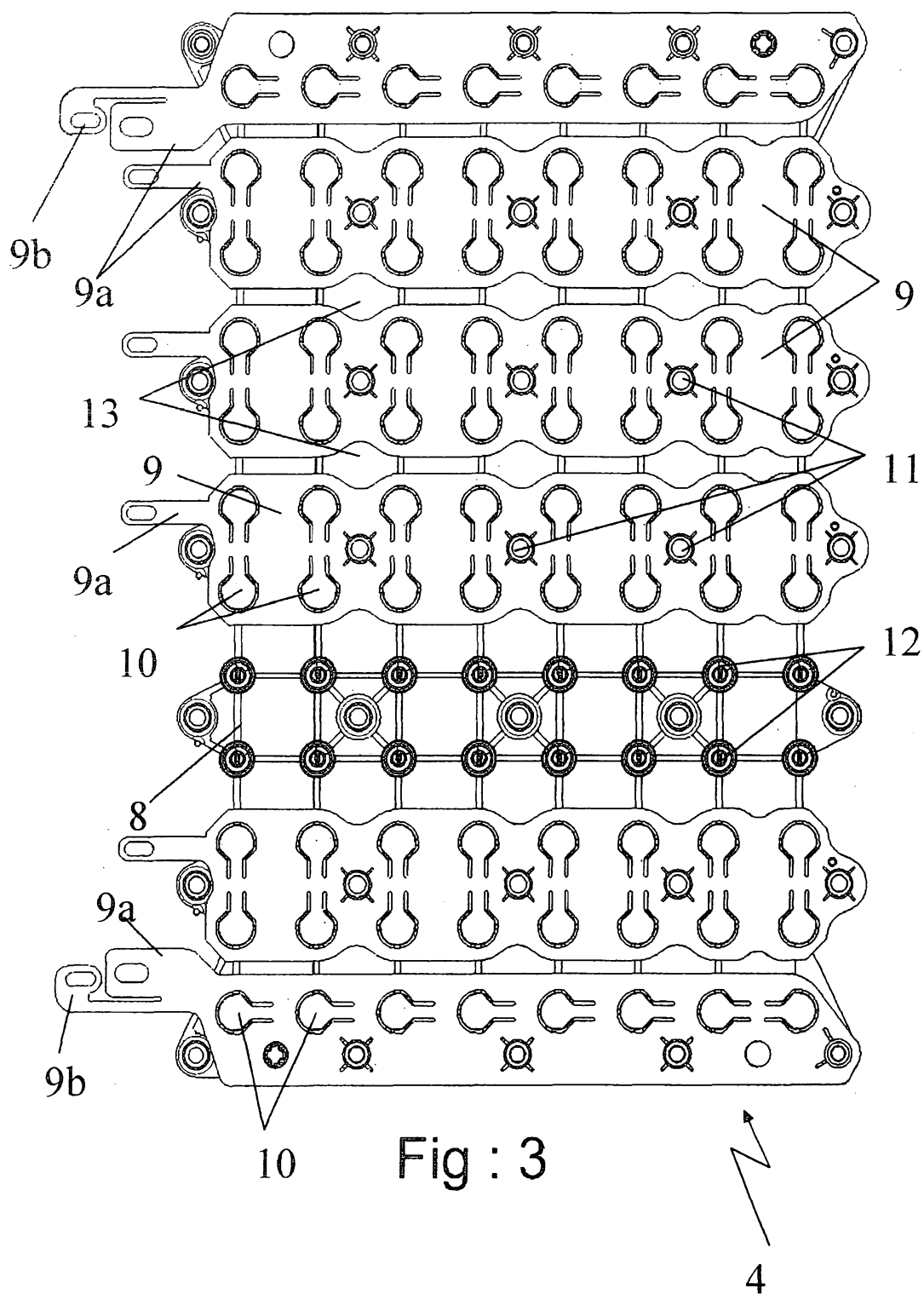
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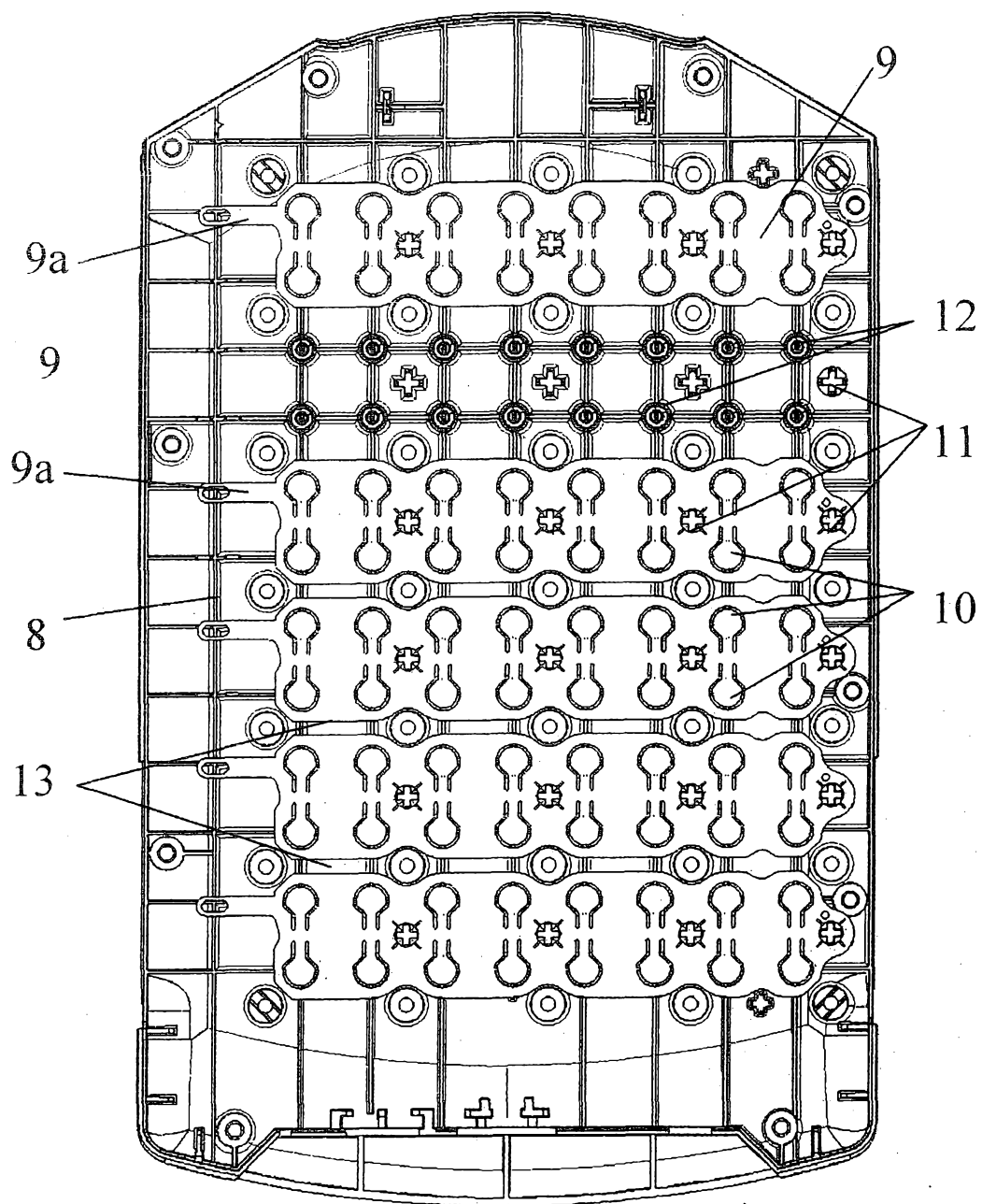
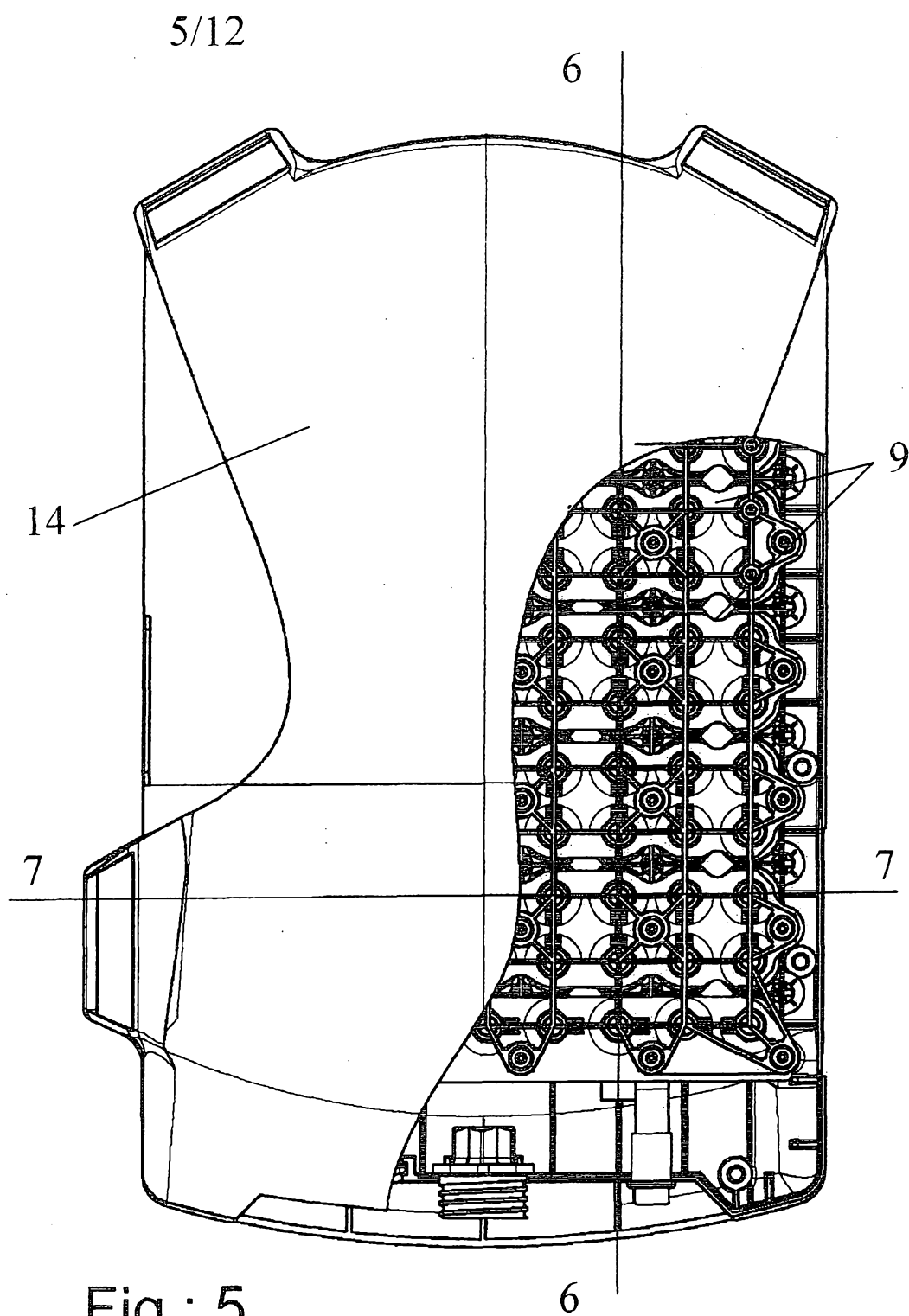


Fig : 4



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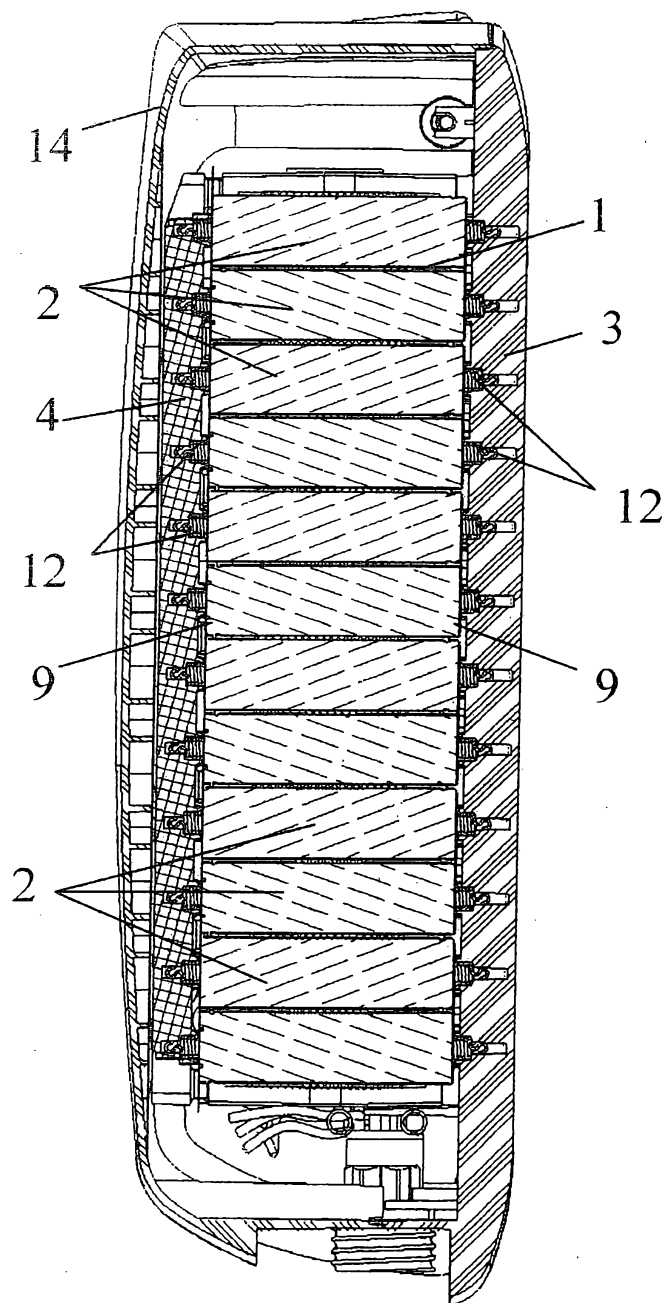


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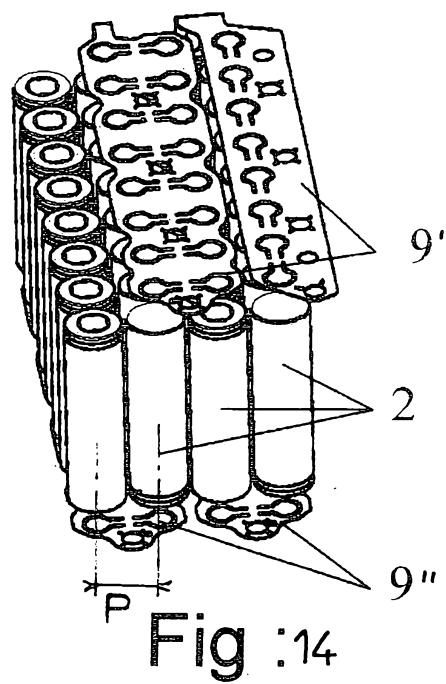


Fig :14

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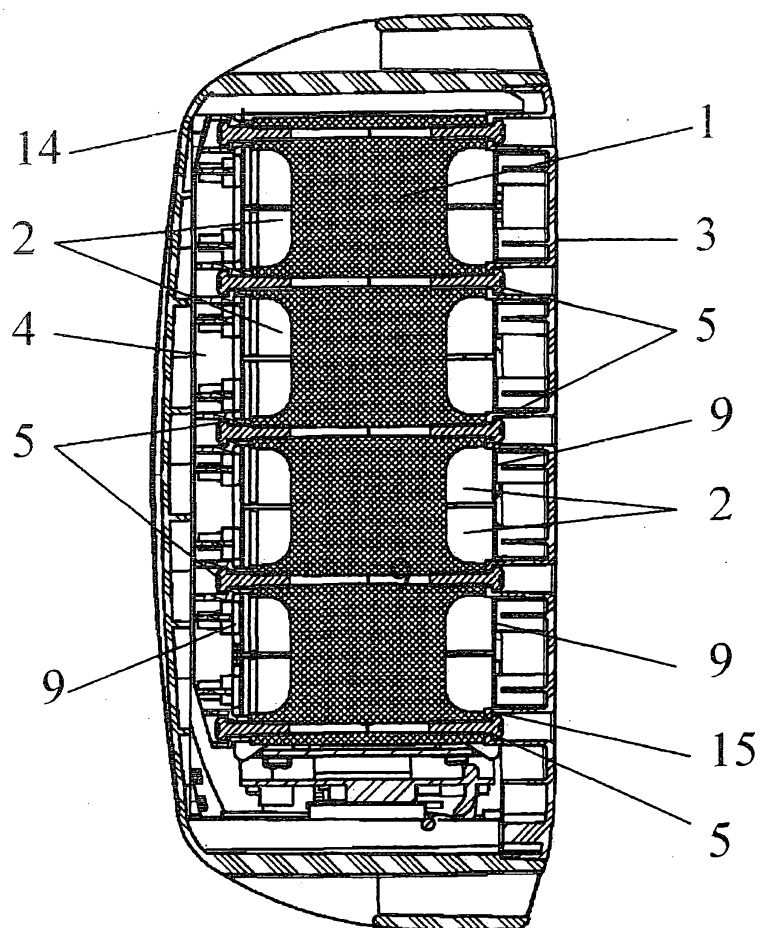


Fig : 7

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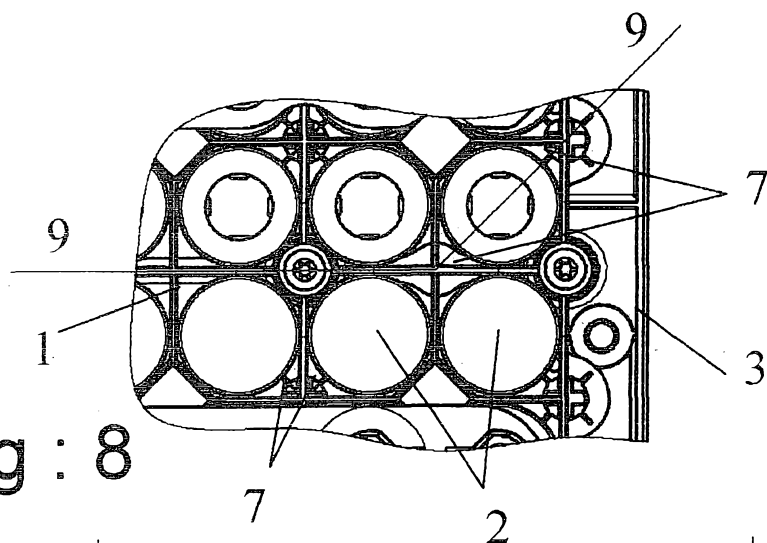


Fig : 8

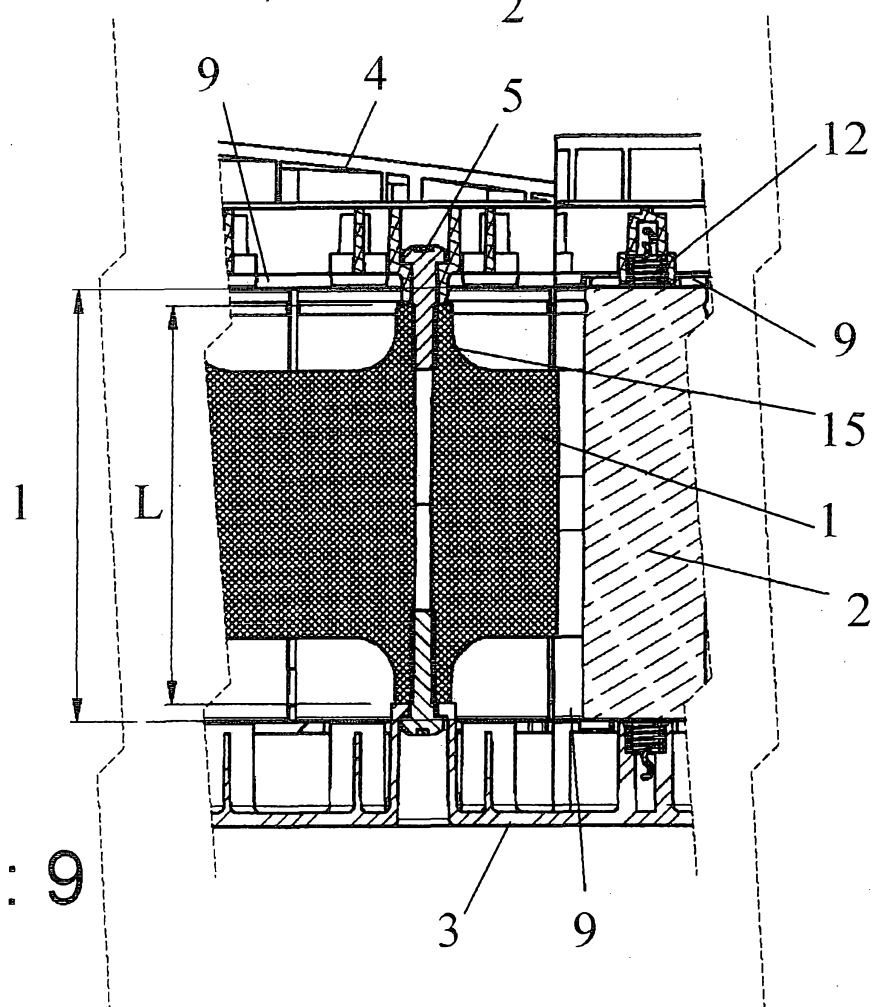


Fig : 9

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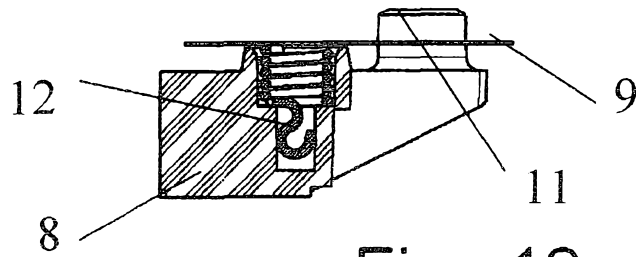


Fig : 12

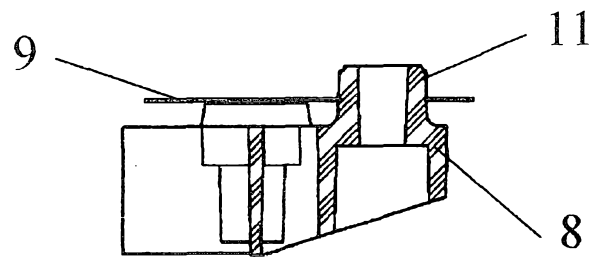


Fig :11

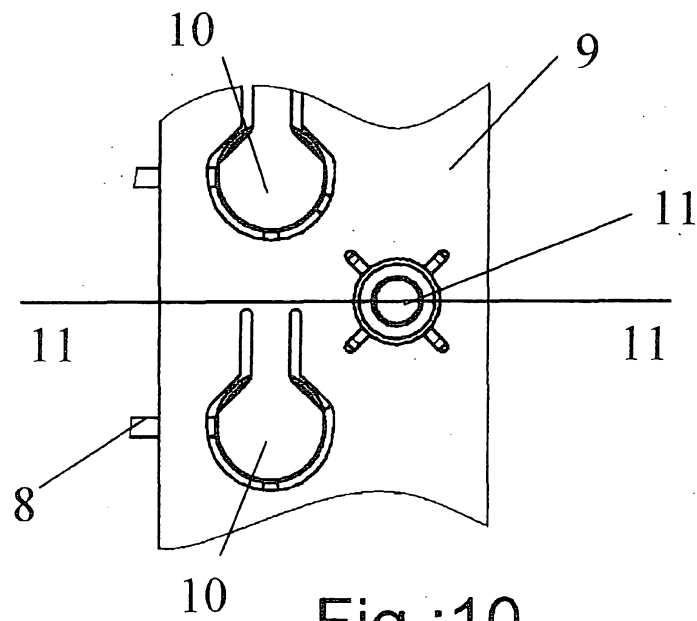


Fig :10

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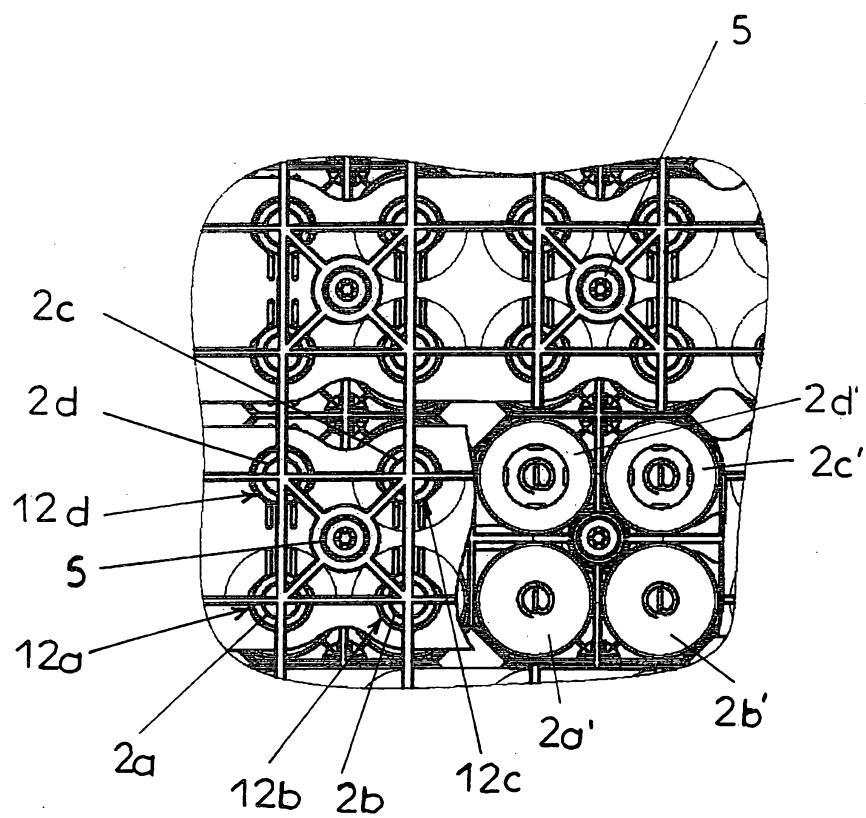
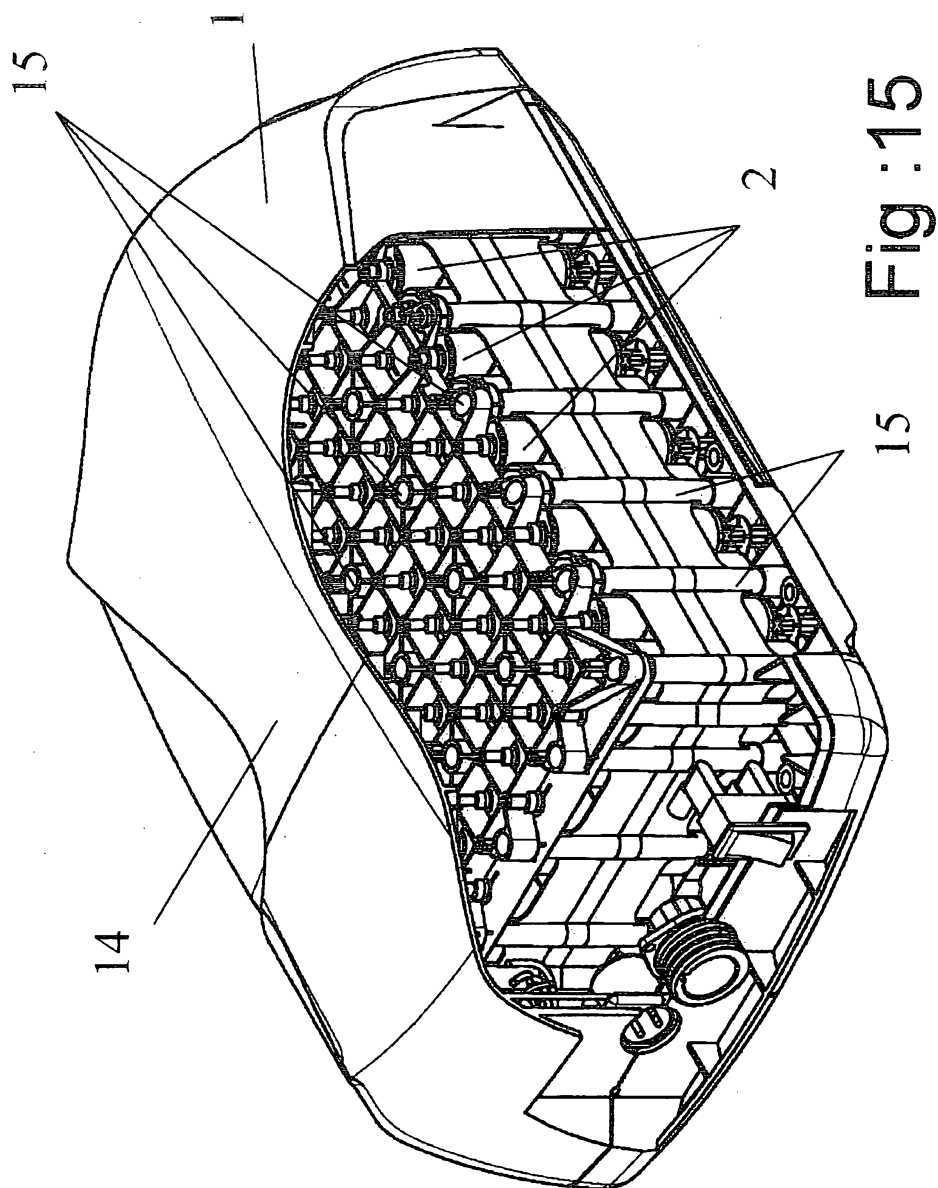


Fig :13

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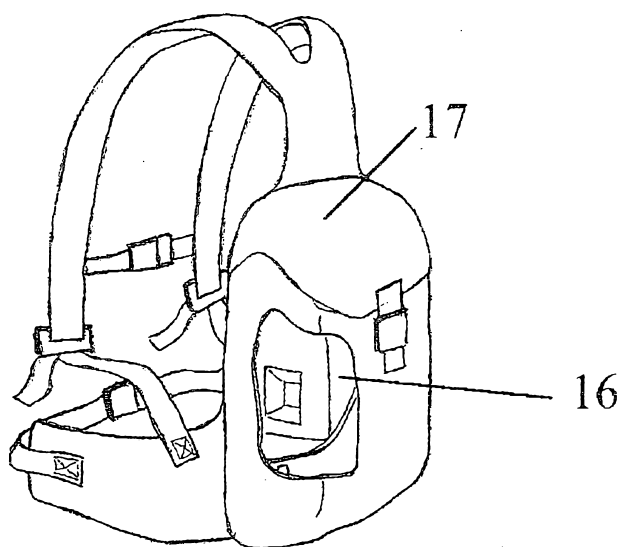


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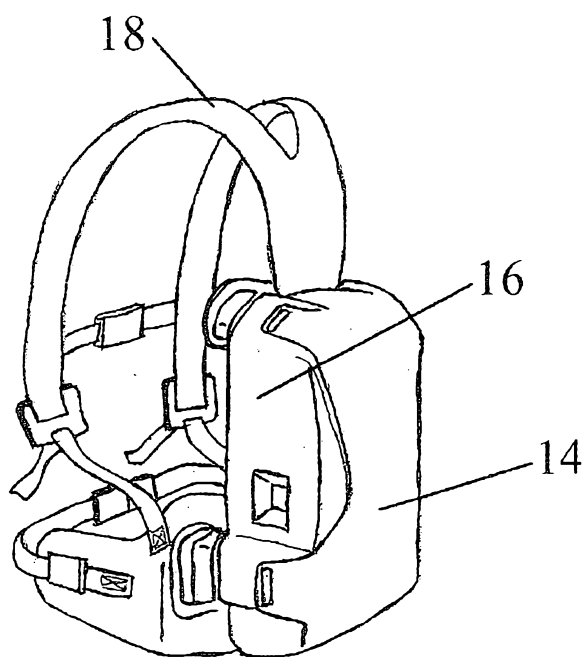


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