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(54) Title: INSERT MOLDED LEADFRAME ASSEMBLY FOR ELECTRICAL CONNECTORS, AND ELECTRICAL CON-
NECTOR PROVIDED WITH SUCH AN ASSEMBLY

(57) Abstract: An insert molded leadframe assembly comprising: Electrical contacts (7a, 7b) having retention portions (11a, 11b), connection portions, and intermediate portions (10) disposed between the retention portions, a first housing (12a) overmolding the first retention portions, a second housing (12b), separate from the first housing, and overmolding the second retention portions, the intermediate portions (10) being elastically deformable.

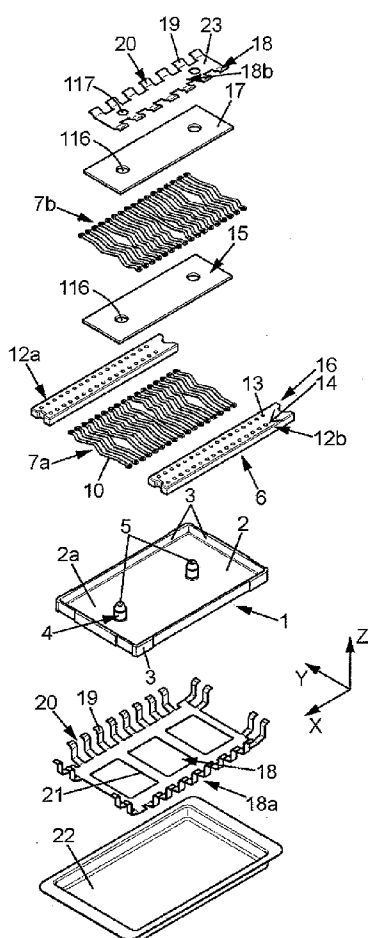


FIG. 1



NZ, OM, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

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**Insert molded leadframe assembly for electrical connectors,
and electrical connector provided with such an assembly**

FIELD OF THE INVENTION

The instant invention relates to insert molded leadframe assemblies for electrical connectors, and to electrical connectors provided with such assemblies.

BACKGROUND OF THE INVENTION

Electrical connectors are known to electrically connect together electrical appliances, devices, integrated circuits, etc.. Among electrical connectors, a given class is made of a plastic housing holding insert molded leadframe assemblies. Such assemblies are made for instance of a network of parallel electrically conducting parts which are held together by an overmolded plastic part. This part also allows preventing short-circuits between the parallel electrically conducting parts.

The applicant has developed a number of electrical connectors based on this technology, such as, for example the AirMaxVS® backpanel connectors.

However, a brand new type of insert molded lead frame assemblies have recently been developed, to benefit of the use of this interesting technology in other kind of applications, which is adapted to compensate deviation in a mating position with a mating connector.

SUMMARY OF THE INVENTION

Thus it is provided an Insert Molded Leadframe Assembly (IMLA) according to claim 1.

Such an insert molded leadframe assembly basically comprises a plurality of electrical contacts, electrically insulated from one another, each having a first and a second retention portions and an intermediate portion between the first and second retention portions. The intermediate portions are elastically deformable so as to

allow a relative movement of first and second housings respectively overmolded on the first and second retention portions.

With these features, the advantages of the insert molded lead frame assembly are obtained for applications where it is desired to have a relative movement of two parts. For example, this would typically be the case to compensate plays and misalignments between two connectors to be each connected to one of the housings, these two connectors having a definite relative position.

In some embodiments, one might also use one or more of the features as defined in the dependent claims.

According to another aspect, the invention relates to an electrical connector according to claim 10.

BRIEF DESCRIPTION OF THE DRAWINGS

Other characteristics and advantages of the invention will readily appear from the following description of embodiments, provided as non-limitative examples, and of the accompanying drawings.

On the drawings:

- Fig. 1 is a perspective exploded view of one embodiment of a connector with an Insert Molded Leadframe Assembly (IMLA) according to the invention,
- Fig. 2 is a detailed perspective view of the central part of Fig. 1,
- Fig. 3 is a sectional view indicated by lines III-III on Fig. 2, of a part of an electrical connector comprising the whole IMLA,
- Fig. 4 is a partial top view of the part of connector of Fig. 3,
- Fig. 5 is a schematic sectional view along line III-III of a connector assembly before assembly.

On the different Figures, the same reference signs designate like or similar elements.

DETAILED DESCRIPTION

Figure 1 shows an example of a part of an electrical connector. This part comprises a base 1 which is for example made of an electrically insulating material (any kind of suitable plastic) and is cup shaped. Hence, the base 1 has a bottom portion 2 with a substantially rectangular shape, and from which a perpendicular side wall 3 extends from each side. The bottom portion has a flat upper surface 2a which, for the sake of simplicity of the description, will be considered as horizontal (although this does not preclude the connector to be used in other orientations). The longest dimension of this surface defines direction X, and its perpendicular direction Y, so that X-Y defines the horizontal plane. Z is the vertical direction.

The base 1 also comprises an anchoring device 4 which, in the present case, is made of two similar anchoring feet 5 which are spaced apart along the median longitudinal line of the base 1. Each anchoring foot comprises a vertically extending base portion integral with the base 1, and an elastically deformable top portion which comprises a bottom facing stop. Of course, other anchoring devices are possible.

An insert molded leadframe assembly (IMLA) 6 is received in the base 1. The IMLA 6 comprises a first layer 7a of a plurality of electrically conducting contacts 7 (see also Fig. 2). As can be seen on Fig. 2, each electrical contact 7 extends between a first end 8a and a second end 8b which are spaced from each other along a direction mainly parallel to the Y direction. In other embodiments, the two ends are located along a direction having a component along the X direction (for example up to 1/10 of its component along the Y direction). The two ends 8a and 8b extend substantially in the same horizontal

plane, although, in some embodiments, there might also be a slight shift in the Z direction as well. Each end 8a and 8b defines a connection portion 9 for electrical connection to a mating part to be described later on. As an example, the connection portions 9 are provided in the shape of eyelets, although other configurations are possible. In other embodiments, the connection portion 9 needs not necessarily to be provided at the ends of the electrical contact 7.

Each electrical contact further comprises an intermediate portion 10. The intermediate portion 10 bridges together the two connection portions 9 of a given contact 7 and, as such, globally extends along the Y direction. The intermediate portion 10 is made to be elastically deformable, and is shown on the figures in its rest state. As shown, although extending generally along the Y direction, the intermediate portion zigzags along the X, Y and/or Z direction(s) in this rest state. Thus, it allows the first and second ends 8a, 8b to move relative to each other by elastic deformation of the intermediate portion 10. All the intermediate portions 10 need not to have the same shape. As show, they may have varying shape and varying elasticity. For example, the central ones may be stiffer. Intermediate portions are separated from their neighbour(s) only by air as an insulating material. The intermediate portions 10 are spaced apart from one another along the X direction so that they cannot be elastically deformed to the extent that they would contact their neighbours. The shape and disposition of the electrical contacts are adapted to meet this specification.

Each electrical contact further comprises two retention portions 11a, 11b. The reference signs to the retention portions are shown on different electrical contacts 7 to ease the representation. The retention portions 11a and 11b extend between the connection portions 9, although the contrary is also possible. In both cases,

the intermediate portion 10 of each contact extends between its retention portions 11a, 11b.

Referring back to Fig. 1, the IMLA 6 further comprises a first and a second similar housings 12a, 12b, separate and spaced apart along the Y direction. Each housing is made of electrically insulating material, typically plastic overmolded parts, which are molded over the electrical contacts during the manufacturing process. In particular, the plastic material of the housings 12a and 12b is overmolded over the retention portions 11a and, respectively, 11b so that the electrical contacts are held in the housings at this retention portions.

During manufacturing, all the contact elements 7 are mechanically connected to one another as an integral piece of metal comprising about 10 or more contact elements 7. The plastic housings 12a, 12b are overmolded where they will maintain the contact elements together, i.e. at least on the retention portions, and then the contact elements are separated from one another, being only retained by the plastic housing, in a manner where they are isolated electrically from one another.

Each housing has mainly a parallelepiped shape, extending mainly along the X direction. It defines, for each electrical contact, a connection region 13 corresponding to the connection portion of the electrical contact. Each connection region 13 is for example a cylindrical through hole extending along the Z direction, and encompassing the connection portion of a corresponding electrical contact.

The connection regions 13 are disposed in the housing 12a or 12b according to a predetermined pattern. For example, this pattern is a set of points regularly spaced along a straight line 14 extending along the X direction, although other geometries are possible.

The IMLA 6 is maintained in any suitable way in the

base 1. For example, the IMLA 6 is deposited in the cavity defined by the base 1. For example, the bases of the anchoring feet 5 will extend between the intermediate portions 10 of two neighbour electrical contacts 7. Then, a cover 15 is used to lock the IMLA in the base. The cover is for example a rectangular piece of material which has two anchoring holes 116 corresponding to the anchoring feet 5. For example, the cover 15 is electrically insulating and is in close proximity or in contact with the electrical members 7 but does not short-circuit them.

According to the disclosed embodiment, the cover 15 is also used to separate the first layer 7a of electrical members from a second layer 7b. In this case, the length of the cover 15 along the X direction somehow corresponds to the spacing between longitudinally opposed walls 3 of the base, and the width of the cover 15 along the Y direction somehow corresponds to the spacing between the two housings 12a, 12b, to prevent any risk of short circuit between the first and second layers.

It should be noted that the so-called "cover" could be used only as a separating layer between two layers 7a and 7b of IMLAs. It does not necessarily comprise through holes if the fixation mechanism is different.

The second layer 7b is of similar design as the first layer 7a, and will not be described in much more details. It extends in a plane above the plane containing the first layer 7a. The pattern of the connection regions of the housings 12a and 12b will have to be adapted to take into account this second layer. As an example, the pattern will include both points equally spaced along line 14, as described above for the first layer, and points spaced along a straight line 16 parallel to line 14 for the second layer. Of course, the pattern corresponding to the second layer might be different. The layers are also arranged so as not to interfere with the connection regions 13 used for

another layer. For example, the connection regions 13 comprise only blind holes not extending to the bottom face of the housing. In an alternative, the contacts of one or more of the layers are shaped to turn around the through holes made to connect the other layers.

Thus, the invention is adapted for the use of one or more layers in the IMLA. The connection pattern of the housings is in any case pre-defined by the envisaged application. The cover 15 may not cooperate with the stops of the feet 5. Instead of such a solution, a topmost cover 17, for example similar to the cover 15, is used for maintaining the IMLAs in the base 1.

In others embodiment with a plurality of layers, there might rather be more independent housings than the two disclosed above, which are for example stacked along the Y direction.

The present embodiment also incorporates a shielding device, although this is optional in the field of the present invention. Innovative features of the shielding device are believed to be patentable by way of divisional applications.

The shielding device 18 aims at providing an electrical connection of the electrical connector including the IMLA to another electrical part such as a mating part of a complementary connector, for example in view of grounding. In the present embodiment, the shielding device 18 has an external part 18a and an internal part 18b. The shielding device 18 is provided with extended and/or flexible contact portions 19 which ensure such an electrical connection in a broad range of possible relative movements of the two housings 12a, 12b. In the particular example shown, this is performed by using elastically deformable, for example flexible, tongues 20, such as surface mounting (SMT) tongues both for the external 18a and the internal 18b parts.

The external part 18a is performed, in the present embodiment, as a central horizontal metallic frame 21 which is fixed to the bottom face of the base 1. The frame 21 is integral with the lateral upward-extending tongues. The termination parts of the tongues extend sensibly horizontally (in fact they are elastically protruding toward the top). The tongues 20 are distributed more or less evenly along the portions of the base 1 which will mate complementary electrical devices. In particular, there are tongues 20 on both lateral sides of the base 1. A receptacle 22 is sized to tightly receive the base 1 with the metallic shielding external part 18a. The tongues 20 elastically engage the side walls of the receptacle 22 to generate friction between these two parts (see in particular Fig. 3).

As shown on Fig. 1, the internal part 18b is performed, in the present embodiment, as the topmost part over the layered IMLAs 6. Thus it has a central body 23 which extends substantially longitudinally along the X direction, and centrally. The central body comprises holes 117 which, as described for the holes 116 of the cover 15 for the previous embodiment, are used to engage the bottom facing stop portions of the feet 5.

From the central body 23, tongues 20 extend laterally, substantially along the Y direction. They are also located on both lateral sides of the central body and laterally spaced from one another along the X direction.

The contact portions 19 are defined as the upward facing surface of the tongues 20.

As can be seen in particular on Fig. 3, the contact portions 19 of both the external part 18a and the internal part 18b extend substantially in the same horizontal plane, although this of course depend on the geometry of the complementary electrical part.

The housing 12a is surrounded, on its external

side, by tongues 20 of the external part 18a, and on its internal side by tongues 20 of the internal part 18b. This holds also for the housing 12b.

Fig. 4 now illustrates the compensation play enabled by the above described IMLAs. This description holds for all the above described embodiments. This Figure illustrates the top right corner of the base 1. As can be seen, there is a play dX , measured along the X direction, between the side of the housing 12b and the side of the base 1. There is a play dY , measured along the Y direction, between the side of the housing 12b and the side of the base 1. There are also plays in the lower right corner for the housing 12b, and in the top and bottom left corners for the housing 12a. Although the housing is shown perfectly aligned with directions X and Y, it must be understood that some level of rotational play around the Z axis is also possible. Fig. 4 is for example shown at the rest state of the elastic electrical contacts 7.

Fig. 5 shows an electrical connector 24 comprising the electrical connector part described up to now in relation to Figs. 1 to 4. The electrical connector comprises a first mating part 25a, and a second mating part 25b, respectively corresponding to the first and second housings 12a, 12b.

Each mating part comprises an insulating housing 26, in which extend electrical contacts 27. The electrical contacts 27 comprise a first end which is electrically connected to the connection portion 9 of the respective electrical contact 7, and a second free end for electrical connection to a complementary connector. For example, the first ends of the contacts 27 are disposed along the same pattern as the pattern of the connection portion 9 of the contacts for electrical connection thereto. For example, the first ends of the electrical contacts 27 are pins which project from the housing 26, and are inserted in the

eyelets 9. Other modes of electrical connection are possible.

In the shielded embodiment, the mating part may also comprise an electrically conductive shield 28. The shield 28 surrounds the housing 26 and has a bottom contact portion 29 which is the lower face of a horizontal plate (for example a ring all around the housing 26). The bottom contact portions electrically contact the contact portions 19 of both the external and internal parts 18 of the shielding device.

The electrical connector 24 is used for electrically connecting together two electrical devices 31a, 31b, for example located side by side on the same circuit board 30. The two electrical devices can be mounted on a circuit board in a not very precise manner, i.e. with high placement tolerances. The spacing S between the two devices is approximately the same as the spacing S' between the two mating parts 25a and 25b of the connector (similar misalignments may be found in the out-of-plane direction, or the mating direction of Fig. 5). The electrical devices 31a and 31b are each of similar construction, comprising a housing 32 holding electrical contacts 33, and, when appropriate, having a shield 34 surrounding the housing 32.

The connector is mounted as follows.

When the connector 24 is moved toward the electrical devices along the insertion direction, each mating part 25a, 25b tends to be guided in connection with the respective electrical devices 31a and 31b. The elastic deformation of the electrical contact members 7 at this stage will enable the housings 12a and/or 12b to move in the receptacle 22 in the X-Y plane, adjusting the gaps dX and dY . The mating parts 25a, 25b, which are fixed relatively to the respective housings 12a, 12b, can then compensate the difference between the spacings S and S' . For shielded connectors, during this connection, the

contact portion 29 of the mating parts slides in the X-Y plane on the contact portions 19 of the external and internal parts of the shielding device 18, while still remaining in contact.

The mating parts 25a, 25b, are brought in electrical contact with the electrical devices 31a, 31b. Compensation for the play along the mating direction may also be compensated by the elasticity of the contacts 7 of the IMLA in this direction. In case the connector is shielded, the tongues 20 will be submitted to different elastic deformations.

Of course, various embodiments may be provided within the scope of the invention. The IMLA could for example comprise 3 laterally spaced housings, i.e. the two housings as shown, and a third housing, placed so that for example the housing 12b becomes a central housing. All three housings can be connected by electrical contact members 7. This would allow connecting three electrical devices. Of course, even more housings are possible.

CLAIMS

1. An insert molded leadframe assembly comprising:

- a plurality of electrical contacts (7), electrically insulated from one another, each having a first and a second retention portions (11a, 11b), a first and a second connection portions (9), and an intermediate portion (10) disposed between the first and second retention portions, the first connection portions being adapted to be electrically connected to a first complementary electrical device (25a), the second connection portions being adapted to be electrically connected to a second complementary electrical device (25b),

- a first housing (12a) overmolding the first retention portions,

- a second housing (12b), distinct from the first housing, and overmolding the second retention portions,

the intermediate portions (10) being elastically deformable so as to allow a relative movement of the first and second housings.

2. An insert molded leadframe assembly according to claim 1, wherein the plurality of electrical contacts (7) comprise at least a first set (7a) of electrical contacts and wherein the first and second connection portions of said first set extend in a first plane in a rest condition of the insert molded leadframe assembly.

3. An insert molded leadframe assembly according to claim 2, wherein the plurality of electrical contacts (7) comprise at least a second set (7b) of electrical contacts, wherein the first and second connection portions of said second set extend in a second plane in a rest condition of the insert molded leadframe assembly, and wherein the first and second planes are parallel.

4. An insert molded leadframe assembly comprising:

- a plurality of electrical contacts (7), electrically insulated from one another, each having a first and a second retention portions (11a, 11b), a first and a second connection portions (9), and an intermediate portion (10) disposed between the first and second retention portions, the first connection portions being adapted to be electrically connected to a first complementary electrical device (25a), the second connection portions being adapted to be electrically connected to a second complementary electrical device (25b), the plurality of electrical contacts (7) comprising at least a first and a second sets (7a, 7b) of electrical contacts, wherein the first and second connection portions of said first set extend in a first plane in a rest condition of the insert molded lead assembly, wherein the first and second connection portions of said second set extend in a second plane in a rest condition of the insert molded lead assembly, and wherein the first and second planes are parallel,

- a first housing (12a) overmolding the first retention portions,

- a second housing (12b), separate from the first housing, and overmolding the second retention portions,

the intermediate portions (10) being elastically deformable so as to allow a relative movement of the first and second housings.

5. An insert molded leadframe assembly according to claim 3 or 4, further comprising a layer (15) of electrically insulating material disposed between said first and second planes, electrically insulating each contact of the first set from any contact from the second set.

6. An insert molded leadframe assembly according to

any of claim 3 to 5, wherein the first (resp. second) connection portions of the first set of electrical contacts are aligned along a first direction (14), wherein the first (resp. second) connection portions of the second set of electrical contacts are aligned along a second direction (14) parallel to the first direction.

7. An electrical connector comprising an insert molded leadframe assembly according to any of claims 1 to 6, and further comprising a base (1), wherein the first and the second housings (12a, 12b) are each floatably movable in the base (1) and retained by the base (1).

8. An electrical connector according to claim 7, further comprising a shielding device (18a, 18b) adapted to contact an electrically conductive complementary shielding device of at least one of said first and second complementary devices.

9. An electrical connector comprising

- an insert molded leadframe assembly comprising:
 - . a plurality of electrical contacts (7), electrically insulated from one another, each having a first retention portion (11a), a first connection portion (9), and a second connection portion (10), the first connection portion being adapted to be electrically connected to a first complementary electrical device (25a),
 - . a first housing (12a) overmolding the first retention portion,
- a base (1), wherein the first housing (12a) is floatably movable in the base (1) and retained by the base (1),
- a shielding device (18a, 18b) mounted to said base (1) and adapted to contact an electrically conductive complementary shielding device of said first complementary device.

10. Electrical connector according to claim 8 or 9, wherein the shielding device comprises at least one

flexible tongue (19) having a contact portion movably mounted with respect to the base (1) and adapted to contact the electrically conductive complementary shielding device.

11. Electrical connector according to any of claims 8 to 10, wherein the shielding device comprises an internal device (18b) having at least one said flexible tongue, wherein the intermediate portions of the electrical contacts extend between the base and the internal device, and are electrically insulated from the central device.

12. Electrical connector according to claim 11, comprising a fixation device (4, 116) attaching together the base and the internal device, and extending between neighbour electrical contacts (7).

13. Electrical connector according to any of claims 8 to 12, wherein the base (1) comprises a shell having a wall and defining a cavity, the first housing extending in said cavity, wherein the shell has an inner wall defining a bottom wall (2a) of said cavity, and an opposed outer wall, and wherein the shielding device comprises an external device (18a) fixed to the outer wall of said shell and having one said flexible tongues.

14. Electrical connector according to any of claims 8 to 13, further comprising a second housing (12b) overmolding a second retention portion of the electrical contacts (7), wherein the internal device (18b) extends between the first and second housings (12a, 12b), wherein the shielding device comprises an external device fixed to the base, having at least a first and a second of said flexible tongues, wherein the external device is electrically insulated from the internal device, wherein the first housing extends between the first flexible tongue and the internal device, and wherein the second housing extends between the second flexible tongue and the internal device.

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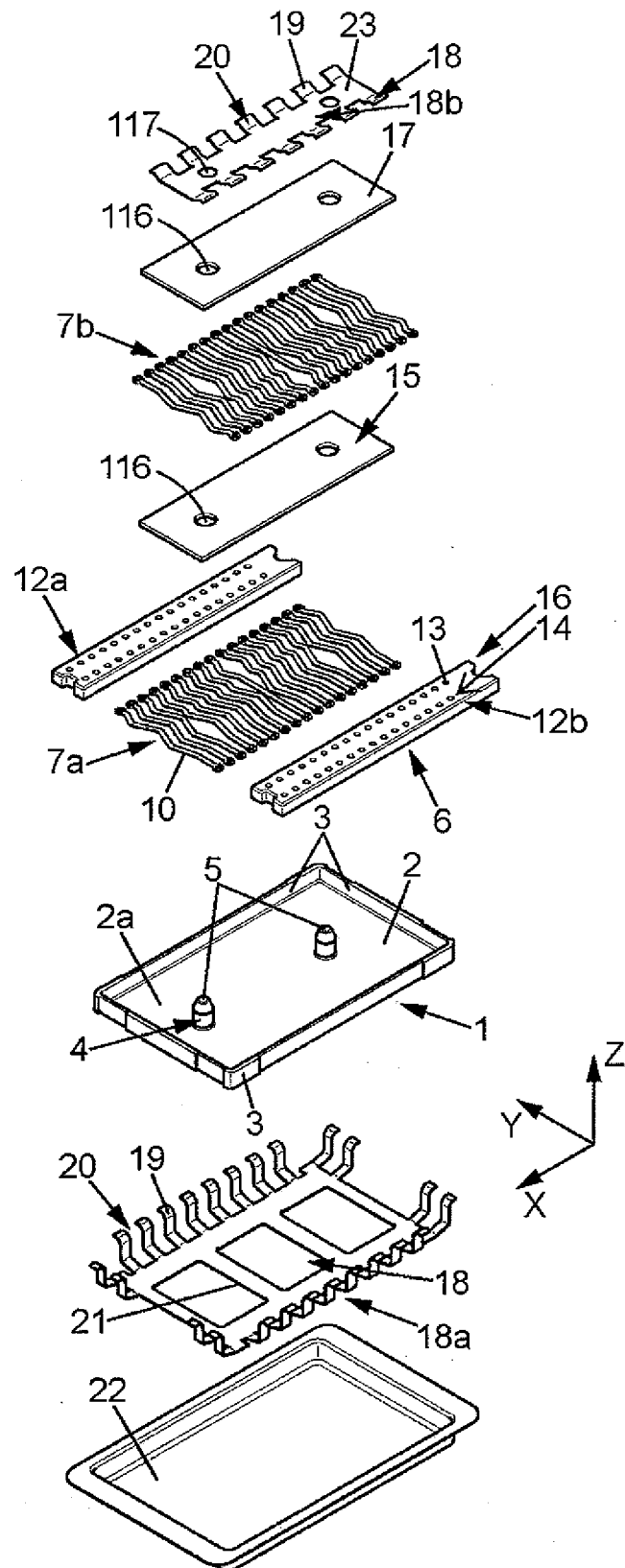
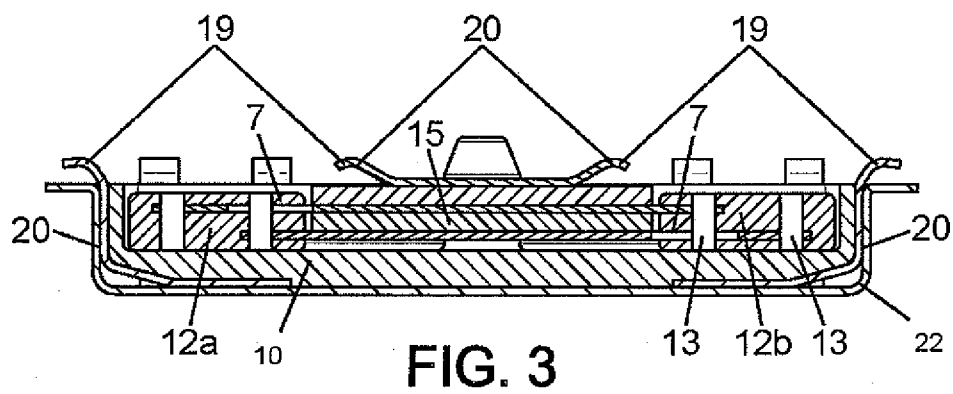
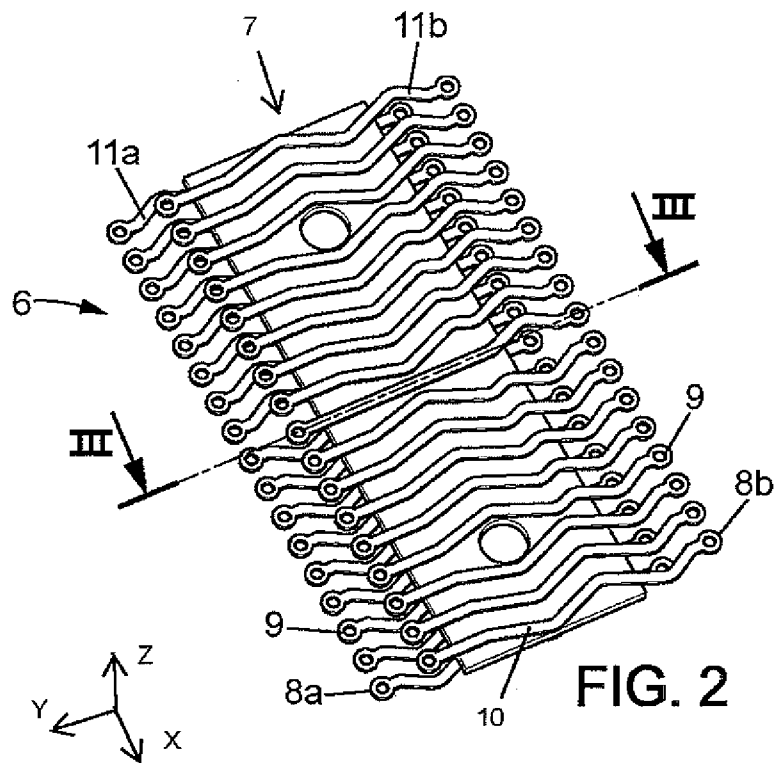
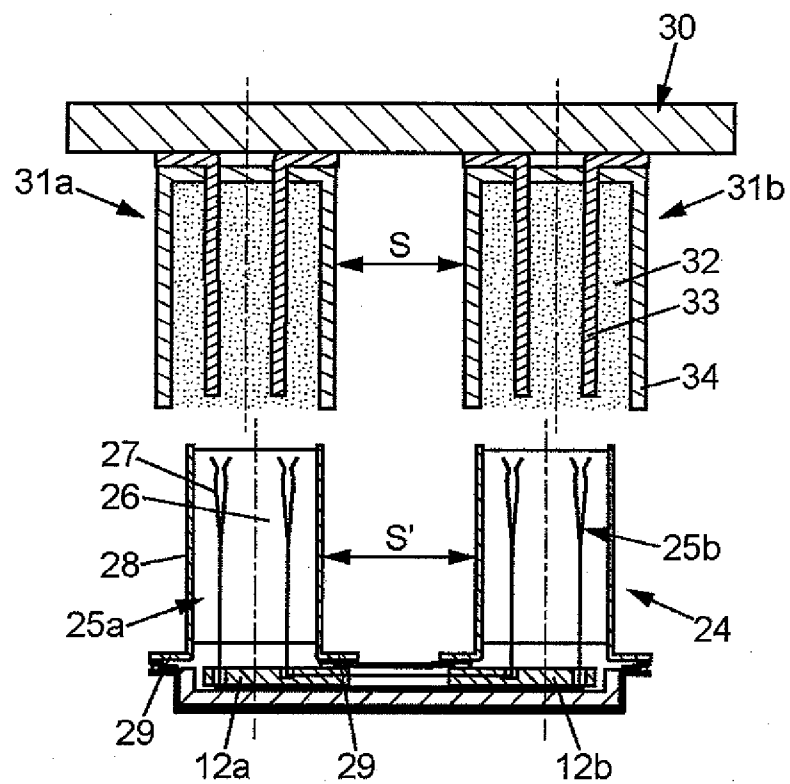
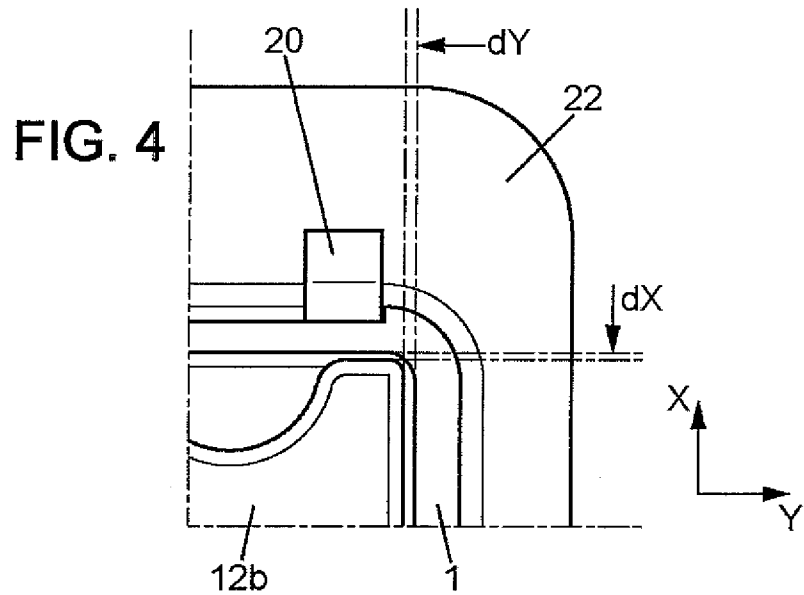


FIG. 1



**FIG. 5**

INTERNATIONAL SEARCH REPORT

International application No

PCT/IB2009/051970

A. CLASSIFICATION OF SUBJECT MATTER

INV. H01R43/24

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)

H01R

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

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

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 81/02703 A (EASTMAN KODAK CO [US]) 1 October 1981 (1981-10-01) page 3, line 11 - page 6, line 35	1-3
X	US 2003/092296 A1 (OLDENBURG GLENN RAY [US] ET AL) 15 May 2003 (2003-05-15) paragraph [0022]	4
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A	DE 203 03 247 U1 (KAN CHIN MAO [TW]) 8 May 2003 (2003-05-08)	

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

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Date of the actual completion of the international search

10 September 2009

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Name and mailing address of the ISA/

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INTERNATIONAL SEARCH REPORT

Information on patent family members

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